# Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents ofthe present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

Y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

The present document is part 4 of a multi-part Technical Specification (TS) covering the New Radio (NR) User Equipment (UE) conformance specification, which is divided in the following parts:

FFS.

# 1 Scope

The present document specifies the measurement procedures for the conformance test of the user equipment (UE) that contain performance requirements as part of 5G-NR.

The requirements are listed in different clauses only if the corresponding parameters deviate. More generally, tests are only applicable to those mobiles that are intended to support the appropriate functionality. To indicate the circumstances in which tests apply, this is noted in the "*definition and applicability*" part of the test.

For example only Release 15 and later UE declared to support 5G-NR shall be tested for this functionality. In the event that for some tests different conditions apply for different releases, this is indicated within the text of the test itself.

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

[3] 3GPP TS 38.101-2: "NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone"

[4] 3GPP TS 38.101-3: "NR; User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios".

[5] 3GPP TS 38.101-4: "NR; User Equipment (UE) radio transmission and reception; Part 4: Performance requirements".

[6] 3GPP TS 38.508-1: "5GS; User Equipment (UE) conformance specification; Part 1: Common test environment"

[7] 3GPP TS 38.521-1: "NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Range 1 Standalone"

[8] 3GPP TS 38.521-2: "NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 2: Range 2 Standalone"

[9] 3GPP TS 38.211: "NR; Physical channels and modulation".

[10] 3GPP TS 38.212: "NR; Multiplexing and channel coding".

[11] 3GPP TS 38.213: "NR; Physical layer procedures for control".

[12] 3GPP TS 38.214: "NR; Physical layer procedures for data".

[13] 3GPP TS 37.340: "Evolved Universal Terrestrial Radio Access (E-UTRA) and NR; Multi-connectivity", Stage 2.

[14] 3GPP TS 38.306: "NR; User Equipment (UE) radio access capabilities".

[15] 3GPP TR 38.901: "Study on channel model for frequencies from 0.5 to 100 GHz".

[16] 3GPP TS 36.521-1: "E-UTRA; User Equipment (UE) conformance specification; Radio transmission and reception; Part1: conformance testing"

[17] 3GPP TS 36.211: "Physical Channels and Modulation".

[18] Recommendation ITU-R M.1545: "Measurement uncertainty as it applies to test limits for the terrestrial component of International Mobile Telecommunications-2000".

[19] 3GPP TS 36.508: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); Common test environments for User Equipment (UE) conformance testing".

[20] 3GPP TS 38.331: “Radio Resource Control (RRC) protocol specification”.

[21] 3GPP TS 38.521-3: "NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios".

[22] 3GPP TS 38.509: "5GS; Special conformance testing functions for User Equipment (UE)".

[23] 3GPP TS 23.287: "Architecture enhancements for 5G System (5GS) to support Vehicle-to-Everything (V2X) services".

[24] 3GPP TS 38.321: "NR; Medium Access Control (MAC) protocol specification".

[25] 3GPP TS 38.133: "NR; Requirements for support of radio resource management".

[26] 3GPP TR 38.903: "NR; Derivation of test tolerances and measurement uncertainty for User Equipment (UE) conformance test cases".

# 3 Definition of terms, symbols and abbreviations

## 3.1 Terms

For the purposes of the present document, the terms given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

**Aggregated channel bandwidth:** The RF bandwidth in which a UE transmits and receives multiple contiguously aggregated carriers.

**Carrier aggregation:** Aggregation of two or more component carriers in order to support wider transmission bandwidths.

**Carrier aggregation band:** A set of one or more operating bands across which multiple carriers are aggregated with a specific set of technical requirements.

**Carrier aggregation bandwidth class:** A class defined by the aggregated transmission bandwidth configuration and maximum number of component carriers supported by a UE.

**Carrier aggregation configuration**: A combination of CA operating band(s) and CA bandwidth class(es) supported by a UE.

**DL BWP**: DL bandwidth part as defined in TS 38.213 [11].

**EN-DC**: E-UTRA-NR Dual Connectivity as defined in TS 37.340 [13] clause 4.1.2.

**FR1**: Frequency range 1 as defined in TS 38.101-3 [4] clause 5.1.

**FR2**: Frequency range 2 as defined in TS 38.101-3 [4] clause 5.1.

**PDSCH mapping type A or B:** A type of PDSCH allocation sent in the RRC message which defines the time domain allocation of PDSCH DMRS symbols. PDSCH mapping type A is slot based assignment with fixed starting OFDM symbol with variable length. PDSCH mapping type B is non-slot based assignment used for configuring min-slots.

**RedCap:** A UE with reduced capabilities as defined in clause 4.2 in TS 38.306 [14].

**SSB:** SS/PBCH block as defined in TS 38.211 [9] clause 7.8.3.

## 3.2 Symbols

For the purposes of the present document, the following symbols apply:

Es The averaged received energy per Hz of the wanted signal during the useful part of the symbol, i.e. excluding the cyclic prefix, at the UE antenna connector; average power is computed within a set of REs used for the transmission of physical, divided transmission bandwidth within the set

 Subcarrier spacing configuration as defined in TS 38.211 [9] clause 4.2]

 The power spectral density of a white noise source with average power per RE normalized to the subcarrier spacing as defined in Section 4.4.3 for conducted requirements and Section 4.5.3 for radiated requirements

## 3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

AGC Automatic Gain Control

CA Carrier Aggregation

CC Component Carrier

CCE Control Channel Element

CORESET Control Resource Set

CP Cyclic Prefix

CSI Channel-State Information

CSI-IM CSI Interference Measurement

CSI-RS CSI Reference Signal

CW Codeword

CQI Channel Quality Indicator

CRC Cyclic Redundancy Check

CRI CSI-RS Resource Indicator

CRS Cell-specific Reference Signal

CRS-IM CRS-Interference MitigationDC Dual Connectivity

DCI Downlink Control Information

DL Downlink

DMRS Demodulation Reference Signal

DPS Dynamic Point Selection

EPRE Energy Per Resource Element

EN-DC E-UTRA-NR Dual Connectivity

FR Frequency Range

FRC Fixed Reference Channel

GNSS Global Navigation Satellite System

HARQ Hybrid Automatic Repeat Request

HST High Speed Train

HST-SFN High Speed Train Single Frequency Network

LI Layer Indicator

MAC Medium Access Control

MCS Modulation and Coding Scheme

MIB Master Information Block

NE-DC NR-E-UTRA Dual Connectivity

NR New Radio

NR/5GC NR connected to 5GC NSA Non-Standalone Operation Mode

NSA Non-Standalone Operation Mode

OCC Orthogonal Cover Code

OCNG OFDMA Channel Noise Generator

OFDM Orthogonal Frequency Division Multiplexing

OFDMA Orthogonal Frequency Division Multiple Access

PBCH Physical Broadcast Channel

Pcell Primary Cell

PDCCH Physical Downlink Control Channel

PDSCH Physical Downlink Shared Channel

PMI Precoding Matrix Indicator

PRB Physical Resource Block

PRG Physical resource block group

PSS Primary Synchronization Signal

PTRS Phase Tracking Reference Signal

PUCCH Physical Uplink Control Channel

PUSCH Physical Uplink Shared Channel

QCL Quasi Co-location

RB Resource Block

RBG Resource Block Group

RE Resource Element

REG Resource Element Group

RI Rank Indicator

RRC Radio Resource Control

SA Standalone operation mode

SCS Subcarrier Spacing

SINR Signal-to-Interference-and-Noise Ratio

SNR Signal-to-Noise Ratio

SS Synchronization Signal

SSB Synchronization Signal Block

SSS Secondary Synchronization Signal

TCI Transmission Configuration Indicator

TDM Time division multiplexing

TRxP Transmission and Reception Point

TTI Transmission Time Interval

UL Uplink

VRB Virtual Resource Block

# 4 General

## 4.1 Relationship between minimum requirements and test requirements

TS 38.101-4 [5] is a Single-RAT and interwork specification for NR UE, covering minimum performance requirements of both conducted and radiated requirements. Conformance to the TS 38.101-4 [5] is demonstrated by fulfilling the test requirements specified in the present document.

The Minimum Requirements given in TS 38.101-4 [5] makes no allowance for measurement uncertainty (MU). The present document defines test tolerances (TT). These test tolerances are individually calculated for each test. The test tolerances are used to relax the minimum requirements in TS 38.101-4 [5] to create test requirements. For some requirements, including regulatory requirements, the test tolerance is set to zero.

The measurement results returned by the test system are compared - without any modification - against the test requirements as defined by various levels of "Shared Risk" principle as described below

a) Core specification value is not relaxed by any relaxation value (TT=0). For each single measurement, the probability of a borderline good UE being judged as FAIL equals the probability of a borderline bad UE being judged as PASS.

- Test tolerances equal to 0 (TT=0) are considered in this specification.

b) Core specification value is relaxed by a relaxation value (TT>0). For each single measurement, the probability of a borderline bad UE being judged as PASS is greater than the probability of a borderline good UE being judged as FAIL.

- Test tolerances lower than measurement uncertainty and greater than 0 (0 < TT < MU) are considered in this specification.

- Test tolerances high up to measurement uncertainty (TT = MU) are considered in this specification which is also known as “Never fail a good DUT” principle.

c) Core specification value is tightened by a stringent value (TT<0). For each single measurement, the probability of a borderline good UE being judged as FAIL is greater than the probability of a borderline bad UE being judged as PASS.

Test tolerances lower than 0 (TT<0) are not considered in this specification. The “Never fail a good DUT” and the “Shared Risk” principles are defined in Recommendation ITU‑R M.1545 [18].

## 4.2 Applicability of minimum requirements

The applicability of each requirement is described under each clause in 5.1, 6.1, 7.1, 8.1, 9.1 and 10.1 of TS 38.101-4.

The conducted minimum requirements specified in TS 38.101-4 [5] shall be met in all applicable scenarios for FR1. The radiated minimum requirements specified in TS 38.101-4 [5] shall be met in all applicable scenarios for FR2. The interwork minimum requirement specified in TS 38.101-4 [5] shall be met in all applicable scenarios for NR interworking operation.

All minimum performance requirements defined in TS 38.101-4 [5] Sections 5-8 are applicable to NR/5GC, EN-DC and NE-DC unless otherwise explicitly stated in TS 38.101-4 [5] Section 9 and 10.

All minimum performance requirements defined in Sections 5-10 are applicable to all UE power classes unless otherwise stated.

For radiated minimum requirements specified in the specification, if maximum achievable SNR in the TE chamber for certain test conditions is less than the defined SNR requirement for those tests, those tests will not be tested.

## 4.3 Specification suffix information

Unless stated otherwise the following suffixes are used for indicating at 2nd level clause, shown in table 4.3-1.

Table 4.3-1: Definition of suffixes

|  |  |
| --- | --- |
| Clause suffix | Variant |
| None | Single Carrier |
| A | Carrier Aggregation (CA) |
| B | Dual-Connectivity (DC) |
| C | Supplement Uplink (SUL) |

A terminal which supports the above features needs to meet the requirement defined in the additional clause (suffix A, B, C) in clauses 5, 6, 7, 8, 9, 10.

## 4.4 Conducted requirements

### 4.4.0 Introduction

The requirements are defined for the following modes:

- Mode 1: Conditions with external noise source

- Wanted signal with power level Es is transmitted.

- External white noise source with power spectral density Noc is used.

- *Es* and *Noc* levels are selected to achieve target SNR as described in Clause 4.4.2.

- Mode 2: Noise free conditions

- Wanted signal with power level Es is transmitted.

- No external noise transmitted.

### 4.4.1 Reference point

The reference point for SNR, *Es* and Noc of DL signal is the UE antenna connector or connectors.

### 4.4.2 SNR definition

For Mode 1 conditions conducted UE demodulation and CSI requirements, the SNR is defined as:

Where:

*- NRX* denotes the number of receiver antenna connectors and the superscript receiver antenna connector *j*.

- The above SNR definition assumes that the REs are not precoded, and does not account for any gain which can be associated to the precoding operation.

- Unless otherwise stated, the SNR refers to the SSS wanted signal.

- The downlink SSS transmit power is defined as the linear average over the power contributions in [W] of all resource elements that carry the SSS within the operating system bandwidth.

- The power ratio of other wanted signals to the SSS is defined in clause C.3.1.

### 4.4.3 Noc

#### 4.4.3.1 Introduction

This clause describes the Noc power level for Mode 1 conditions conducted testing of demodulation and CSI requirements.

Unless otherwise stated for CA and EN-DC testing, the same Noc level shall be provided on different component carriers.

#### 4.4.3.2 Noc for NR operating bands in FR1

The Noc power spectrum density shall be larger or equal to the minimum Noc power level for each operating band supported by the UE as defined in clause 4.4.3.2.1.

Unless otherwise stated, a fixed Noc power level of -134 dBm/Hz shall be used for all operating bands.

##### 4.4.3.2.1 Derivation of Noc values for NR operating bands in FR1

The minimum Noc power level for an operating band, subcarrier spacing and channel bandwidth is derived based on the following equation:

NocBand\_X, SCS\_Y, CBW\_Z = REFSENSBand\_X, SCS\_Y, CBW\_Z – 10\*log10(12\*SCS\_Y\*nPRB) + D – SNRREFSENS + ∆thermal

where

- REFSENSBand\_X, SCS\_Y, CBW\_Z is the REFSENS value in dBm for Band X, SCS Y and CBW Z specified in Table 7.3.2-1 of TS 38.101-1 [2]

- 12 is the number of subcarriers in a PRB

- SCS Y is the subcarrier spacing associated with the REFSENS value

- nPRB is the maximum number of PRB for SCS Y and CBW Z associated with the REFSENS value, and is specified in Table 5.3.2-1 of TS 38.101-1 [2]

- D is diversity gain equal to 3 dB

- SNRREFSENS = -1 dB is the SNR used for simulation of REFSENS

- ∆thermal is the amount of dB that the wanted noise is set above UE thermal noise, giving a defined rise in total noise. ∆thermal = 16dB, giving a rise in total noise of 0.1dB, regarded as insignificant**.**

The calculated Noc value for the baseline of Band n12, 15 kHz SCS, 15 MHz CBW is -135.5 dBm/Hz.

An allowance of 1.5dB is made for CA and for future bands, giving an Noc power level of -134 dBm/Hz.

### 4.4.4 Es

#### 4.4.4.1 Introduction

This clause describes the Es power level for Mode 2 conditions conducted testing of demodulation and CSI requirements.

Unless otherwise stated for CA and EN-DC testing, the same Es level shall be provided on different component carriers.

#### 4.4.4.2 Es for NR operating bands in FR1

The Es power spectrum density shall be larger or equal to the minimum Es power level for each operating band supported by the UE as defined in Clause 4.4.4.2.1.

Unless otherwise stated, a fixed Es power level of -112 dBm/Hz shall be used for all operating bands.

##### 4.4.4.2.1 Derivation of Es values for NR operating bands in FR1

The minimum Es power level for an operating band, subcarrier spacing and channel bandwidth is derived based on the following equation:

EsBand\_X, SCS\_Y, CBW\_Z = REFSENSBand\_X, SCS\_Y, CBW\_Z – 10\*log10(12\*SCS\_Y\*nPRB) + D – SNRREFSENS + dBEVM +∆thermal

where:

- REFSENSBand\_X, SCS\_Y, CBW\_Z is the REFSENS value in dBm for Band X, SCS Y and CBW Z specified in Table 7.3.2-1 of TS 38.101-1 [2]

- 12 is the number of subcarriers in a PRB

- SCS Y is the subcarrier spacing associated with the REFSENS value

- nPRB is the maximum number of PRB for SCS Y and CBW Z associated with the REFSENS value, and is specified in Table 5.3.2-1 of TS 38.101-1 [2]

- D is diversity gain equal to 3 dB

- SNRREFSENS = -1 dB is the SNR used for simulation of REFSENS

- dBEVM is the SNR of the applied signal due to EVM impairment on the wanted Es. An allowed EVM of 3% gives a dBEVM of 30.5dB, derived as 20\*log10(1/0.03)**.** An allowed EVM of 2.5% gives a dBEVM of 32dB, derived as 20\*log10(1/0.025).

- ∆thermal is the amount of dB that the impairment due to EVM on the wanted Es is set above UE thermal noise, giving a defined rise in total impairment. ∆thermal = 7.6dB, giving a rise in total impairment of 0.7dB, regarded as acceptable**.**

For an allowed EVM of 3%, the calculated Es value for the baseline of Band n12, 15kHz SCS, 15MHz CBW is -113.5 dBm/Hz.

For an allowed EVM of 2.5%, the calculated Es value for the baseline of Band n12, 15kHz SCS, 15MHz CBW is -112 dBm/Hz.

An allowance of 1.5dB is made for CA and for future bands, giving an Es power level of -112 dBm/Hz for EVM of 3%, and -110.5 dBm/Hz for EVM of 2.5%.

## 4.5 Radiated requirements

### 4.5.0 Introduction

The requirements are defined for the following modes:

- Mode 1: conditions with external noise source

- Wanted signal with power level Es is transmitted.

- External white noise source with power spectral density Noc is used.

- Es and Noc levels are selected to achieve target SNR as described in Clause 4.5.2.

- Mode 2: Noise free conditions

- Wanted signal with power level Es is transmitted.

- No external noise transmitted.

### 4.5.1 Reference point

The reference point for SNR, Es and Noc of DL signal from the UE perspective is the input of UE antenna array.



Figure 4.5.1-1: Reference point for radiated Demodulation and CSI requirements

### 4.5.2 SNR definition

For Mode 1 conditions UE demodulation and CSI requirements, the Minimum performance requirement in clause 7, 8, 9 and 10 are defined relative to the baseband SNR level *SNRBB.* The SNR at the reference point is defined as

SNR = SNRBB + **∆BB**

where **∆BB**is specified in clause 4.5.3.

The reference point SNR is defined as:

*- NRX* denotes the number of receiver reference points, and the super script receiver reference point *j*.

- The above SNR definition assumes that the REs are not precoded, and does not account for any gain which can be associated to the precoding operation.

- Unless otherwise stated, the SNR refers to the SSS wanted signal.

- The downlink SSS transmit power is defined as the linear average over the power contributions in [W] of all resource elements that carry the SSS within the operating system bandwidth.

- The power ratio of other wanted signals to the SSS is defined in clause C.3.1.

### 4.5.3 Noc

#### 4.5.3.1 Introduction

For Mode 1 conditions radiated testing of demodulation and CSI requirements it is not feasible in practice to use signal levels high enough to make the noise contribution of the UE negligible. Demodulation requirements are therefore specified with the applied noise higher than the UE peak EIS level in TS 38.101-2 [3] by a defined amount, so that the impact of UE noise floor is limited to no greater than a value **∆BB** at the specified Noc level. As UEs have EIS levels that are dependent on operating band and power class, Noc level is dependent on operating band and power class.

The Noc power level for test case execution shall be further increased by 5.19dB for UE power class 3 on top of the Noc power level defined in 4.5.3.2.

#### 4.5.3.2 Noc for NR operating bands in FR2

Values for Noc according to operating band and power class for single carrier requirements are specified in Table 4.5.3.2-1 for **∆BB** =1dB.

Table 4.5.3.2-1: Noc power level for different UE power classes and frequency bands

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Operating band** | **UE Power class** | | | | | | |
| **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| n257 | -167.3 | -161.8 | -158.1 | -166.8 | -162.4 | -162.4 | -155.1 |
| n258 | -167.3 | -161.8 | -158.1 | -166.8 | -162.6 | -162.6 | -155.1 |
| n259 |  | -158.5 | -154.5 |  | -159.5 |  |  |
| n260 | -164.3 |  | -155.5 | -164.8 |  |  |  |
| n261 | -167.3 | -161.8 | -158.1 | -166.8 |  | -162.4 | -155.1 |
| Note 1: Noc levels are specified in dBm/Hz | | | | | | | |

For PC3 multi-band devices, the Noc power level (NocMB) shall increase by multi-band relaxation defined in TS 38.101-2 [3] Table 6.2.1.3-4.

NocMB = NocSB + ∆MBP,n

- NocSB is the Noc defined in Table 4.5.3.2-1

- ∆MBP,n values are specified in TS 38.101-2 [3].

For CA case, the Noc power level (NocCA) shall increase by a relaxation factor defined in TS 38.101-2 [3] Table 7.3A.2.1-1:

NocCA = NocSC + ΔRIB

- NocSC is derived by assuming UE supports single carrier.

- ΔRIB values are specified in TS 38.101-2 [3].

#### 4.5.3.3 Derivation of Noc values for NR operating bands in FR2

The Noc values in Table 4.5.3.2-1 are based on REFSENS for the operating band X and on the UE Power class P, derived based on the following equation.

NocPC\_P, Band\_X = REFSENSPC\_P, Band\_X, 50MHz -10Log10(12 x 120kHz x PRBREFSENS) – SNRREFSENS + ∆thermal

where:

- REFSENSPC\_P, Band\_X, 50MHz is the REFSENS value in dBm specified for Power Class P of UE in Band X for 50MHz Channel bandwidth in TS 38.101-2 [3] Table 7.3.2.3-1.

- 12 is the number of subcarriers in a PRB

- 120 kHz is chosen as a subcarrier spacing to select PRBREFSENS. - PRBREFSENS is NRB associated with subcarrier spacing 120 kHz for 50MHz in TS 38.101-2 [3] Table 5.3.2-1 and is 32.

- SNRREFSSENS = -1 dB is the SNR used for simulation of R EFSENS.

- ∆thermal is the amount of dB that the wanted noise is set above UE thermal noise, giving a rise in total noise of **∆BB**. ∆thermal -10Log10(10^(∆BB/10)-1) = 5.87dB, giving a rise in total noise ∆BB of 1 dB**.**

For example, the calculated Noc value for the baseline of UE Power class 3 in Band n260 is rounded to -155.5 dBm/Hz.

### 4.5.4 Angle of arrival

Unless otherwise stated, the downlink signal and noise are aligned to the direction with the following criteria:

- Select the known Rx beam peak direction reused from RF testing if available, as far as it satisfies the minimum isolation requirement and rank number defined in the present document corresponding to the test cases.

- Otherwise select one direction which satisfies the REFSENS defined in TS 38.101-2 [3], minimum isolation requirement and rank number defined in the present document corresponding to the test cases.

### 4.5.5 Es

For Mode 2 the test system shall transmit the wanted signal with power level Es which is the best achievable power level by the test system.

The test system shall be able to determine achievable Es level and the maximum achievable SNR level

## 4.6 Test coverage across 5G NR connectivity options

The test cases in the present document cover both NR/5GC (including FR1+FR2 CA or FR1+FR2 NR-DC) as well as EN-DC, NE-DC and NGEN-DC testing. Below shall be the understanding with respect to coverage across 5G NR connectivity options:

1) Unless otherwise stated within the test case, it shall be understood that test requirements are agnostic of the NR/5GC, EN-DC, NE-DC and NGEN-DC connectivity options configured within the test. The test coverage across the NR/5GC, EN-DC, NE-DC and NGEN-DC connectivity options shall be considered fulfilled by executing the test case in one of these connectivity options.

2) Except for sustained data rate test cases, NR/5GC, EN-DC, NE-DC and NGEN-DC connectivity option types are utilized in the definition of each test case within this test specification. NR/5GC is the default connectivity option if supported.

Editor’s Note: Generic procedure parameter to be used in Initial Conditions for NE-DC and NGEN-DC is FFS

3) If UE supports NR/5GC in addition to other connectivity options, it suffices to test the requirements using NR/5GC connectivity option for all test cases. Additionally for sustained data rate test case, if UE supports EN-DC and NE-DC, test coverage is fulfilled by testing the UE using EN-DC connectivity option.

Table 4.6-1: Void

Table 4.6-2: Void

# 5 Demodulation performance requirements (Conducted requirements)

## 5.1 General

### 5.1.1 Applicability of requirements

#### 5.1.1.1 General

The minimum performance requirements are applicable to all FR1 operating bands defined in TS 38.101-1 [2].

The minimum performance requirements in Clause 5 are mandatory for UE supporting NR operation, except test cases listed in Clauses 5.1.1.3, 5.1.1.4, 5.1.1.5, 5.1.1.6, 5.1.1.7, 5.1.1.8.

If same test is listed for different UE features/capabilities in Clauses 5.1.1.3 and 5.1.1.4, then this test shall apply for UEs which support all corresponding UE features/capabilities.

#### 5.1.1.2 Applicability of requirements for different number of RX antenna ports

The number of RX antenna ports for different RF operating bands is up to UE declaration.

The UE shall support 2 or 4 RX antenna ports for different RF operating bands. The operating bands, where 4 RX antenna ports shall be the baseline, are defined in Clause 7.2 of TS 38.101-1 [3]. The UE requirements applicability for UEs with different number of RX antenna ports is defined in Table 5.1.1.2-1.

Table 5.1.1.2-1: Requirements applicability

|  |  |  |
| --- | --- | --- |
| Supported RX antenna ports | Test type | Test list |
| UE supports only 2RX | PDSCH | All tests in Clause 5.2.2 |
| PDCCH | All tests in Clause 5.3.2 |
| PBCH | All tests in Clause 5.4.2 |
| UE supports only 4RX or both 2RX and 4RX | PDSCH | All tests in Clause 5.2.3 (Note 2) |
| PDCCH | All tests in Clause 5.3.3 (Note 2) |
| PBCH | All tests in Clause 5.4.2 or 5.4.3 Note 1 |
| Note 1: Requirements for PBCH with 4Rx is up to UE declaration.  Note 2: ‘*maxMIMO-Layers-r16*’ is not configured during the performance requirements testing for UE supporting Release 16 per-BWP MIMO layer adaptation. | | |

#### 5.1.1.3 Applicability of requirements for optional UE features

The performance requirements in Table 5.1.1.3-1 shall apply for UEs which support optional UE features only.

Table 5.1.1.3-1: Requirements applicability for optional UE features

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE feature/capability [14] | Test type | | Test list | Applicability notes |
| SU-MIMO Interference Mitigation advanced receiver | FR1 FDD | PDSCH | Clause 5.2.2.1.1 (Test 3-1)  Clause 5.2.3.1.1 (Test 5-1) |  |
| FR1 TDD | PDSCH | Clause 5.2.2.2.1 (Test 3-1)  Clause 5.2.3.2.1 (Test 5-1) |
| Alternative additional DMRS position for co-existence with LTE CRS (*additionalDMRS-DL-Alt)* | FR1 FDD | PDSCH | Clause 5.2.2.1.4 (Test 1-2)  Clause 5.2.3.1.4 (Test 1-2) |  |
| FR1 TDD | PDSCH | Clause 5.2.2.2.4 (Test 1-2)  Clause 5.2.3.2.4 (Test 1-2) |
| Basic DL NR-NR CA operation (*supportedBandCombinationList*) | NR CA | SDR | Clause 5.5A.1 | 1) Up to 16 DL carriers  2) Same numerology across carrier for data/control channel at a given time |
| Enhanced demodulation processing for HST-SFN joint transmission scheme with velocity up to 500km/h | FR1 FDD | PDSCH | Clause 5.2.2.1.9 (Test 1-1)  Clause 5.2.3.1.9 (Test 1-1) |  |
| FR1 TDD | PDSCH | Clause 5.2.2.2.9 (Test 1-1)  Clause 5.2.3.2.9 (Test 1-1) |
| Single DCI based SDM transmission for multi-TRxP (singleDCI-SDM-scheme-r16) | FR1 FDD | PDSCH | Clause 5.2.2.1.11  Clause 5.2.3.1.11 |  |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.11  Clause 5.2.3.2.11 |  |
| Multi DCI based multi-TRxP support (multiDCI-MultiTRP-r16) | FR1 FDD | PDSCH | Clause 5.2.2.1.12  Clause 5.2.3.1.12 |  |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.12  Clause 5.2.3.2.12 |  |
| Single DCI based FDM Scheme-A for multi-TRxP(supportFDM-SchemeA-r16) | FR1 FDD | PDSCH | Clause 5.2.2.1.13  Clause 5.2.3.1.13 |  |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.13  Clause 5.2.3.2.13 |  |
| Single DCI based inter-slot TDM for multi-TRxP (supportInter-slotTDM-r16) | FR1 FDD | PDSCH | Clause 5.2.2.1.14  Clause 5.2.3.1.14 |  |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.14  Clause 5.2.3.2.14 |  |
| Maximum number of TCI states in Single-DCI based inter-slot TDM (maxNumberTCI-states-r16) | FR1 FDD | PDSCH | Clause 5.2.2.1.14  Clause 5.2.3.1.14 | The requirements apply only when maxNumberTCI-states-r16 = 2. |
| FR1 TDD | PDSCH | Clause 5.2.2.2.14  Clause 5.2.3.2.14 |
| Alternative 64QAM MCS table for PDSCHNew 64QAM MCS table for PDSCH (*dl-64QAM-MCS-TableAlt*) | FR1 FDD | PDSCH | Clause 5.2.2.1.5  Clause 5.2.3.1.5  Clause 5.2.2.1.6  Clause 5.2.3.1.6 |  |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.5  Clause 5.2.3.2.5  Clause 5.2.2.2.6  Clause 5.2.3.2.6 |  |
| CQI table with target BLER of 10^-5New CQI table (cqi-TableAlt) | FR1 FDD | PDSCH | Clause 5.2.2.1.5  Clause 5.2.3.1.5 |  |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.5  Clause 5.2.3.2.5 |  |
| PDSCH repetitions over multiple slots *(pdsch-RepetitionMultiSlots)* | FR1 FDD | PDSCH | Clause 5.2.2.1.6  Clause 5.2.3.1.6 |  |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.6  Clause 5.2.3.2.6 |  |
| UE PDSCH processing capability #2 *(pdsch-ProcessingType2)* | FR1 FDD | PDSCH | Clause 5.2.2.1.7  Clause 5.2.3.1.7 |  |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.7  Clause 5.2.3.2.7 |  |
| Pre-emption indication for DL *(pre-EmptIndication-DL)* | FR1 FDD | PDSCH | Clause 5.2.2.1.8  Clause 5.2.3.1.8 |  |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.8  Clause 5.2.3.2.8 |  |
| 1024QAM modulation for PDSCH for FR1 (pdsch-1024QAM-FR1-r17 or *pdsch-1024QAM-2MIMO-FR1-r17*) | FR1 FDD | PDSCH | Clause 5.2.2.1.1 (Test 1-8)  Clause 5.2.3.1.1 (Test 1-8) |  |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.1 (Test 1-12)  Clause 5.2.3.2.1 (Test 1-12) |  |
|  |  | SDR | Clause 5.5.1  Clause 5.5A.1 | 1024QAM MCS indexes are used only if UE supports 1024QAM for FR1 DL. |
| DRX Adaptation (*drx-adaptation-r16*) | FR1 FDD | PDCCH | Clause 5.3.2.1.3 | If the Test 1 in Clause 5.3.2.1.3 is passed, the test coverage can be considered fulfilled without executing Test 3 in clause 5.3.2.1.1. |
|  | FR1 TDD | PDCCH | Clause 5.3.2.2.3 | If the Test 1 in Clause 5.3.2.2.3 is passed, the test coverage can be considered fulfilled without executing Test 2 in clause 5.3.2.2.1. |
|  | FR1 FDD | PDCCH | Clause 5.3.3.1.3 | If the Test 1 in Clause 5.3.3.1.3 is passed, the test coverage can be considered fulfilled without executing Test 3 in clause 5.3.3.1.1. |
|  | FR1 TDD | PDCCH | Clause 5.3.3.2.3 | If the Test 1 in Clause 5.3.3.2.3 is passed, the test coverage can be considered fulfilled without executing Test 2 in clause 5.3.3.2.1. |
| Support of neighboring LTE cell CRS-IM in DSS scenario with NR 15 kHz SCS ( CRS-IM-DSS-15kHzSCS-r17) | FR1 FDD | PDSCH | Clause 5.2.2.1.18  Clause 5.2.3.1.17 | UE can support the feature on the CC(s) in a band only if the UE indicates support of rateMatchingLTE-CRS on that band. |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.19  Clause 5.2.3.2.18 |  |
| Support of neighboring LTE cell CRS-IM in non-DSS and 15 kHz NR SCS scenario, without the assistance of network signalling on LTE channel bandwidth (CRS-IM-nonDSS-15kHzSCS-r17) | FR1 FDD | PDSCH | Clause 5.2.2.1.19 (Test 2-1)  Clause 5.2.3.1.18 (Test 2-1) | The UE can perform CRS-IM when MeasObjectEUTRA IE is configured, and the configured measurement gaps overlap with neighbour LTE cell PBCH position. |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.20 (Test 2-1)  Clause 5.2.3.2.19 (Test 2-1) |  |
| Support of neighboring LTE cell CRS-IM in non-DSS and 15 kHz NR SCS scenario, with the assistance of network signalling on LTE channel bandwidth (CRS-IM-nonDSS-NWA-15kHzSCS-r17) | FR1 FDD | PDSCH | Clause 5.2.2.1.19 (Test 1-1)  Clause 5.2.3.1.18 (Test 1-1) | If the Test 2-1 in Clause 5.2.2.1.19 is passed, the test coverage can be considered fulfilled without executing Test 1-1 in clause 5.2.2.1.19.  If the Test 2-1 in Clause 5.2.3.1.18 is passed, the test coverage can be considered fulfilled without executing Test 1-1 in clause 5.2.3.1.18. |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.20 (Test 1-1)  Clause 5.2.3.2.19 (Test 1-1) | If the Test 2-1 in Clause 5.2.2.2.20 is passed, the test coverage can be considered fulfilled without executing Test 1-1 in clause 5.2.2.2.20.  If the Test 2-1 in Clause 5.2.3.2.19 is passed, the test coverage can be considered fulfilled without executing Test 1-1 in clause 5.2.3.2.19. |
| CRS-IM in non-DSS and 30 kHz NR SCS scenario, without the assistance of network signalling on LTE channel bandwidth (crs-IM-nonDSS-30kHzSCS-r17) | FR1 TDD | PDSCH | Clause 5.2.2.2.20 (Test 2-2)  Clause 5.2.3.2.19 (Test 2-2) | The UE can perform CRS-IM when MeasObjectEUTRA IE is configured, and the configured measurement gaps overlap with neighbour LTE cell PBCH position. |
| CRS-IM in non-DSS and 30 kHz NR SCS scenario, with the assistance of network signalling on LTE channel bandwidth (crs-IM-nonDSS-NWA-30kHzSCS-r17) | FR1 TDD | PDSCH | Clause 5.2.2.2.20 (Test 1-2)  Clause 5.2.3.2.19 (Test 1-2) | If the Test 2-2 in Clause 5.2.2.2.20 is passed, the test coverage can be considered fulfilled without executing Test 1-2 in clause 5.2.2.2.20.  If the Test 2-2 in Clause 5.2.3.2.19 is passed, the test coverage can be considered fulfilled without executing Test 1-2 in clause 5.2.3.2.19. |
| Support for SFN scheme A for PDCCH scheduling SFN Scheme A PDSCH (sfn-SchemeA-r17) | FR1 FDD | PDSCH | Clause 5.2.2.1.20  Clause 5.2.3.1.19 |  |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.21  Clause 5.2.3.2.20 |  |
| Support for SFN scheme B for PDCCH scheduling SFN Scheme B PDSCH (sfn-SchemeB-r17) | FR1 FDD | PDSCH | Clause 5.2.2.1.21  Clause 5.2.3.1.20 |  |
|  | FR1 TDD | PDSCH | Clause 5.2.2.2.22  Clause 5.2.3.2.21 |  |

#### 5.1.1.4 Applicability of requirements for mandatory UE features with capability signalling

The performance requirements in Table 5.1.1.4-1 shall apply for UEs which support mandatory UE features with capability signalling only.

Table 5.1.1.4-1: Requirements applicability for mandatory features with UE capability signalling

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE feature/capability [14] | Test type | | Test list | Applicability notes |
| 256QAM modulation scheme for PDSCH for FR1 (*pdsch-256QAM-FR1*) | FR1 FDD | PDSCH | Clause 5.2.2.1.1 (Test 1-3)  Clause 5.2.3.1.1 (Test 1-3) |  |
| FR1 TDD | PDSCH | Clause 5.2.2.2.1 (Test 1-3)  Clause 5.2.3.2.1 (Test 1-3) |  |
| PDSCH mapping type B (*pdsch-MappingTypeB*) | FR1 FDD | PDSCH | Clause 5.2.2.1.3  Clause 5.2.3.1.3  Clause 5.2.2.1.7  Clause 5.2.3.1.7 |  |
| FR1 TDD | PDSCH | Clause 5.2.2.2.3  Clause 5.2.3.2.3  Clause 5.2.2.2.7  Clause 5.2.3.2.7 |  |
| Rate-matching around LTE CRS (rateMatchingLTE-CRS) | FR1 FDD | PDSCH | Clause 5.2.2.1.4  Clause 5.2.3.1.4 | For UEs supporting “Alternative additional DMRS position for co-existence with LTE CRS”, if Test 1-2 is tested, the test coverage can be considered fulfilled without executing Test 1-1. Otherwise, only Test 1-1 is tested. |
| FR1 TDD | PDSCH | Clause 5.2.2.2.4  Clause 5.2.3.2.4 |
| Supported maximum number of ports across all configured NZP-CSI-RS resources per CC  (maxConfigNumberPortsAcrossNZP-CSI-RS-PerCC) | FR1 FDD | PDSCH | Clause 5.2.2.1.4 (Tests 1-1, 1-2)  Clause 5.2.3.1.1 (Tests 3-1, 4-1, 5-1)  Clause 5.2.3.1.4 (Tests 1-1, 1-2) | The requirements apply only in case the number of NZP-CSI-RS ports in the test case satisfies UE capability on maximum number of NZP-CSI-RS ports |
|  | FR1 TDD | PDSCH | Clause 5.2.3.2.1 (Tests 3-1, 4-1, 5-1) |  |
| Supported maximum number of PDSCH MIMO layers (*maxNumberMIMO-LayersPDSCH*) | FR1 FDD | PDSCH | Clause 5.2.2.1.1 (Tests 2-1, 2-2, 3-1)  Clause 5.2.2.1.2  Clause 5.2.3.1.1 (Tests 2-1, 2-2, 3-1, 4-1, 5-1)  Clause 5.2.3.1.2 | The requirements apply only in case the PDSCH MIMO rank in the test case does not exceed UE PDSCH MIMO layers capability |
| FR1 TDD | PDSCH | Clause 5.2.2.2.1 (Tests 2-1, 2-2, 3-1)  Clause 5.2.2.2.2  Clause 5.2.3.2.1 (Tests 2-1, 2-2, 3-1, 4-1, 5-1)  Clause 5.2.3.2.2 |
| Support number of active TCI states per BWP per CC, including control and data *(maxNumberActiveTCI-PerBWP)* | FR1 FDD | PDSCH | Clause 5.2.2.1.10 (Test 1-2)  Clause 5.2.3.1.10 (Test 1-2) | The requirements apply only when *maxNumberActiveTCI-PerBWP* is other than n1. |
| FR1 TDD | PDSCH | Clause 5.2.2.2.10 (Test 1-2)  Clause 5.2.3.2.10 (Test 1-2) |
| Support for maximum number of TRS resource sets per CC which the UE can track simultaneously (*maxSimultaneousResourceSetsPerCC*) | FR1 FDD | PDSCH | Clause 5.2.2.1.10 (Test 1-2)  Clause 5.2.3.1.10 (Test 1-2)  Clause 5.2.2.1.11  Clause 5.2.2.1.12  Clause 5.2.2.1.13  Clause 5.2.2.1.14  Clause 5.2.3.1.11  Clause 5.2.3.1.12  Clause 5.2.3.1.13  Clause 5.2.3.1.14 | The requirements apply only when *maxSimultaneousResourceSetsPerCC* ≥ 2 |
| FR1 TDD | PDSCH | Clause 5.2.2.2.10 (Test 1-2)  Clause 5.2.3.2.10 (Test 1-2)  Clause 5.2.2.2.11  Clause 5.2.2.2.12  Clause 5.2.2.2.13  Clause 5.2.2.2.14  Clause 5.2.3.2.11  Clause 5.2.3.2.12  Clause 5.2.3.2.13  Clause 5.2.3.2.14 |

#### 5.1.1.5 Applicability of CA requirements

##### 5.1.1.5.1 Definition of CA capability

The definition with respect to CA capabilities is given as in Table 5.1.1.5.1-1.

Table 5.1.1.5.1-1: Definition of CA capability

|  |  |
| --- | --- |
| CA Capability | CA Capability Description |
| CA\_C | Intra-band contiguous CA |
| CA\_N | Intra-band non-contiguous CA |
| CA\_AX | Inter-band CA (X bands) |
| NOTE 1: CA\_C corresponds to NR CA configurations and bandwidth combination sets defined in Section 5.5A.1 of TS 38.101-1[2]. CA\_N corresponds to NR CA configurations and bandwidth combination sets defined in Section 5.5A.2 of TS 38.101-1[2]. CA\_AX corresponds to NR CA configurations and bandwidth combination sets defined in Section 5.5A.3 of TS 38.101-1[2]. | |

##### 5.1.1.5.2 Applicability and test rules for different CA configurations and bandwidth combination sets

The performance requirement for CA UE demodulation tests in Section 5.2A are defined independent of CA configurations and bandwidth combination sets specified in Section 5.5A of TS 38.101-1[2]. For UEs supporting different CA configurations and bandwidth combination sets, the applicability and test rules are defined in Table 5.1.1.5.2-1 and Table 5.1.1.5.2-2. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set.

Table 5.1.1.5.2-1: Applicability and test rules for CA UE demodulation tests

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Tests | CA capability where the tests apply | CA configuration from the selected CA capability where the tests apply | CA Bandwidth combination to be tested in priority order | PCell CC configuration |
| Test 1 in Section 5.2A.2.1 and 5.2A.3.1 | CA\_C, CA\_N, CA\_AX | Table 5.1.1.5.2-2 | Largest aggregated CA bandwidth combination | Any of CCs |
| Test 2 in Section 5.2A.2.1 and 5.2A.3.1 | CA\_C, CA\_N, CA\_AX | Table 5.1.1.5.2-2 | Largest aggregated CA bandwidth combination | Any of CCs |
| Test 3 in Section 5.2A.2.1 and 5.2A.3.1 | CA\_AX | Table 5.1.1.5.2-2 | Largest aggregated CA bandwidth combination | TDD CC if supported, otherwise FDD CC |
| Test 4 in Section 5.2A.2.1 and 5.2A.3.1 (NOTE 2) | CA\_AX | Table 5.1.1.5.2-2 | Largest aggregated CA bandwidth combination | Any of CCs |
| Test 5 in Section 5.2A.2.1 and 5.2A.3.1 (NOTE 3) | CA\_AX | Table 5.1.1.5.2-2 | Largest aggregated CA bandwidth combination | 15 kHz CC if supported, otherwise 30 kHz CC |
| NOTE 1: In case CA\_AX with different number of X is supported then one or two CA configurations are selected based on procedure from Table 5.1.1.5.2-2.  NOTE 2: These scenarios are only tested for UEs which are not verified with Test 3 in Section 5.2A.2.1 and 5.2A.3.1  NOTE 3: These scenarios are only tested for UEs which are not verified with Test 4 in Section 5.2A.2.1 and 5.2A.3.1 | | | | |

Table 5.1.1.5.2-2: Selection of CA configurations

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| CA capability | Step 1 | Step 2 | Step 3 | Step 4 |
| CA\_C or CA\_N | Select the CA configurations with the maximum number of CCs, for which the supported maximum number of MIMO layers is not lower than 2. | Select any one of CA configurations, which contain CA bandwidth combination with the largest aggregated channel bandwidth and supported maximum data rate is not lower than the tested date rate, among all the selected CA configurations from Step 1. | N/A | N/A |
| CA\_AX | Select the CA configurations with the maximum number of CCs, for which the supported maximum number of MIMO layers is not lower than 2. | Select any one of CA configurations, which contain CA bandwidth combination with the largest aggregated channel bandwidth and supported maximum data rate is not lower than the tested date rate, among all the selected CA configurations from Step 1. | Select the CA configurations with the largest number of bands and with the maximum number of CCs, for which the supported maximum number of MIMO layers is not lower than 2. | Select any one of CA configurations, which contain CA bandwidth combination with the largest aggregated channel bandwidth and supported maximum data rate is not lower than the tested date rate, among all the selected CA configurations from Step 3. |
| NOTE 1: For CA\_AX capability, if CA configuration from step 2 is CA configuration with the largest number of bands then Step 3 and Step 4 are skipped. Otherwise, the two CA configurations selected from Step 2 and Step 4 are used for testing.  NOTE 2: Maximum supported data rate for Step 2 and Step 4 is calculated based clause 4.1.2 of TS 38.306 [14].  NOTE 3: Tested data rate for Step 2 and Step 4 is calculated based on the equation and FRCs used in the test. | | | | |

##### 5.1.1.5.3 Applicability rule and antenna connection for CA tests with 4 RX

Within the CA configuration if any of the PCell and/or the SCells is a 2Rx supported RF band, 2 out of the 4Rx should be connected with data source from system simulator, depending on UE’s declaration and AP configuration. Requirements from Clause 5.2A.2.1 are applied.

Within the CA configuration if any of the PCell and/or the SCells is a 4Rx supported RF band, all 4Rx should be connected with data source from system simulator. Requirements from Clause 5.2A.3.1 are applied.

For 4Rx capable UEs, the 2Rx supported RF bands and 4Rx supported RF bands are up to UE’s declaration.

##### 5.1.1.5.4 Applicability of different requirements for HST

The applicability rules for different HST requirements in section 5 are specified in Table 5.1.1.5.4-1.

Table 5.1.1.5.4-1: Applicability of requirements for HST

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| If UE has passed | | | UE can skip | | | Applicability notes |
| Test type | | Test list | Test type | | Test list |  |
| FR1 2Rx | PDSCH | Clause 5.2A.2.4 (Test 3), and Clause 5.2A.2.5 (Test 1-2) | FR1 2Rx | PDSCH | Clause 5.2A.2.4 (Test 2), and Clause 5.2A.2.5 (Test 1-3) |  |
| FR1 2Rx | PDSCH | Clause 5.2A.2.4 (Test 1), and Clause 5.2A.2.5 (Test 1-2) | FR1 2Rx | PDSCH | Clause 5.2A.2.4 (Test 2), and Clause 5.2A.2.5 (Test 1-1) |  |
| FR1 4Rx | PDSCH | Clause 5.2A.3.4 (Test 3), and Clause 5.2A.3.5 (Test 1-2) | FR1 4Rx | PDSCH | Clause 5.2A.3.4 (Test 2), and Clause 5.2A.3.5 (Test 1-3), |  |
| FR1 4Rx | PDSCH | Clause 5.2A.3.4 (Test 1), and Clause 5.2A.3.5 (Test 1-2) | FR1 4Rx | PDSCH | Clause 5.2A.3.4 (Test 2), and Clause 5.2A.3.5 (Test 1-1), |  |
| FR1 2Rx | PDSCH | Clause 5.2A.2.5 (Test 1-3) | FR1 2Rx | PDSCH | Clause 5.2A.2.5 (Test 1-1) |  |
| FR1 2Rx | PDSCH | Clause 5.2A.2.4 (Test 3) | FR1 2Rx | PDSCH | Clause 5.2A.2.4 (Test 1) |  |
| FR1 4Rx | PDSCH | Clause 5.2A.3.5 (Test 1-3) | FR1 4Rx | PDSCH | Clause 5.2A.3.5 (Test 1-1) |  |
| FR1 4Rx | PDSCH | Clause 5.2A.3.4 (Test 3) | FR1 4Rx | PDSCH | Clause 5.2A.3.4 (Test 1) |  |
| FR1 2Rx | PDSCH | Clause 5.2A.2.4 (Test 3) | FR1 2Rx | PDSCH | Clause 5.2.2.1.9 (Test 1-1), Clause 5.2.2.2.1 (Test 1-11),  Clause 5.2.2.2.9 (Test 1-1) |  |
| FR1 2Rx | PDSCH | Clause 5.2A.2.5 (Test 1-3) | FR1 2Rx | PDSCH | Clause 5.2.2.1.10 (Test 1-1), Clause 5.2.2.2.1 (Test 1-11),  Clause 5.2.2.2.10 (Test 1-1) |  |
| FR1 2Rx | PDSCH | Clause 5.2A.2.4 (Test 1) | FR1 2Rx | PDSCH | Clause 5.2.2.1.9 (Test 1-1) |  |
| FR1 2Rx | PDSCH | Clause 5.2A.2.5 (Test 1-1) | FR1 2Rx | PDSCH | Clause 5.2.2.1.10 (Test 1-1) |  |
| FR1 2Rx | PDSCH | Clause 5.2A.2.4 (Test 2) | FR1 2Rx | PDSCH | Clause 5.2.2.2.1 (Test 1-11),  Clause 5.2.2.2.9 (Test 1-1) |  |
| FR1 2Rx | PDSCH | Clause 5.2A.2.5 (Test 1-2) | FR1 2Rx | PDSCH | Clause 5.2.2.2.1 (Test 1-11),  Clause 5.2.2.2.10 (Test 1-1) |  |
| FR1 4Rx | PDSCH | Clause 5.2A.3.4 (Test 3) | FR1 4Rx | PDSCH | Clause 5.2.3.1.9 (Test 1-1), Clause 5.2.3.2.1 (Test 1-11),  Clause 5.2.3.2.9 (Test 1-1) |  |
| FR1 4Rx | PDSCH | Clause 5.2A.3.5 (Test 1-3) | FR1 4Rx | PDSCH | Clause 5.2.3.1.10 (Test 1-1), Clause 5.2.3.2.1 (Test 1-11),  Clause 5.2.3.2.10 (Test 1-1) |  |
| FR1 4Rx | PDSCH | Clause 5.2A.3.4 (Test 1) | FR1 4Rx | PDSCH | Clause 5.2.3.1.9 (Test 1-1) |  |
| FR1 4Rx | PDSCH | Clause 5.2A.3.5 (Test 1-1) | FR1 4Rx | PDSCH | Clause 5.2.3.1.10 (Test 1-1) |  |
| FR1 4Rx | PDSCH | Clause 5.2A.3.4 (Test 2) | FR1 4Rx | PDSCH | Clause 5.2.3.2.1 (Test 1-11),  Clause 5.2.3.2.9 (Test 1-1) |  |
| FR1 4Rx | PDSCH | Clause 5.2A.3.5 (Test 1-2) | FR1 4Rx | PDSCH | Clause 5.2.3.2.1 (Test 1-11),  Clause 5.2.3.2.10 (Test 1-1) |  |
| FR1 2Rx | PDSCH | Clause 5.2A.2.5 (Test 2-1) | FR1 2Rx | PDSCH | Clause 5.2A.2.5 (Test 1-1) |  |
| FR1 2Rx | PDSCH | Clause 5.2A.2.5 (Test 2-2) | FR1 2Rx | PDSCH | Clause 5.2A.2.5 (Test 1-2) |  |
| FR1 2Rx | PDSCH | Clause 5.2A.2.5 (Test 2-3) | FR1 2Rx | PDSCH | Clause 5.2A.2.5 (Test 1-3) |  |
| FR1 4Rx | PDSCH | Clause 5.2A.3.5 (Test 2-1) | FR1 4Rx | PDSCH | Clause 5.2A.3.5 (Test 1-1) |  |
| FR1 4Rx | PDSCH | Clause 5.2A.3.5 (Test 2-2) | FR1 4Rx | PDSCH | Clause 5.2A.3.5 (Test 1-2) |  |
| FR1 4Rx | PDSCH | Clause 5.2A.3.5 (Test 2-3) | FR1 4Rx | PDSCH | Clause 5.2A.3.5 (Test 1-3) |  |
| FR1 2Rx | PDSCH | Clause 5.2A.2.4 (Test 3), and Clause 5.2A.2.5 (Test 2-2) | FR1 2Rx | PDSCH | Clause 5.2A.2.4 (Test 2), and Clause 5.2A.2.5 (Test 2-3) |  |
| FR1 2Rx | PDSCH | Clause 5.2A.2.4 (Test 1), and Clause 5.2A.2.5 (Test 2-2) | FR1 2Rx | PDSCH | Clause 5.2A.2.4 (Test 2), and Clause 5.2A.2.5 (Test 2-1) |  |
| FR1 4Rx | PDSCH | Clause 5.2A.3.4 (Test 3), and Clause 5.2A.3.5 (Test 2-2) | FR1 4Rx | PDSCH | Clause 5.2A.3.4 (Test 2), and Clause 5.2A.3.5 (Test 2-3), |  |
| FR1 4Rx | PDSCH | Clause 5.2A.3.4 (Test 1), and Clause 5.2A.3.5 (Test 2-2) | FR1 4Rx | PDSCH | Clause 5.2A.3.4 (Test 2), and Clause 5.2A.3.5 (Test 2-1), |  |
| FR1 2Rx | PDSCH | Clause 5.2A.2.5 (Test 2-3) | FR1 2Rx | PDSCH | Clause 5.2A.2.5 (Test 2-1) |  |
| FR1 4Rx | PDSCH | Clause 5.2A.3.5 (Test 2-3) | FR1 4Rx | PDSCH | Clause 5.2A.3.5 (Test 2-1) |  |
| FR1 2Rx | PDSCH | Clause 5.2A.2.5 (Test 2-3) | FR1 2Rx | PDSCH | Clause 5.2.2.1.10 (Test 1-1), Clause 5.2.2.2.1 (Test 1-11),  Clause 5.2.2.2.10 (Test 1-1),  Clause 5.2.2.1.10 (Test 1-2),  Clause 5.2.2.2.10 (Test 1-2) |  |
| FR1 2Rx | PDSCH | Clause 5.2A.2.5 (Test 2-1) | FR1 2Rx | PDSCH | Clause 5.2.2.1.10 (Test 1-1),  Clause 5.2.2.1.10 (Test 1-2) |  |
| FR1 2Rx | PDSCH | Clause 5.2A.2.5 (Test 2-2) | FR1 2Rx | PDSCH | Clause 5.2.2.2.1 (Test 1-11),  Clause 5.2.2.2.10 (Test 1-1),  Clause 5.2.2.2.10 (Test 1-2) |  |
| FR1 4Rx | PDSCH | Clause 5.2A.3.5 (Test 2-3) | FR1 4Rx | PDSCH | Clause 5.2.3.1.10 (Test 1-1), Clause 5.2.3.2.1 (Test 1-11),  Clause 5.2.3.2.10 (Test 1-1),  Clause 5.2.3.1.10 (Test 1-2),  Clause 5.2.3.2.10 (Test 1-2) |  |
| FR1 4Rx | PDSCH | Clause 5.2A.3.5 (Test 2-1) | FR1 4Rx | PDSCH | Clause 5.2.3.1.10 (Test 1-1),  Clause 5.2.3.1.10 (Test 1-2) |  |
| FR1 4Rx | PDSCH | Clause 5.2A.3.5 (Test 2-2) | FR1 4Rx | PDSCH | Clause 5.2.3.2.1 (Test 1-11),  Clause 5.2.3.2.10 (Test 1-1),  Clause 5.2.3.2.10 (Test 1-2) |  |

#### 5.1.1.6 Applicability and test rules for PDSCH performance requirements with power imbalance for intra-band contiguous CA

For UE passing the FDD and TDD CA power imbalance performance requirements with 2 DL CCs as defined in sections 5.2A.2.2 and 5.2A.3.2, the test coverage can be considered fulfilled with FDD or TDD intra-band contiguous CA with 3 or more DL CCs supported by the UE. During the test, UE is required to test the supported intra-band contiguous CA configurations with 2 DL CCs covering the lowest and highest operating bands.

The channel bandwidth combination for testing is determined by following procedure:

- First select the bandwidth combinations with the same bandwidth in each carrier.

- If there is no such bandwidth combination, select the bandwidth combinations with smallest bandwidth difference between the two carriers, and the carrier with smaller bandwidth will be used for test.

- Among the bandwidth combinations selected, select the CA combination with largest aggregated bandwidth combination.

#### 5.1.1.7 Applicability of different requirements for HST

The applicability rules for different HST requirements in section 5 are specified in Table 5.1.1.7-1.

Table 5.1.1.7-1: Applicability of requirements for HST

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| If UE has passed | | | UE can skip | | | Applicability notes |
| Test type | | Test list | Test type | | Test list |
| FR1 FDD | PDSCH | Clause 5.2.2.1.1 (Test 1-6) | FR1 FDD | PDSCH | Clause 5.2.2.1.1 (Test 1-5) |  |
| FR1 TDD | PDSCH | Clause 5.2.2.2.1 (Test 1-11) | FR1 TDD | PDSCH | Clause 5.2.2.2.1 (Test 1-7) |  |
| FR1 FDD | PDSCH | Clause 5.2.3.1.1 (Test 1-6) | FR1 FDD | PDSCH | Clause 5.2.3.1.1 (Test 1-5) |  |
| FR1 TDD | PDSCH | Clause 5.2.3.2.1 (Test 1-11) | FR1 TDD | PDSCH | Clause 5.2.3.2.1 (Test 1-7) |  |
| FR1 FDD | PDSCH | Clause 5.2.2.1.9 (Test 1-1) | FR1 FDD | PDSCH | Clause 5.2.2.1.1 (Test 1-5 ) |  |
| FR1 TDD | PDSCH | Clause 5.2.2.2.9 (Test 1-1) | FR1 TDD | PDSCH | Clause 5.2.2.2.1 (Test 1-7 and 1-11) |  |
| FR1 FDD | PDSCH | Clause 5.2.3.1.9 (Test 1-1) | FR1 FDD | PDSCH | Clause 5.2.3.1.1 (Test 1-5) |  |
| FR1 TDD | PDSCH | Clause 5.2.3.2.9 (Test 1-1) | FR1 TDD | PDSCH | Clause 5.2.3.2.1 (Test 1-7 and 1-11) |  |
| FR1 FDD | PDSCH | Clause 5.2.2.1.1 (Test 1-7) | FR1 FDD | PDSCH | Clause 5.2.2.1.1 (Test 1-1) |  |
| FR1 FDD | PDSCH | Clause 5.2.3.1.1 (Test 1-7) | FR1 FDD | PDSCH | Clause 5.2.3.1.1 (Test 1-1) |  |
| FR1 FDD | PDSCH | Clause 5.2.2.1.10 (Test 1-1 or 1-2) | FR1 FDD | PDSCH | Clause 5.2.2.1.1 (Test 1-5 ) |  |
| FR1 TDD | PDSCH | Clause 5.2.2.2.10 (Test 1-1 or 1-2) | FR1 TDD | PDSCH | Clause 5.2.2.2.1 (Test 1-7 and 1-11) |  |
| FR1 FDD | PDSCH | Clause 5.2.3.1.10 (Test 1-1 or 1-2) | FR1 FDD | PDSCH | Clause 5.2.3.1.1 (Test 1-5) |  |
| FR1 TDD | PDSCH | Clause 5.2.3.2.10 (Test 1-1 or 1-2) | FR1 TDD | PDSCH | Clause 5.2.3.2.1 (Test 1-7 and 1-11) |  |
| FR1 FDD | PDSCH | Clause 5.2.2.1.10 (Test 1-2) | FR1 FDD | PDSCH | Clause 5.2.2.1.10 (Test 1-1) |  |
| FR1 TDD | PDSCH | Clause 5.2.2.2.10 (Test 1-2) | FR1 TDD | PDSCH | Clause 5.2.2.2.10 (Test 1-1) |  |
| FR1 FDD | PDSCH | Clause 5.2.3.1.10 (Test 1-2) | FR1 FDD | PDSCH | Clause 5.2.3.1.10 (Test 1-1) |  |
| FR1 TDD | PDSCH | Clause 5.2.3.2.10 (Test 1-2) | FR1 TDD | PDSCH | Clause 5.2.3.2.10 (Test 1-1) |  |

Table 5.1.1.7-2: Applicability of requirements for HST Enhanced SFN Transmission schemes

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| If UE has passed | | | UE can skip | | | Applicability notes |
| Test type | | Test list | Test type | | Test list |  |
| FR1 FDD | PDSCH | Clause 5.2.2.1.20 | FR1 FDD | PDSCH | Clause 5.2.2.1.21 |  |
| FR1 TDD | PDSCH | Clause 5.2.2.2.21 | FR1 TDD | PDSCH | Clause 5.2.2.2.22 |  |
| FR1 FDD | PDSCH | Clause 5.2.3.1.19 | FR1 FDD | PDSCH | Clause 5.2.3.1.20 |  |
| FR1 TDD | PDSCH | Clause 5.2.3.2.20 | FR1 TDD | PDSCH | Clause 5.2.3.2.21 |  |

#### 5.1.1.8 Applicability of different requirements with Multi-TRxP

The applicability rules for requirements with multi-TRxP transmission schemes in section 5 are specified in Table 5.1.1.8-1.

Table 5.1.1.8-1: Applicability of requirements with Multi-TRxP Transmission

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| If UE has passed | | | UE can skip | | | Applicability notes |
| Test type | | Test list | Test type | | Test list |
| FR1 FDD | PDSCH | Clause 5.2.2.1.12 (Test 1-1) | FR1 FDD | PDSCH | Clause 5.2.2.1.11 (Test 1-1) |  |
| FR1 FDD | PDSCH | Clause 5.2.2.1.12 (Test 1-1) | FR1 FDD | PDSCH | Clause 5.2.2.1.13 (Test 1-1) |  |
| FR1 FDD | PDSCH | Clause 5.2.2.1.6 (Test 1-1) | FR1 FDD | PDSCH | Clause 5.2.2.1.14 (Test 1-1) |  |
| FR1 TDD | PDSCH | Clause 5.2.2.2.12 (Test 1-1) | FR1 TDD | PDSCH | Clause 5.2.2.2.11 (Test 1-1) |  |
| FR1 TDD | PDSCH | Clause 5.2.2.2.12 (Test 1-1) | FR1 TDD | PDSCH | Clause 5.2.2.2.13 (Test 1-1) |  |
| FR1 TDD | PDSCH | Clause 5.2.2.2.6 (Test 1-1) | FR1 TDD | PDSCH | Clause 5.2.2.2.14 (Test 1-1) |  |
| FR1 FDD | PDSCH | Clause 5.2.3.1.12 (Test 1-1) | FR1 FDD | PDSCH | Clause 5.2.3.1.11 (Test 1-1) |  |
| FR1 FDD | PDSCH | Clause 5.2.3.1.12 (Test 1-1) | FR1 FDD | PDSCH | Clause 5.2.3.1.13 (Test 1-1) |  |
| FR1 FDD | PDSCH | Clause 5.2.3.1.6 (Test 1-1) | FR1 FDD | PDSCH | Clause 5.2.3.1.14 (Test 1-1) |  |
| FR1 TDD | PDSCH | Clause 5.2.3.2.12 (Test 1-1) | FR1 TDD | PDSCH | Clause 5.2.3.2.11 (Test 1-1) |  |
| FR1 TDD | PDSCH | Clause 5.2.3.2.12 (Test 1-1) | FR1 TDD | PDSCH | Clause 5.2.3.2.13 (Test 1-1) |  |
| FR1 TDD | PDSCH | Clause 5.2.3.2.6 (Test 1-1) | FR1 TDD | PDSCH | Clause 5.2.3.2.14 (Test 1-1) |  |

#### 5.1.1.9 Applicability of requirements for PDSCH on bands with shared spectrum access

|  |  |
| --- | --- |
| Tests | Applicability notes |
| All tests in Clause 5.2.2.2.15 and 5.2.3.2.15 | Only test the supported largest channel bandwidth. |
| All tests in Clause 5.2A.2.3 and 5.2A.3.3 | Only test the supported largest channel bandwidth on SCell. |

#### 5.1.1.10 Applicability of requirements for PDSCH with inter cell interference

|  |  |
| --- | --- |
| Tests | Applicability notes |
| All tests in Clause 5.2.2.1.15, 5.2.3.1.15, 5.2.2.2.16 and 5.2.3.2.16 | If UE supporting both duplex mode TDD and FDD with 2RX, only test 1-1 in clause 5.2.2.1.15 and test 1-2 in clause 5.2.2.2.16 will be applied.  If UE supporting both duplex mode TDD and FDD with 4RX, only test 1-1 in clause 5.2.3.1.15 and test 1-2 in clause 5.2.3.2.16 will be applied. |

#### 5.1.1.11 Applicability of requirements for RedCap

The performance requirements in Table 5.1.1.11-1 shall apply for UEs which support optional feature *supportOfRedCap*.

Other performance requirements mandatory for UE supporting NR operation defined in Section 5 but not included in table 5.1.1.11-1 should not be considered applicable to RedCap UEs.

Table 5.1.1.11-1: Requirements applicability for RedCap

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE capability | Test type | | Test list | Applicability notes |
| RedCap with 1RX | FR1 FDD and HD-FDD (Note 1) | PDSCH | All tests in Clause 5.2.1.1.1 |  |
|  |  | PDCCH | All tests in Clause 5.3.1.1.1 |  |
|  |  | PBCH | All tests in Clause 5.4.1.1 |  |
|  |  | SDR | Clause 5.5. 3 |  |
|  | FR1 TDD | PDSCH | All tests in Clause 5.2.1.2.1 |  |
|  |  | PDCCH | All tests in Clause 5.3.1.2.1 |  |
|  |  | PBCH | All tests in Clause 5.4.1.2 |  |
|  |  | SDR | Clause 5.5.3 |  |
| RedCap with 2RX | FR1 FDD and HD-FDD (Note 1) | PDSCH | All tests in Clause 5.2.2.1.17 |  |
|  |  | PDCCH | All tests in Clause 5.3.2.1.4 |  |
|  |  | PBCH | Clause 5.4.2.1 (Table 5.4.2.1-2 Test 1)  Clause 5.4.2.1 (Table 5.4.2.1-3 Test 1) |  |
|  |  | SDR | Clause 5.5.3 |  |
|  | FR1 TDD | PDSCH | All tests in Clause 5.2.2.2.18 |  |
|  |  | PDCCH | All tests in Clause 5.3.2.2.4 |  |
|  |  | PBCH | Clause 5.4.2.2 (Table 5.4.2.2-4 Test 1)  Clause 5.4.2.2 (Table 5.4.2.2-5 Test 1) |  |
|  |  | SDR | Clause 5.5.3 |  |
| Note 1: If UE support only HD-FDD in a FDD band, this UE is tested with HD-FDD mode otherwise UE is tested with full-duplex FDD mode | | | | |

## 5.2 PDSCH demodulation requirements

The parameters specified in Table 5.2-1 are valid for all PDSCH tests unless otherwise stated.

Table 5.2-1: Common test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Value |
| PDSCH transmission scheme | | |  | Transmission scheme 1 |
| Carrier configuration | Offset between Point A and the lowest usable subcarrier on this carrier (Note 2) | | RBs | 0 |
| Subcarrier spacing | | kHz | 15 or 30 |
| DL BWP configuration #1 | Cyclic prefix | |  | Normal |
| RB offset | | RBs | 0 |
| Number of contiguous PRB | | PRBs | Maximum transmission bandwidth configuration as specified in clause 5.3.2 of TS 38.101-1 [2] for tested channel bandwidth and subcarrier spacing |
| Common serving cell parameters | Physical Cell ID | |  | 0 |
| SSB position in burst | |  | First SSB in Slot #0 |
| SSB periodicity | | ms | 20 |
| PDCCH configuration | Slots for PDCCH monitoring | |  | Each slot |
| Symbols with PDCCH | | Symbols | 0, 1 |
| Number of PRBs in CORESET | |  | Table 5.2-2 for tested channel bandwidth and subcarrier spacing |
| Number of PDCCH candidates and aggregation levels | |  | 1/AL8 |
| CCE-to-REG mapping type | |  | Non-interleaved |
| DCI format | |  | 1\_1 |
| TCI state | |  | TCI state #1 |
| PDCCH & PDCCH DMRS Precoding configuration | |  | For number of Tx=1: No precoding;  For number of Tx>1: Single Panel Type I, Randomized precoder selection for every REG bundle and updated per slot with equal probability of each applicable i1/i2 combination or codebook  index, chosen from section 5.2.2.2.1 of TS 38.214 [12] |
| Cross carrier scheduling | | |  | Not configured |
| CSI-RS for tracking | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resource 1,2,3,4 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resource 1 and 3  l0 = 10 for CSI-RS resource 2 and 4 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 |
| CDM Type | |  | 'No CDM' for CSI-RS resource 1,2,3,4 |
| Density (ρ) | |  | 3 for CSI-RS resource 1,2,3,4 |
| CSI-RS periodicity | | Slots | 15 kHz SCS: 20 for CSI-RS resource 1,2,3,4  30 kHz SCS: 40 for CSI-RS resource 1,2,3,4 |
| CSI-RS offset | | Slots | 15 kHz SCS:  10 for CSI-RS resource 1 and 2  11 for CSI-RS resource 3 and 4  30 kHz SCS:  20 for CSI-RS resource 1 and 2  21 for CSI-RS resource 3 and 4 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = BWP size |
| QCL info | |  | TCI state #0 |
| NZP CSI-RS for CSI acquisition | First subcarrier index in the PRB used for CSI-RS | |  | k0 = 0 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 12 |
| Number of CSI-RS ports (X) | |  | Same as number of transmit antenna |
| CDM Type | |  | 'No CDM' for 1 transmit antenna  'FD-CDM2' for 2 and 4 transmit antenna |
| Density (ρ) | |  | 1 |
| CSI-RS periodicity | | Slots | 15 kHz SCS: 20  30 kHz SCS: 40 |
| CSI-RS offset | | Slots | 0 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = BWP size |
| QCL info | |  | TCI state #1 |
| ZP CSI-RS for CSI acquisition | First subcarrier index in the PRB used for CSI-RS | |  | k0 = 4 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 12 |
| Number of CSI-RS ports (X) | |  | 4 |
| CDM Type | |  | 'FD-CDM2' |
| Density (ρ) | |  | 1 |
| CSI-RS periodicity | | Slots | 15 kHz SCS: 20  30 kHz SCS: 40 |
| CSI-RS offset | | Slots | 0 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = BWP size |
| PDSCH DMRS configuration | Antenna ports indexes | |  | {1000} for Rank 1 tests {1000, 1001} for Rank 2 tests  {1000-1002} for Rank 3 tests  {1000-1003} for Rank 4 tests |
| Position of the first DMRS for PDSCH mapping type A | |  | 2 |
| Number of PDSCH DMRS CDM group(s) without data | |  | 1 for Rank 1 and Rank 2 tests  2 for Rank 3 and Rank 4 tests |
| TCI state #0 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| PT-RS configuration | | |  | PT-RS is not configured |
| Maximum number of code block groups for ACK/NACK feedback | | |  | 1 |
| Maximum number of HARQ transmission | | |  | 4 |
| HARQ ACK/NACK bundling | | |  | Multiplexed |
| Redundancy version coding sequence | | |  | {0,2,3,1} |
| PDSCH & PDSCH DMRS Precoding configuration | | |  | For number of Tx=1: No precoding;  For number of Tx>1: Single Panel Type I, Randomized precoder selection for every PRB bundle and updated per slot with equal probability of each applicable i1/i2 combination or codebook  index, chosen from section 5.2.2.2.1 of TS 38.214 [12] |
| Symbols for all unused REs | | |  | OCNG Annex A.5 |
| Physical signals, channels mapping and precoding | | |  | As specified in Annex B.4.1 |
| Note 1: UE assumes that the TCI state for the PDSCH is identical to the TCI state applied for the PDCCH transmission.  Note 2: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-1 [2] for tested channel bandwidth and subcarrier spacing. | | | | |

Table 5.2-2: Number of PRBs in CORESET

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SCS (kHz) | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 80 MHz | 100 MHz |
| 15 | 24 | 48 | 78 | 102 | 132 | 156 | 216 | 270 | N/A | N/A | N/A |
| 30 | 6 | 24 | 36 | 48 | 60 | 78 | 102 | 132 | 162 | 216 | 270 |

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2

### 5.2.1 1RX requirements

#### 5.2.1.1 FDD

##### 5.2.1.1.1 1Rx FDD FR1 PDSCH performance for RedCap

5.2.1.1.1.1 Test Purpose

To verify the PDSCH performance mapping Type A under 1 receive antenna conditions with different channel models and MCSs for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput.

5.2.1.1.1.2 Test applicability

This test case applies to all types of NR UE release 17 and forward that support NR RedCap.

5.2.1.1.1.3 Minimum conformance requirements

The performance requirements are specified in Table 5.2.1.1.1.3-3, with the addition of test parameters in Table 5.2.1.1.1.3-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.1.1.1.3-1.

Table 5.2.1.1.1.3-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH mapping Type A normal performance under 1 receive antenna conditions and with different channel models and MCSs for RedCap | 1-1, 1-2, 1-3, 1-4 |

Table 5.2.1.1.1.3-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 12 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 4 for Test 1-1  2 for other tests |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 2 for Test 1-1, 1 for other tests |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CSI-RS for tracking | CSI-RS periodicity | Slots | Table 5.2-1 |
|  | CSI-RS offset | Slots | Table 5.2-1 |
| Number of HARQ Processes | |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 |

Table 5.2.1.1.1.3-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel (Note 1) | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
|  |  |  |  |  |  | Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-1.1 FDD  R.PDSCH.1-1.1 HD-FDD | 10 / 15 | QPSK, 0.30 | TDLB100-400 | 2x1 Low | 70 | 3.7 |
| 1-2 | R.PDSCH.1-2.1 FDD  R.PDSCH.1-1.2 HD-FDD | 10 / 15 | 16QAM, 0.48 | TDLC300-100 | 2x1 Low | 70 | 12.2 |
| 1-3 | R.PDSCH.1-3.5 FDD  R.PDSCH.1-1.3 HD-FDD | 10 / 15 | 64QAM, 0.50 | TDLA30-10 | 2x1 Low | 70 | 16.5 |
| 1-4 | R.PDSCH.1-4.2 FDD  R.PDSCH.1-1.4 HD-FDD | 10 / 15 | 256QAM, 0.67 | TDLA30-10 | 2x1 Low | 70 | 25.3 |
| Note 1: Applied reference channel depends on the supported operation mode: FDD or HD-FDD. | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.1.1.1.

5.2.1.1.1.4 Test description

5.2.1.1.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.0 for TE diagram and clause A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2A-1 to Table 5.2A-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.2.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.1.1.1.4.3.

5.2.1.1.1.4.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.1.1.1.3-2. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.1.1.1.5-1 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail according to Table G.1.5-1 in Annex G.1.5.

4. Repeat steps from 1 to 3 for each test points in Table 5.2.1.1.1.5-1 as appropriate.

5.2.1.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2 with the following exceptions:

Table 5.2.1.1.1.4.3-1: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | n4, n2 | n4 for test 1-1 | test 1-1 |
|  | Not present | n2 will be used by default | test point other than test 1-1 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.1.1.1.4.3-2: CSI-ResourcePeriodicityAndOffset for CSI Tracking

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots40 | 20 (for CSI-RS resources 1 and 2)  21 (for CSI-RS resources 3 and 4) | CSI-RS offset:  20 for CSI-RS resources 1 and 2  21 for CSI-RS resources 3 and 4  CSI-RS periodicity: 40 slots |  |
| slots20 | 10 (for CSI-RS resources 1 and 2)  11 (for CSI-RS resources 3 and 4) | CSI-RS offset:  10 for CSI-RS resources 1 and 2  11 for CSI-RS resources 3 and 4  CSI-RS periodicity: 20 slots |  |
| } |  |  |  |

5.2.1.1.1.5 Test Requirement

Table 5.2.1.1.1.5-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 and A.3.2.3 for each throughput test shall meet or exceed the specified value in Table 5.2.1.1.1.5-1 the specified SNR including test tolerances for all throughput tests.

Table 5.2.1.1.1.5-1: Test Requirements for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel (Note 1) | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
|  |  |  |  |  |  | Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-1.1 FDD  R.PDSCH. 1-1.1 HD-FDD | 10 / 15 | QPSK, 0.30 | TDLB100-400 | 2x1 Low | 70 | 3.7 + 0.9 |
| 1-2 | R.PDSCH.1-2.1 FDD  R.PDSCH. 1-1.2 HD-FDD | 10 / 15 | 16QAM, 0.48 | TDLC300-100 | 2x1 Low | 70 | 12.2 + 0.9 |
| 1-3 | R.PDSCH.1-3.5 FDD  R.PDSCH. 1-1.3 HD-FDD | 10 / 15 | 64QAM, 0.50 | TDLA30-10 | 2x1 Low | 70 | 16.5 + 1.0 |
| 1-4 | R.PDSCH.1-4.2 FDD  R.PDSCH. 1-1.4 HD-FDD | 10 / 15 | 256QAM, 0.67 | TDLA30-10 | 2x1 Low | 70 | 25.3 + 1.0 |
| Note 1: Applied reference channel depends on the supported operation mode: FDD or HD-FDD. | | | | | | | |

#### 5.2.1.2 TDD

##### 5.2.1.2.1 1Rx TDD FR1 PDSCH performance for RedCap

5.2.1.2.1.1 Test Purpose

To verify the PDSCH performance mapping Type A under 1 receive antenna conditions with different channel models and MCSs for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput.

5.2.1.2.1.2 Test applicability

This test case applies to all types of NR UE release 17 and forward that support NR RedCap.

5.2.1.2.1.3 Minimum conformance requirements

The performance requirements are specified in Table 5.2.1.2.1.3-3, with the addition of test parameters in Table 5.2.1.2.1.3-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.1.2.1.3-1.

Table 5.2.1.2.1.3-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and with different channel models, MCSs for RedCap UEs | 1-1, 1-2, 1-3, 1-4 |

Table 5.2.1.2.1.3-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | Specific to each Reference channel |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 4 for Test 1-1,  2 for other tests |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 2 for Test 1-1,  1 for other tests |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CSI-RS for tracking | First OFDM symbol in the PRB used for CSI-RS |  | Table 5.2-1 |
|  | CSI-RS periodicity | Slots | Table 5.2-1 |
|  | CSI-RS offset | Slots | Table 5.2-1 |
|  | Frequency Occupation |  | Table 5.2-1 |
| Number of HARQ Processes | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |

Table 5.2.1.2.1.3-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-1.5 TDD | 20 / 30 | QPSK, 0.30 | FR1.30-1A | TDLB100-400 | 2x1 Low | 70 | 3.8 |
| 1-2 | R.PDSCH.2-26.1 TDD | 20 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLC300-100 | 2x1 Low | 70 | 12.3 |
| 1-3 | R.PDSCH.2-3.5 TDD | 20 / 30 | 64QAM, 0.50 | FR1.30-1 | TDLA30-10 | 2x1 Low | 70 | 17.1 |
| 1-4 | R.PDSCH.2-4.3 TDD | 20 / 30 | 256QAM, 0.67 | FR1.30-1 | TDLA30-10 | 2x1 Low | 70 | 25.5 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.1.2.1.

5.2.1.2.1.4 Test description

5.2.1.2.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.0 for TE diagram and clause A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2A-1 to Table 5.2A-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.2.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.1.2.1.4.3.

5.2.1.2.1.4.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.1.2.1.3-2. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.1.2.1.5-1 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail according to Table G.1.5-1 in Annex G.1.5.

4. Repeat steps from 1 to 3 for each test points in Table 5.2.1.2.1.5-1 as appropriate.

5.2.1.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2 with the following exceptions:

Table 5.2.1.2.1.4.3-1: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | n4, n2 | n4 for test 1-1 | test 1-1 |
|  | Not present | n2 will be used by default | test point other than test 1-1 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.1.2.1.4.3-2: CSI-ResourcePeriodicityAndOffset for CSI Tracking

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots40 | 20 (for CSI-RS resources 1 and 2)  21 (for CSI-RS resources 3 and 4) | CSI-RS offset:  20 for CSI-RS resources 1 and 2  21 for CSI-RS resources 3 and 4  CSI-RS periodicity: 40 slots |  |
| slots20 | 10 (for CSI-RS resources 1 and 2)  11 (for CSI-RS resources 3 and 4) | CSI-RS offset:  10 for CSI-RS resources 1 and 2  11 for CSI-RS resources 3 and 4  CSI-RS periodicity: 20 slots |  |
| } |  |  |  |

5.2.1.2.1.5 Test Requirement

Table 5.2.1.2.1. 5-1defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.1.2.1.5-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.1.2.1.5-1: Test Requirements for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-1.5 TDD | 20 / 30 | QPSK, 0.30 | FR1.30-1A | TDLB100-400 | 2x1 Low | 70 | 4.7 |
| 1-2 | R.PDSCH.2-26.1 TDD | 20 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLC300-100 | 2x1 Low | 70 | 13.2 |
| 1-3 | R.PDSCH.2-3.5 TDD | 20 / 30 | 64QAM, 0.50 | FR1.30-1 | TDLA30-10 | 2x1 Low | 70 | 18.1 |
| 1-4 | R.PDSCH.2-4.3 TDD | 20 / 30 | 256QAM, 0.67 | FR1.30-1 | TDLA30-10 | 2x1 Low | 70 | 26.5 |

### 5.2.2 2RX requirements

#### 5.2.2.1 FDD

##### 5.2.2.1.1 2Rx FDD FR1 PDSCH mapping Type A performance

5.2.2.1.1.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.1.0-3 and Table 5.2.2.1.1.0-4, with the test parameters defined in table 5.2.2.1.1.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.2.1.1.0-1.

Table 5.2.2.1.1.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and with different channel models, MCSs and number of MIMO layers | 1-1, 1-2, 1-3, 1-5, 1-6, 1-7, 1-8, 2-1, 2-2 |
| Verify the PDSCH mapping Type A HARQ soft combining performance under 2 receive antenna conditions. | 1-4 |
| Verify the PDSCH mapping Type A performance requirements for Enhanced Receiver Type 1 under 2 receive antenna conditions. | 3-1 |

Table 5.2.2.1.1.0-2: Test Parameters for Testing

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
|  | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 12 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
| PDSCH configuration | PRB bundling size |  | 4 for Test 1-1  2 for other tests |
|  | Resource allocation type |  | Test 1-2: Type 1 with start RB = 23, LRBs = 6  Other tests: Type 0 |
|  | RBG size |  | Test 1-2: N/A  Other tests: Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
|  | DMRS Type |  | Type 1 |
| PDSCH DMRS configuration | Number of additional DMRS |  | 2 for Tests 1-1, 1-5, 1-6, 1-7 1 for other tests |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CSI-RS for tracking | CSI-RS periodicity | Slots | Test 1-5, 1-6, 1-7: 10 for CSI-RS resource 1,2,3,4.  Other tests: Table 5.2-1. |
|  | CSI-RS offset | Slots | Test 1-5, 1-6, 1-7: 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4.  Other tests: Table 5.2-1. |
| Number of HARQ Processes | |  | 8 for Test 1-4  4 for other tests |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 |

Table 5.2.2.1.1.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-1.1 FDD | 10 / 15 | QPSK, 0.30 | TDLB100-400 | 2x2, ULA Low | 70 | -0.8 |
| 1-2 | R.PDSCH.1-1.2 FDD | 10 / 15 | QPSK, 0.30 | TDLC300-100 | 2x2, ULA Low | 70 | 0.2 |
| 1-3 | R.PDSCH.1-4.1 FDD | 10 / 15 | 256QAM, 0.82 | TDLA30-10 | 2x2, ULA Low | 70 | 24.6 |
| 1-4 | R.PDSCH.1-2.1 FDD | 10 / 15 | 16QAM, 0.48 | TDLC300-100 | 2x2, ULA Low | 30 | 1.1 |
| 1-5 | R.PDSCH.1-8.1 FDD | 10 / 15 | 16QAM, 0.48 | HST-750 | 1x2 | 70 | 6.2 |
| 1-6 | R.PDSCH.1-8.2 FDD | 10 / 15 | 64QAM, 0.43 | HST-972 | 1x2 | 70 | 9.9 |
| 1-7 | R.PDSCH.1-8.1 FDD | 10 / 15 | 16QAM, 0.48 | TDLC300-600 | 2x2 | 70 | 8.6 |
| 1-8 | R.PDSCH.1-17.1 FDD | 10 / 15 | 1024QAM, 0.79 | TDLD30-5 | 2x2, ULA Low | 70 | 29.5 |

Table 5.2.2.1.1.0-4: Minimum performance for Rank 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 2-1 | R.PDSCH.1-3.1 FDD | 10 / 15 | 64QAM, 0.50 | TDLA30-10 | 2x2, ULA Low | 70 | 19.4 |
| 2-2 | R.PDSCH.2-1.1 FDD | 20 / 30 | 64QAM, 0.50 | TDLA30-10 | 2x2, ULA Low | 70 | 19.7 |

Table 5.2.2.1.1.0-5: Minimum performance for Rank 2 and Enhanced Receiver Type 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 3-1 | R.PDSCH.1-2.2 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Medium | 70 | 17.6 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.1.

###### 5.2.2.1.1\_1 2Rx FDD FR1 PDSCH mapping Type A performance - 2x2 MIMO with baseline receiver for both SA and NSA

Editor's Note: This test cases is incomplete in following aspects:

- SNR in test requirements table is within square brackets for test point 1-6, 1-7.

5.2.2.1.1\_1.1 Test purpose

To verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 1 and Rank 2 scenarios.

5.2.2.1.1\_1.2 Test applicability

This test applies to all types of UE release 15 and forward supporting NR/5GC.

This test also applies to all types of UE release 15 and forward supporting EN-DC.

5.2.2.1.1\_1.3 Test description

5.2.2.1.1\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.2.1.1.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for NR/5GC with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for EN-DC according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.1\_1.3.3.

5.2.2.1.1\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.2.1.1\_1.4-1 and 5.2.2.1.1\_1.4-2. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.1.1\_1.4-1 and 5.2.2.1.1\_1.4-2 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

4. Repeat steps from 1 to 3 for each subtest in Tables 5.2.2.1.1\_1.4-1 and 5.2.2.1.1\_1.4-2 as appropriate.

5.2.2.1.1\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.2.1.1\_1.3.3\_1 Message exceptions for NR/5GC

Table 5.2.2.1.1\_1.3.3\_1-1: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | n4 | n4 for test 1-1 | test 1-1 |
|  | Not present | n2 will be used by default | test point other than test 1-1 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.1.1\_1.3.3\_1-2: DMRS-DownlinkConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24 | | | |
| Information Element | Value/remark | Comment | Condition |
| DMRS-DownlinkConfig ::= SEQUENCE { |  |  |  |
| dmrs-AdditionalPosition | pos2 | For test 1-1, 1-5, 1-6 and 1-7 |  |
| pos1 | For other tests |  |
| } |  |  |  |

Table 5.2.2.1.1\_1.3.3\_1-3: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | n8, n4 | n8 for Test 1-4  n4 for other tests |  |
| } |  |  |  |

Table 5.2.2.1.1\_1.3.3\_1-4: CSI-ResourcePeriodicityAndOffset for CSI Tracking

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots10 | 1 (for CSI-RS resources 1 and 2)  2 (for CSI-RS resources 3 and 4) | For test 1-5, 1-6, 1-7:  CSI-RS offset:  1 for CSI-RS resources 1 and 2  2 for CSI-RS resources 3 and 4  CSI-RS periodicity: 10 slots |  |
| slots40 | 20 (for CSI-RS resources 1 and 2)  21 (for CSI-RS resources 3 and 4) | For test 2-2:  CSI-RS offset:  20 for CSI-RS resources 1 and 2  21 for CSI-RS resources 3 and 4  CSI-RS periodicity: 40 slots |  |
| slots20 | 10 (for CSI-RS resources 1 and 2)  11 (for CSI-RS resources 3 and 4) | For other tests:  CSI-RS offset:  10 for CSI-RS resources 1 and 2  11 for CSI-RS resources 3 and 4  CSI-RS periodicity: 20 slots |  |
| } |  |  |  |

5.2.2.1.1\_1.3.3\_2 Message exceptions for EN-DC

Same as 5.2.2.1.1\_1.3.3\_1.

5.2.2.1.1\_1.4 Test requirement

Tables 5.2.2.1.1\_1.4-1 and 5.2.2.1.1\_1.4-2 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.1\_1.4-1 and Table 5.2.2.1.1\_1.4-2 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.1\_1.4-1: Test Requirements for Rank 1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Modulation format | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-1.1 FDD | QPSK, 0.30 | TDLB100-400 | 2x2, ULA Low | 70 | 0.1 |
| 1-2 | R.PDSCH.1-1.2 FDD | QPSK, 0.30 | TDLC300-100 | 2x2, ULA Low | 70 | 1.1 |
| 1-3 | R.PDSCH.1-4.1 FDD | 256QAM, 0.82 | TDLA30-10 | 2x2, ULA Low | 70 | 25.6 |
| 1-4 | R.PDSCH.1-2.1 FDD | 16QAM, 0.48 | TDLC300-100 | 2x2, ULA Low | 30 | 2 |
| 1-5 | R.PDSCH.1-8.1 FDD | 16QAM, 0.48 | HST-750 | 1x2 | 70 | 7.1 |
| 1-6 | R.PDSCH.1-8.2 FDD | 64QAM, 0.43 | HST-972 | 1x2 | 70 | [10.5] |
| 1-7 | R.PDSCH.1-8.1 FDD | 16QAM, 0.48 | TDLC300-600 | 2x2 | 70 | [9.5] |

Table 5.2.2.1.1\_1.4-2: Test Requirements for Rank 2

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 2-1 | R.PDSCH.1-3.1 FDD | 64QAM, 0.51 | TDLA30-10 | 2x2, ULA Low | 70 | 20.4 |
| 2-2 | R.PDSCH.2-1.1 FDD | 64QAM, 0.51 | TDLA30-10 | 2x2, ULA Low | 70 | 20.7 |

###### 5.2.2.1.1\_2 2Rx FDD FR1 PDSCH mapping Type A performance - 2x2 MIMO with enhanced receiver type 1 for both SA and NSA

5.2.2.1.1\_2.1 Test purpose

To verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with enhanced receiver type 1 configuration, for Rank 2 scenarios.

5.2.2.1.1\_2.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting NR enhanced receiver type 1.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and NR enhanced receiver type 1.

5.2.2.1.1\_2.3 Test description

Same test description as in clause 5.2.2.1.1\_1.3.

5.2.2.1.1\_2.3.1 Initial conditions

Same initial conditions as in clause 5.2.2.1.1\_1.3.1.

5.2.2.1.1\_2.3.2 Test procedure

Same test procedure as in clause 5.2.2.1.1\_1.3.2.

5.2.2.1.1\_2.3.3 Message contents

Same message contents as in clause 5.2.2.1.1\_1.3.3.

5.2.2.1.1\_2.3.3\_1 Message exceptions for SA

Same message exceptions for SA as in clause 5.2.2.1.1\_1.3.3\_1.

5.2.2.1.1\_2.3.3\_2 Message exceptions for NSA

Same message exceptions for NSA as in clause 5.2.2.1.1\_1.3.3\_2.

5.2.2.1.1\_2.3.4 Test requirement

Same test requirement as in clause 5.2.2.1.1\_1.3.4.

Table 5.2.2.1.1\_2.3.4-1: Test Requirements for Rank 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 3-1 | R.PDSCH.1-2.2 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Medium | 70 | 18.6 |

###### 5.2.2.1.1\_3 2Rx FDD FR1 PDSCH mapping Type A performance – 2x2 MIMO with baseline receiver for DL1024QAM for both SA and NSA

Editor’s Note: Following aspects needs further investigation

- DL EVM of <= 2.5% for f > 4.2 GHz pending further analysis by the TE vendors.

5.2.2.1.1\_3.1 Test purpose

Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions with DL1024QAM for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput for Rank 1 scenario.

5.2.2.1.1\_3.2 Test applicability

This test applies to all types of UE release 17 and forward supporting NR/5GC and DL1024QAM.

This test also applies to all types of UE release 17 and forward supporting EN-DC and DL1024QAM.

5.2.2.1.1\_3.3 Test description

5.2.2.1.1\_3.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.2.1.1.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for NR/5GC with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for EN-DC according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.1\_3.3.3.

5.2.2.1.1\_3.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.2.1.1\_3.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.1.1\_3.4-1 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.2.1.1\_3.3.3 Message contents

Message contents are according to 38.508-1 [6] subclauses 4.6.1 and 5.4.2.

5.2.2.1.1\_3.3.3\_1 Message exceptions for NR/5GC

Same as 5.2.2.1.1\_1.3.3\_1 with the following exceptions.

Table 5.2.2.1.1\_3.3.3\_1-1: PDSCH-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| mcs-Table-r17 | qam1024 |  | Test 1-8 |
| } |  |  |  |

5.2.2.1.1\_3.3.3\_2 Message exceptions for EN-DC

Same as 5.2.2.1.1\_3.3.3\_1.

5.2.2.1.1\_3.4 Test requirement

Table 5.2.2.1.1\_3.4-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.1\_3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.1\_3.4-1: Test Requirements for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-8 | R.PDSCH.1-17.1 FDD | 10 / 15 | 1024QAM, 0.79 | TDLD30-5 | 2x2, ULA Low | 70 | 30.4 |

##### 5.2.2.1.2 2Rx FDD FR1 PDSCH mapping Type A and CSI-RS overlapped with PDSCH performance

5.2.2.1.2.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.2.0-3, with the addition of test parameters in table 5.2.2.1.2.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.2.1.2.0-1.

Table 5.2.2.1.2.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| [Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and CSI-RS overlapped with PDSCH] | 1-1 |

Table 5.2.2.1.2.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S) |  | 2 |
| Length (L) |  | 12 |
| PDSCH aggregation factor |  | 1 |
| PRB bundling type |  | Static |
| PRB bundling size |  | 2 |
| PRB size |  | Config2 |
| Resource allocation type |  | Type 0 |
| VRB-to-PRB mapping type |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
| Number of additional DMRS |  | 1 |
| Length |  | 1 |
| NZP CSI-RS for CSI acquisition | OFDM symbols in the PRB used for CSI-RS |  | l0 = 13 |
| CSI-RS periodicity | Slots | 5 |
| ZP CSI-RS for CSI acquisition | Subcarrier index in the PRB used for CSI-RS |  | (k0, k1, k2, k3)=(2, 4, 6, 8) |
| Number of CSI-RS ports (X) |  | 8 |
| CSI-RS periodicity | Slots | 5 |
| Number of HARQ Processes | |  | 4 |
| K1 value (PDSCH-to-HARQ-timing-indicator) | |  | 2 |

Table 5.2.2.1.2.0-3: Minimum performance for Rank 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-5.1 FDD | 10 / 15 | 16QAM, 0.48 | TDLC300-100 | 2x2, ULA Low | 70 | 14.8 |

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2.2.1.2.

###### 5.2.2.1.2\_1 2Rx FDD FR1 PDSCH mapping Type A and CSI-RS overlapped with PDSCH performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.1.2\_1.1 Test purpose

Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and CSI-RS overlapped with PDSCH

5.2.2.1.2\_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC.

5.2.2.1.2\_1.3 Test description

5.2.2.1.2\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [8].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.6.2 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.2.1.1.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.2\_1.3.3.

5.2.2.1.2\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.2.1.2\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.1.2\_1.4-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Annex G.1.4.

5.2.2.1.2\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.2.1.2\_1.3.3\_1 Message exceptions for SA

Same as for test number 1-2 in 5.2.2.1.1\_1.3.3\_1 with following exceptions:

Table 5.2.2.1.2\_1.3.3\_1-1: NZP CSI-RS-ResourceMapping for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 13 | l0 = 13 |  |
| } |  |  |  |

Table 5.2.2.1.2\_1.3.3\_1-2: CSI-ResourcePeriodicityAndOffset for ZP and NZP CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-16 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots5 | 0 | CSI-RS offset: 0  CSI-RS periodicity: 5 slots |  |
| } |  |  |  |

Table 5.2.2.1.2\_1.3.3\_1-3: ZP CSI-RS-ResourceMapping for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause5.4.2.0-21 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 011110 | (k0, k1, k2, k3)=(2, 4, 6, 8) |  |
| } |  |  |  |
| nrofPorts | P8 | Number of CSI-RS ports (X) = 8 |  |
| firstOFDMSymbolInTimeDomain | 12 | l0 = 12 |  |
| cdm-Type | fd-CDM2 |  |  |
| density CHOICE { |  |  |  |
| one | NULL | Density (ρ) = 1 |  |
| } |  |  |  |
| freqBand | CSI-FrequencyOccupation | Frequency Occupation:  Start PRB 0 (see Table 4.6.3-33 in TS 38.508-1)  Number of PRB = 52 (see Table 5.4.2.0-23:in TS 38.508-1 [6]. |  |
| } |  |  |  |

Table 5.2.2.1.2\_1.3.3\_1-4: Void

5.2.2.1.2\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.2.1.2\_1.3.3\_1

5.2.2.1.2\_1.4 Test requirement

Table 5.2.2.1.2.0-2 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.2\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.2\_1.4-1: Test Requirements for Rank 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-5.1 FDD | 10 / 15 | 16QAM, 0.48 | TDLC300-100 | 2x2, ULA Low | 70 | 15.7 |

##### 5.2.2.1.3 2Rx FDD FR1 PDSCH mapping Type B performance

5.2.2.1.3.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.3.0-3, with the addition of test parameters in Table 5.2.2.1.3.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.3.0-1.

Table 5.2.2.1.3.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH mapping Type B performance under 2 receive antenna conditions | 1-1 |

Table 5.2.2.1.3.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type B |
| k0 |  | 0 |
| Starting symbol (S) |  | 5 |
| Length (L) |  | 7 |
| PDSCH aggregation factor |  | 1 |
| PRB bundling type |  | Static |
| PRB bundling size |  | 2 |
| Resource allocation type |  | Type 0 |
| RBG size |  | Config2 |
| VRB-to-PRB mapping type |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
| Number of additional DMRS |  | 1 |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Number of HARQ Processes | |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 |

Table 5.2.2.1.3.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-1.3 FDD | 10 / 15 | QPSK, 0.30 | TDLA30-10 | 2x2, ULA Low | 70 | -0.9 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.3.

###### 5.2.2.1.3\_1 2Rx FDD FR1 PDSCH mapping Type B performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.1.3\_1.1 Test purpose

To verify PDSCH mapping Type B performance under 2 receive antenna conditions.

5.2.2.1.3\_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting PDSCH mapping type B.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and PDSCH mapping type B.

5.2.2.1.3\_1.3 Test description

5.2.2.1.3\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2.3.4 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.2.1.3.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, C.3.1 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 5.2.2.1.3\_1.3.3.

5.2.2.1.3\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.2.1.3\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.1.3\_1.4-1 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.2.1.3\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 4.6.1.

5.2.2.1.3\_1.3.3\_1 Message exceptions for SA

Table 5.2.2.1.3\_1.3.3\_1-1: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | n4 |  |  |
| } |  |  |  |

Table 5.2.2.1.3\_1.3.3\_1-2: PDSCH-TimeDomainResourceAllocationList

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF { | 2 entry |  |  |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeB |  |  |
| startSymbolAndLength | 89 | Start symbol(S)=5, Length(L)=7 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[2] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.1.3\_1.3.3\_1-3: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-100 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| dmrs-DownlinkForPDSCH-MappingTypeB CHOICE { |  |  |  |
| setup | DMRS-DownlinkConfig |  |  |
| } |  |  |  |
| } |  |  |  |

5.2.2.1.3\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.2.1.3\_1.3.3\_1

5.2.2.1.3\_1.4 Test requirement

Table 5.2.2.1.3\_1.4-1 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.3\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.3\_1.4-1: Test Requirements for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-1.3 FDD | 10 / 15 | QPSK, 0.30 | TDLA30-10 | 2x2, ULA Low | 70 | 0.1 |

##### 5.2.2.1.4 2Rx FDD FR1 PDSCH Mapping Type A and LTE-NR coexistence performance

5.2.2.1.4.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.4.0-3, with the addition of test parameters in Table 5.2.2.1.4.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.2.1.4.0-1.

Table 5.2.2.1.4.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions with CRS rate matching configured | 1-1, 1-2 |

Table 5.2.2.1.4.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
| NR UL transmission with a 7.5 kHz shift to the LTE raster | |  | true |
| PDCCH configuration | Symbols with PDCCH |  | Symbol# 2 |
|  | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 3 |
|  | Length (L) |  | 9 for Test 1-1 11 for Test 1-2 |
| PDSCH configuration | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
|  | DMRS Type |  | Type 1 |
| PDSCH DMRS configuration | Position of the first DM-RS for downlink |  | 3 |
|  | Number of additional DMRS |  | 1 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
|  | LTE carrier centre subcarrier location |  | Same as NR carrier centre subcarrier location |
|  | LTE carrier BW | MHz | 10 |
| CRS for rate matching (Note 1) | Number of antenna ports |  | 4 |
|  | v-shift |  | 0 |
| Number of HARQ Processes | |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 |
| Note 1: No MBSFN is configured on LTE carrier | | | |

Table 5.2.2.1.4.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-7.1 FDD | 10 / 15 | QPSK, 0.30 | TDLA30-10 | 4x2, ULA Low | 70 | -1.0 |
| 1-2 | R.PDSCH.1-7.2 FDD | 10 / 15 | QPSK, 0.30 | TDLA30-10 | 4x2, ULA Low | 70 | -1.0 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.4.

###### 5.2.2.1.4\_1 2Rx FDD FR1 PDSCH Mapping Type A and LTE-NR coexistence performance - 4x2 MIMO with baseline receiver for both SA and NSA

5.2.2.1.4\_1.1 Test purpose

To verify the Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions with CRS rate matching configured.

5.2.2.1.4\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 15 and forward supporting capability IE *rateMatchingLTE-CRS* but not supporting capability IE *additionalDMRS-DL-Alt*.

Test1-1 also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and capability IE *rateMatchingLTE-CRS* but not supporting capability IE *additionalDMRS-DL-Alt*.

Test 1-2 applies to all types of NR UE release 15 and forward supporting capability IE *additionalDMRS-DL-Alt* and *rateMatchingLTE-CRS*.

Test 1-2 also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and capability IE *additionalDMRS-DL-Alt* and *rateMatchingLTE-CRS*.

5.2.2.1.4\_1.3 Test description

5.2.2.1.4\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.6 for TE diagram and section A.3.2.3 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.1.4.0-2 and Table 5.2.2.1.4.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.4\_1.3.3.

5.2.2.1.4\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.2.1.4.0-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.1.4\_1.3.4-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

NOTE: In the test using the NR/5GC connectivity option, collisions between NR SIB1 scheduling and LTE CRS can occur. However, these do not impact the throughput.

5.2.2.1.4\_1.3.3 Message contents

5.2.2.1.4\_1.3.3\_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.2.1.4\_1.3.3\_1-1: PDSCH-TimeDomainResourceAllocationList

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF { | 2 entry |  | FR1 |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  |  |  |
| k0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 94 | Start symbol(S)=3, Length(L)=9 for Test 1-1 |  |
|  | 66 | Start symbol(S)=3, Length(L)=11 for Test 1-2 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[2] SEQUENCE { |  |  |  |
| k0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 66 | Start symbol(S)=3, Length(L)=11 for Test 1-2 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.1.4\_1.3.3\_1-2: *SearchSpace*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-162 and5.4.2.0-7 using condition USS, FR1\_10MHz, Long\_DCI | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 2 |  |  |
| monitoringSymbolsWithinSlot | 00100000000000 |  |  |
| } |  |  |  |

Table 5.2.2.1.4\_1.3.3\_1-3: ServingCellConfigCommon

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfigCommon ::= SEQUENCE { |  |  |  |
| dmrs-TypeA-Position | pos3 |  |  |
| lte-CRS-ToMatchAround | RateMatchPatternLTE-CRS |  |  |
| } |  |  |  |

Table 5.2.2.1.4\_1.3.3\_1-4: RateMatchPatternLTE-CRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2-20 | | | |
| Information Element | Value/remark | Comment | Condition |
| RateMatchPatternLTE-CRS ::= SEQUENCE { |  |  |  |
| carrierFreqDL | Same as NR carrier centre subcarrier location |  |  |
| carrierBandwidthDL | n50 | 10MHz |  |
| mbsfn-SubframeConfigList | Not present |  |  |
| nrofCRS-Ports | n4 |  |  |
| v-Shift | n0 |  |  |
| } |  |  |  |

Table 5.2.2.1.4\_1.3.3\_1-5: *Void*

Table 5.2.2.1.4\_1.3.3\_1-6: *FrequencyInfoUL-SIB*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-62 | | | |
| Information Element | Value/remark | Comment | Condition |
| FrequencyInfoUL-SIB SEQUENCE { |  |  |  |
| frequencyShift7p5khz | true |  |  |
| } |  |  |  |

Table 5.2.2.1.4\_1.3.3\_1-7: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: Table TS 38.508-1 [6], 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 2 |  | SA |
| duration | 1 | SearchSpace duration of 1 symbol from third symbol |  |
| } |  |  |  |

Table 5.2.2.1.4\_1.3.3\_1-8: *Void*

Table 5.2.2.1.4\_1.3.3\_1-9: *SearchSpace for CSS*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-162 and 5.4.2.0.7 using condition CSS, FR1\_10MHz, Long\_DCI | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| searchSpaceId | SearchSpaceId with condition CSS |  | CSS |
| controlResourceSetId | 1 |  |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| duration | Not present | 1 slot per default |  |
| monitoringSymbolsWithinSlot | 00100000000000 |  |  |
| nrofCandidates SEQUENCE { |  |  | SA |
| aggregationLevel2 | n1 |  |  |
| aggregationLevel8 | n0 |  |  |
| } |  |  |  |

Table 5.2.2.1.4\_1.3.3\_1-10: *PDCCH-ConfigCommon*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-96 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| commonControlResourceSet ::= SEQUENCE { |  |  | SA |
| controlResourceSetId | 1 |  |  |
| frequencyDomainResources | 01110000 00000000 00000000 00000000 00000000 00000 |  |  |
| Duration | 1 |  |  |
| cce-REG-MappingType CHOICE { |  |  |  |
| nonInterleaved | Null |  |  |
| } |  |  |  |
| precoderGranularity | sameAsREG-bundle |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.1.4\_1.3.3\_1-11: *SearchSpace for USS*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-162 and 5.4.2.0-7 using condition USS, FR1\_10MHz, Long\_DCI | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  | SA |
| searchSpaceId | 2 |  |  |
| controlResourceSetId | 2 |  |  |
| monitoringSymbolsWithinSlot | 00100000000000 |  |  |
| } |  |  |  |

5.2.2.1.4\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.2.1.4\_1.3.3\_1 with the following exceptions:

Table 5.2.2.1.4\_1.3.3\_2-1: *SearchSpace*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-162 and 5.4.2.0-7 using condition USS, FR1\_10MHz, Long\_DCI | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 1 |  |  |
| monitoringSymbolsWithinSlot | 00100000000000 |  |  |
| } |  |  |  |

Table 5.2.2.1.4\_1.3.3\_2-2: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 1 |  |  |
| duration | 1 | SearchSpace duration of 1 symbol from third symbol |  |
| } |  |  |  |

5.2.2.1.4\_1.3.4 Test requirement

Table 5.2.2.1.4.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.4\_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.4\_1.3.4-1: Test requirement for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-7.1 FDD | 10 / 15 | QPSK, 0.30 | TDLA30-10 | 4x2, ULA Low | 70 | 0.0 |
| 1-2 | R.PDSCH.1-7.2 FDD | 10 / 15 | QPSK, 0.30 | TDLA30-10 | 4x2, ULA Low | 70 | 0.0 |

##### 5.2.2.1.5 2Rx FDD FR1 PDSCH 0.001% BLER performance

5.2.2.1.5.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.5.0-3, with the addition of test parameters in Table 5.2.2.1.5.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.5.0-1.

Table 5.2.2.1.5.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH 0.001% BLER performance under 2 receive antenna conditions | 1-1 |

Table 5.2.2.1.5.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 12 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 1 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Maximum number of HARQ transmission | |  | 1 |
| Number of HARQ Processes | |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 |

Table 5.2.2.1.5.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target BLER | SNR (dB) |
| 1-1 | R.PDSCH.1-1.4 FDD | 10 / 15 | QPSK, 0.59 | AWGN | 1x2, ULA Low | 0.001% | 3.2 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.5.

###### 5.2.2.1.5\_1 2Rx FDD FR1 PDSCH 0.001% BLER performance - 1x2 MIMO with baseline receiver for both SA and NSA

5.2.2.1.5\_1.1 Test purpose

To verify the PDSCH 0.001% BLER performance under 2 receive antenna conditions.

5.2.2.1.5\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *dl-64QAM-MCS-TableAlt* and capability IE *cqi-TableAlt*.

5.2.2.1.5\_1.3 Test description

5.2.2.1.5\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.2 for TE diagram and section A.3.2.3 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.1.5.0-2 and Table 5.2.2.1.5.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.5\_1.3.3.

5.2.2.1.5\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.2.1.5.0-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.1.5\_1.3.4-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.4. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.4.3-1 in Annex G.

5.2.2.1.5\_1.3.3 Message contents

5.2.2.1.5\_1.3.3\_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.2.1.5\_1.3.3\_1-1: PDSCH-TimeDomainResourceAllocationList

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF { | 2 entry |  | FR1 |
| mcs-Table | qam64LowSE |  |  |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  |  |  |
| k0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| } |  |  |  |

5.2.2.1.5\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.2.1.5\_1.3.3\_1.

5.2.2.1.5\_1.3.4 Test requirement

Table 5.2.2.1.5.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.5\_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.5\_1.3.4-1: Test requirement for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target BLER | SNR (dB) |
| 1-1 | R.PDSCH.1-1.4 FDD | 10 / 15 | QPSK, 0.59 | AWGN | 1x2, ULA Low | 0.001% | 4.3 |

##### 5.2.2.1.6 2Rx FDD FR1 PDSCH repetitions over multiple slots performance

5.2.2.1.6.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.6.0-3, with the addition of test parameters in Table 5.2.2.1.6-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.6.0-1.

Table 5.2.2.1.6.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH repetitions over multiple slots performance under 2 receive antenna conditions | 1-1 |

Table 5.2.2.1.6.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 12 |
|  | PDSCH aggregation factor |  | 2 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 1 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Number of HARQ Processes | |  | 4 |
| The number of slots between final repetition of PDSCH and corresponding HARQ-ACK information | |  | 2 |

Table 5.2.2.1.6.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target BLER | SNR (dB) |
| 1-1 | R.PDSCH.1-11.1 FDD | 10 / 15 | 16QAM, 0.54 | TDLA30-10 | 2x2, ULA Low | 1% (Note 1) | 1.6 |
| Note 1: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block. | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.6.

###### 5.2.2.1.6\_1 2Rx FDD FR1 PDSCH repetitions over multiple slots performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.1.6\_1.1 Test purpose

To Verify the PDSCH repetitions over multiple slots performance under 2 receive antenna conditions.

5.2.2.1.6\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE dl-64QAM-MCS-TableAlt and *pdsch-RepetitionMultiSlots-r16*.

Test 1-1 also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and capability IE dl-64QAM-MCS-TableAlt and pdsch-RepetitionMultiSlots-r16.

5.2.2.1.6\_1.3 Test description

5.2.2.1.6\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.2 for TE diagram and section A.3.2.3 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.1.6.0-2 and Table 5.2.2.1.6.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.6\_1.3.3.

5.2.2.1.6\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.2.1.5.0-3. The SS sends downlink MAC padding bits on the DL RMC. The UE may expect that the TB is repeated with same symbol allocation among each of the *pdsch-AggregationFactor* consecutive slots.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.1.5\_1.3.4-1.

3. Measure the BLER for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of correctly and incorrectly received transport bloks based on ACK/NACK feedback on the UL during each subtest and decide pass or fail according to clause G.1.5 and Table G.1.5-1a in Annex G clause G.1.5.

5.2.2.1.6\_1.3.3 Message contents

5.2.2.1.6\_1.3.3\_1 Message exceptions for SA & NSA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.2.1.6\_1.3.3\_1-1: PDSCH-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| pdsch-AggregationFactor | 2 |  |  |
| } |  |  |  |

5.2.2.1.6\_1.3.4 Test requirement

Table 5.2.2.1.6.0-3 defines the primary level settings.

The target BLER percentage for the downlink reference measurement channels specified in Annex 3.2.1 for each BLER test shall meet or exceed the specified value in Table 5.2.2.1.6\_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.6\_1.3.4-1: Test requirement for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target BLER | SNR (dB) |
| 1-1 | R.PDSCH.1-11.1 FDD | 10 / 15 | 16QAM, 0.54 | TDLA30-10 | 2x2, ULA Low | 1% (Note 1) | 2.5 |
| Note 1: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block. | | | | | | | |

##### 5.2.2.1.7 2Rx FDD FR1 PDSCH Mapping Type B and UE processing capability 2 performance

5.2.2.1.7.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.7.0-3, with the addition of test parameters in Table 5.2.2.1.7.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.7.0-1.

Table 5.2.2.1.7.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH mapping Type B performance and UE processing capability 2 under two receive antenna conditions | 1-1 |

Table 5.2.2.1.7.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type B |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 2 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 0 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Maximum number of HARQ transmission | |  | 1 |
| Number of HARQ Processes | |  | 2 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 0 |

Table 5.2.2.1.7.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-12.1 FDD | 10 / 15 | QPSK, 0.30 | TDLA30-10 | 2x2, ULA Low | 70 | 0.8 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.7.

###### 5.2.2.1.7\_1 2Rx FDD FR1 PDSCH Mapping Type B and UE processing capability 2 performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.1.7\_1.1 Test purpose

To verify PDSCH mapping Type B performance and UE processing capability 2 under two receive antenna conditions.

5.2.2.1.7\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *pdsch-ProcessingType2*.

5.2.2.1.7\_1.3 Test description

5.2.2.1.7\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.1.7.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.7\_1.3.3.

5.2.2.1.7\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.2.1.7.0-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.1.7\_1.4-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.2.1.7\_1.3.3 Message contents

5.2.2.1.7\_1.3.3\_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.2.1.7\_1.3.3\_1-1: PDSCH-TimeDomainResourceAllocationList

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF { | 2 entries |  | FR1 |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  |  |  |
| k0 | Not present |  |  |
| mappingType | typeB |  |  |
| startSymbolAndLength | 16 | Start symbol(S)=2, Length(L)=2 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.1.7\_1.3.3\_1-2: *PUCCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-112 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUCCH-Config ::= SEQUENCE { |  |  | FR1 |
| dl-DataToUL-ACK SEQUENCE (SIZE (1)) OF INTEGER { | 1 entry |  |  |
| INTEGER[1] | 0 | entry 1 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.1.7\_1.3.3\_1-3: Physical layer parameters for DCI format 1\_1

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1 | | | |
| Parameter | Value | Value in binary | Condition |
| PDSCH-to-HARQ\_feedback timing indicator | K1=0 as per dl-DataToUL-ACK in Table 5.2.2.1.7\_1.3.3\_1-3 | “000” |  |

5.2.2.1.7\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.2.1.7\_1.3.3\_1.

5.2.2.1.7\_1.4 Test requirement

Table 5.2.2.1.7.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.7\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.7\_1.4-1: Test requirement for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-12.1 FDD | 10 / 15 | QPSK, 0.30 | TDLA30-10 | 2x2, ULA Low | 70 | 1.8 |

##### 5.2.2.1.8 2Rx FDD FR1 PDSCH pre-emption performance

5.2.2.1.8.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.8.0-3, with the addition of test parameters in Table 5.2.2.1.8.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.8.0-1.

Table 5.2.2.1.8.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH pre-emption performance under 2 receive antenna conditions | 1-1 |

Table 5.2.2.1.8.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
| PDCCH configuration (Note 4) | Symbols with PDCCH |  | 0, 1 |
|  | DCI format |  | 2\_1 |
|  | timeFrequencySet |  | 14x1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 12 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 1 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Pre-emption configuration (Note 2) | Starting symbol (S) |  | 3 |
|  | Length (L) |  | 2 |
|  | Pre-emption periodicity and offset (Note 3) | Slots | 10/1 |
| Number of HARQ Processes | |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 |
| Note 1: Void  Note 2: Interference modelled as random data on pre-empted REs.  Note 3: Pre-emption is scheduled with a fixed scheduling with 10% probability within 10ms periodicity.  Note 4: In addition to PDCCH configuration in Table 5.2-1. | | | |

Table 5.2.2.1.8.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH. 1-2.5 FDD | 10 / 15 | 16QAM  0.64 | TDLA30-10 | 2x2, ULA Low | 70 | 10.5 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.8.

###### 5.2.2.1.8\_1 2Rx FDD FR1 PDSCH pre-emption performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.1.8\_1.1 Test purpose

To Verify the PDSCH pre-emption performance under 2 receive antenna conditions.

5.2.2.1.8\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *pre-EmptIndication-DL-r16*.

5.2.2.1.8\_1.3 Test description

5.2.2.1.8\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.1.8.0-2 and Table 5.2.2.1.8.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.8\_1.3.3.

5.2.2.1.8\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.2.1.8.0-3. The SS sends downlink MAC padding bits on the DL RMC.

2. SS transmits PDCCH DCI format 2\_1 for int\_RNTI with 10% probability to transmit the DL Preemption indication according to Table 5.2.2.1.8.0-2. In the time and frequency set indicated by PDCCH DCI format 2\_1, SS stops transmission of PDSCH.

3. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.1.8\_1.3.4-1.

4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.2.1.8\_1.3.3 Message contents

5.2.2.1.8\_1.3.3\_1 Message exceptions for SA

Table 5.2.2.1.8\_1.3.3\_1-1: PDSCH-TimeDomainResourceAllocationList

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF { | 2 entry |  | FR1 |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  |  |  |
| k0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.1.8\_1.3.3\_1-2: PDCCH-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-95 | | | |
| Information Element | | Value/remark | Comment | Condition |
| PDCCH-Config ::= SEQUENCE { | |  |  |  |
| DownlinkPreemption ::= SEQUENCE { | | SS arbitrarily selects a value between ‘0001’H and ‘FFEF’H different from the MCG (and SCG) RNTI-Value. |  |  |
| int-RNTI | |  |  |  |
| timeFrequencySet | | set0 |  |  |
| dci-PayloadSize | | 14 |  |  |
| Int-ConfigurationPerServingCell SEQUENCE (SIZE (1..maxNrofServingCells)) OF SEQUENCE { | |  |  |  |
| servingCellId | | ServCellIndex |  |  |
| positionInDCI | | 0 |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

Table 5.2.2.1.8\_1.3.3\_1-3: Physical layer parameters for DCI format 2\_1

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Value | Value in binary | Condition |
| Pre-emption indication 1 | Indicating symbols 3 and 4 | 00011000000000 |  |

Table 5.2.2.1.8\_1.3.3\_1-4: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| processingType2Enabled | true |  |  |
| } |  |  |  |

Table 5.2.2.1.8\_1.3.3\_1-5: PDCCH Search *Space*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| common SEQUENCE { |  |  |  |
| dci-Format0-0-AndFormat1-0 SEQUENCE { |  |  |  |
| } |  |  |  |
| dci-Format2-1 |  | Search Space for DCI Format 2-1 |  |
| } |  |  |  |

5.2.2.1.8\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.2.1.8\_1.3.3\_1.

5.2.2.1.8\_1.3.4 Test requirement

Table 5.2.2.1.8.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.8\_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.8\_1.3.4-1: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH. 1-2.5 FDD | 10 / 15 | 16QAM  0.64 | TDLA30-10 | 2x2, ULA Low | 70 | 11.5 |

##### 5.2.2.1.9 2Rx FDD FR1 HST-SFN performance

5.2.2.1.9.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.9.0-3, with the test parameters defined in Table 5.2.2.1.9.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.2.1.9.0-1.

Table 5.2.2.1.9.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH performance under 2 receive antenna conditions in the HST-SFN scenario defined in B.3.2 when highSpeedDemodFlag-r16 IE [20] is configured | 1-1 |

Table 5.2.2.1.9.0-2: Test Parameters for Testing

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S) |  | 2 |
| Length (L) |  | 12 |
| PDSCH aggregation factor |  | 1 |
| PRB bundling type |  | Static |
| PRB bundling size |  | 2 |
| Resource allocation type |  | Type 0 |
| RBG size |  | Config2 |
| VRB-to-PRB mapping type |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
| Number of additional DMRS |  | 2 |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CSI-RS for tracking | CSI-RS periodicity | Slots | 10 for CSI-RS resource 1,2,3,4. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4. |
| Number of HARQ Processes | |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 |

Table 5.2.2.1.9.0-3: Minimum performance for Rank 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-8.3 FDD | 10 / 15 | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 13.0 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.9.

###### 5.2.2.1.9\_1 2Rx FDD FR1 HST-SFN performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.1.9\_1.1 Test purpose

To verify the PDSCH performance under 2 receive antennas conditions in the HST-SFN scenario defined in B.3.2 when *highSpeedDemodFlag-r16* IE [20] is configured and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 2 scenarios.

5.2.2.1.9\_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting enhanced demodulation processing for HST-SFN joint transmission scheme.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC that supporting enhanced demodulation processing for HST-SFN joint transmission scheme.

5.2.2.1.9\_1.3 Test description

5.2.2.1.9\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.2.1.9.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.9\_1.3.3.

5.2.2.1.9\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.2.1.9\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.1.9\_1.4-1 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

4. Repeat steps from 1 to 3 for each subtest in Tables 5.2.2.1.9\_1.4-1 as appropriate.

5.2.2.1.9\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.2.1.9\_1.3.3\_1 Message exceptions for SA

Table 5.2.2.1.9\_1.3.3\_1-1: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | Not present | n2 for test 1-1 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.1.9\_1.3.3\_1-2: DMRS-DownlinkConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24 | | | |
| Information Element | Value/remark | Comment | Condition |
| DMRS-DownlinkConfig ::= SEQUENCE { |  |  |  |
| dmrs-AdditionalPosition | pos2 | for test 1-1 |  |
| } |  |  |  |

Table 5.2.2.1.9\_1.3.3\_1-3: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | n4 | for test 1-1 |  |
| } |  |  |  |

Table 5.2.2.1.9\_1.3.3\_1-4: CSI-ResourcePeriodicityAndOffset for CSI Tracking

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots10 | 1 for CSI-RS resource #1 and #2  2 for CSI-RS resource #3 and #4 | For test 1-1:  offset = 1 for CSI-RS resource 1 and 2  offset =2 for CSI-RS resource 3 and 4. |  |
| } |  |  |  |

5.2.2.1.9\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.2.1.9\_1.3.3\_1

5.2.2.1.9\_1.4 Test requirement

Tables 5.2.2.1.9\_1.4-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.9\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.9\_1.4-1: Test Requirements for Rank 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-8.3 FDD | 10 / 15 | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 13.6 |

##### 5.2.2.1.10 2Rx FDD FR1 HST DPS performance

5.2.2.1.10.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.10.0-3, with the test parameters defined in Table 5.2.2.1.10.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.2.1.10.0-1.

Table 5.2.2.1.10.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify UE performance in the HST-DPS scenario defined in B.3.3 | 1-1, 1-2 |

Table 5.2.2.1.10.0-2: Test Parameters for Testing

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Value |
| Duplex mode | | |  | FDD |
| Active DL BWP index | | |  | 1 |
| PDCCH configuration | TCI state | |  | Note 1 |
| PDSCH configuration | Mapping type | |  | Type A |
|  | k0 | |  | 0 |
|  | Starting symbol (S) | |  | 2 |
|  | Length (L) | |  | 12 |
|  | PDSCH aggregation factor | |  | 1 |
|  | PRB bundling type | |  | Static |
|  | PRB bundling size | |  | 2 |
|  | Resource allocation type | |  | Type 0 |
|  | RBG size | |  | Config2 |
|  | VRB-to-PRB mapping type | |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size | |  | N/A |
|  | TCI state | |  | Note 1 |
| PDSCH DMRS configuration | DMRS Type | |  | Type 1 |
|  | Number of additional DMRS | |  | 2 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS | |  | 1 |
| CSI-RS for tracking | Resource set #1 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 5 for CSI-RS resource 1 and 3  l0 = 9 for CSI-RS resource 2 and 4 |
|  |  | CSI-RS periodicity | Slots | 10 for CSI-RS resource 1,2,3,4. |
|  |  | CSI-RS offset | Slots | 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4 |
|  |  | QCL info |  | TCI state #2 |
|  | Resource set #2 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 6 for CSI-RS resource 5 and 6  l0 = 10 for CSI-RS resource 7 and 8 |
|  |  | CSI-RS periodicity | Slots | 10 for CSI-RS resource 5,6,7,8. |
|  |  | CSI-RS offset | Slots | 1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8 |
|  |  | QCL info |  | TCI state #3 |
| NZP CSI-RS for CSI acquisition | Resource set #3 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 12 |
|  |  | CSI-RS periodicity | Slots | 20 |
|  |  | CSI-RS offset | Slots | 0 |
|  |  | QCL info |  | TCI state #0 |
|  | Resource set #4 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 13 |
|  |  | CSI-RS periodicity | Slots | 20 |
|  |  | CSI-RS offset | Slots | 0 |
|  |  | QCL info |  | TCI state #1 |
| TCI state #0 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking Resource set #1' configuration |
|  |  | QCL Type |  | Type A |
|  | Type 2 QCL information | CSI-RS resource |  | N/A |
|  |  | QCL Type |  | N/A |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration |
|  |  | QCL Type |  | Type A |
|  | Type 2 QCL information | CSI-RS resource |  | N/A |
|  |  | QCL Type |  | N/A |
| TCI state #2 | Type 1 QCL information | SSB index |  | SSB #0 |
|  |  | QCL Type |  | Type C |
|  | Type 2 QCL information | SSB index |  | N/A |
|  |  | QCL Type |  | N/A |
| TCI state #3 | Type 1 QCL information | SSB index |  | SSB #1 |
|  |  | QCL Type |  | Type C |
|  | Type 2 QCL information | SSB index |  | N/A |
|  |  | QCL Type |  | N/A |
| Number of HARQ Processes | | |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | |  | 2 |
| Note 1: SSB # (k mod 2) , CSI-RS (for tracking) resource set # ((k mod 2) + 1) and CSI-RS (for CSI acquisition) resource set # ((k mod 2) + 3) are transmitted by kth RRH.  For Test 1-1, TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy.  PDCCH and PDSCH associated with TCI # (k mod 2) is transmitted by kth RRH from  slot#  to  slot#  ,  PDCCH and PDSCH are DTXed in other slots in which throughput statistics are not considered.  For Test 1-2, TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that  satisfy. PDCCH and PDSCH associated with TCI # (k mod 2) is transmitted by kth RRH from.  slot#  to  slot#  PDCCH and PDSCH are DTXed in other slots in which throughput statistics are not considered.  Where k=0, 1, 2… is the RRH number, n = 2520 is half of the number of slots between two RRH, = 2 is the number of slots between PDSCH and corresponding HARQ-ACK information, = 3 is the number of slots for MAC CE processing, = 6 is the number of slots to first TRS transmission occasion after MAC CE command is decoded by the UE, = 2 is the number of slots for TRS processing. | | | | |

Table 5.2.2.1.10.0-3: Minimum performance for HST-DPS

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Number of active PDSCH TCI states | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-8.4 FDD | 10 / 15 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.4 |
| 1-2 | R.PDSCH.1-8.4 FDD | 10 / 15 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.4 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.10.

###### 5.2.2.1.10\_1 2Rx FDD FR1 HST-DPS performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.1.10\_1.1 Test purpose

To verify UE performance in the HST-DPS scenario defined in B.3.3 and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 2 scenarios.

5.2.2.1.10\_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC.

5.2.2.1.10\_1.3 Test description

5.2.2.1.10\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.2.1.10.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.10\_1.3.3.

5.2.2.1.10\_1.3.2 Test procedure

Test 1-1:

1. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.1.10\_1.4-1 as appropriate.

2. SS is configured to transmit SSB and CSI-RS continuously and schedule PDSCH and PDCCH transmission according to Note 1 in 5.2.2.1.10\_1.4-1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.2.1.10\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

Note: All TCI states are known to the UE through configuration inside RrcReconfiguration. There is no need to configure additional L1-RSRP measurements.

3. Send MAC CE command “TCI State Indication for UE-specific PDCCH” according to the timing described in Note 1 of table 5.2.2.1.10\_1.4-1 to switch from active TCI state 0 to 1 for PDCCH and vice versa periodically. PDSCH is automatically associated with TCI state 0 or 1 as tci-PresentInDCI is not present. TCI states 3 and 4 for SSBs are automatically activated through relation of QCL-Info in NZP CSI-RS.

4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

Test 1-2:

1. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.1.10\_1.4-1 as appropriate.

2. SS activates TCI state 0 and TCI 1 for PDSCH at the same time via MAC CE command “TCI States Activation/Deactivation for UE-specific PDSCH”.

3. SS is configured to transmit SSB and CSI-RS continuously and schedule PDSCH and PDCCH transmission according to Note 1 in 5.2.2.1.10\_1.4-1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.2.1.10\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

Note: All TCI states are known to the UE through configuration inside RrcReconfiguration. There is no need to configure additional L1-RSRP measurements.

4. Send MAC CE command “TCI State Indication for UE-specific PDCCH” according to the timing described in Note 1 of table 5.2.2.1.10\_1.4-1 to switch from active TCI state 0 to 1 for PDCCH and vice versa periodically. PDSCH is automatically associated with TCI state 0 or 1 as tci-PresentInDCI is not present. TCI states 3 and 4 for SSBs are automatically activated through relation of QCL-Info in NZP CSI-RS.

5. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.2.1.10\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.2.1.10\_1.3.3\_1 Message exceptions for SA

Table 5.2.2.1.10\_1.3.3\_1-1: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | Not present | n2 is used | test 1-1, 1-2 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.1.10\_1.3.3\_1-2: DMRS-DownlinkConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24 | | | |
| Information Element | Value/remark | Comment | Condition |
| DMRS-DownlinkConfig ::= SEQUENCE { |  |  |  |
| dmrs-AdditionalPosition | pos2 | for test 1-1, 1-2 |  |
| } |  |  |  |

Table 5.2.2.1.10\_1.3.3\_1-3: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | n4 | for test 1-1, 1-2 |  |
| } |  |  |  |

Table 5.2.2.1.10\_1.3.3\_1-4: NZP-CSI-RS-Resource for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| nzp-CSI-RS-ResourceId | i-1 for CSI-RS resource #i, i=1,2,3,4,5,6,7,8 | for test 1-1, 1-2 |  |
| qcl-InfoPeriodicCSI-RS | 2 for CSI-RS resource #1, #2, #3, #4  3 for CSI-RS resource #5, #6, #7, #8 | for test 1-1, 1-2:  TCI-StateId for TCI-State #2 for CSI-RS resource #1, #2, #3, #4  TCI-StateId for TCI-State #3 for CSI-RS resource #5, #6, #7, #8 |  |
| } |  |  |  |

Table 5.2.2.1.10\_1.3.3\_1-5: CSI-RS-ResourceMapping for TRS (Table 5.2.2.1.10\_1.3.3\_1-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 with condition TRS | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 5 for CSI-RS resource #1 and #3  9 for CSI-RS resource #2 and #4  6 for CSI-RS resource #5 and #6  10 for CSI-RS resource #7 and #8 | for test 1-1, 1-2:  l0 = 5 for CSI-RS resource 1 and 3  l0 = 9 for CSI-RS resource 2 and 4  l0 = 6 for CSI-RS resource 5 and 6  l0 = 10 for CSI-RS resource 7 and 8 |  |
| } |  |  |  |

Table 5.2.2.1.10\_1.3.3\_1-5: CSI-ResourcePeriodicityAndOffset for CSI Tracking (Table 5.2.2.1.10\_1.3.3\_1-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots10 | 1 for CSI-RS resource #1, #2, #5, #6  2 for CSI-RS resource #3 #4, #7, #8 | For test 1-1, 1-2:  periodicity:  10 slots.  offset:  1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4  1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8 |  |
| } |  |  |  |

Table 5.2.2.1.10\_1.3.3\_1-6: NZP-CSI-RS-ResourceSet for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-12 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-ResourceSet ::= SEQUENCE { |  |  |  |
| nzp\_CSI\_ResourceSetId | 0 for Resource set #1  1 for Resource set #2 | For test 1-1, 1-2 |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 4 entries | For test 1-1, 1-2 | Resource set #1 |
| NZP-CSI-RS-ResourceId[1] | 0 | entry 1  CSI-RS resource #1 |  |
| NZP-CSI-RS-ResourceId[2] | 1 | entry 2  CSI-RS resource #2 |  |
| NZP-CSI-RS-ResourceId[3] | 2 | entry 3  CSI-RS resource #3 |  |
| NZP-CSI-RS-ResourceId[4] | 3 | entry 4  CSI-RS resource #4 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 4 entries | For test 1-1, 1-2 | Resource set #2 |
| NZP-CSI-RS-ResourceId[1] | 4 | entry 1  CSI-RS resource #5 |  |
| NZP-CSI-RS-ResourceId[2] | 5 | entry 2  CSI-RS resource #6 |  |
| NZP-CSI-RS-ResourceId[3] | 6 | entry 3  CSI-RS resource #7 |  |
| NZP-CSI-RS-ResourceId[4] | 7 | entry 4  CSI-RS resource #8 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.1.10\_1.3.3\_1-7: NZP-CSI-RS-Resource for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-14 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| nzp-CSI-RS-ResourceId | 8 for CSI-RS resource #9  9 for CSI-RS resource #10 | for test 1-1, 1-2 |  |
| qcl-InfoPeriodicCSI-RS | 0 for CSI-RS resource #9  1 for CSI-RS resource #10 | for test 1-1, 1-2:  TCI-State #0 for CSI-RS resource #9  TCI-State #1 for CSI-RS resource #10 |  |
| } |  |  |  |

Table 5.2.2.1.10\_1.3.3\_1-8: CSI-RS-ResourceMapping for CSI Acquisition (Table 5.2.2.1.10\_1.3.3\_1-7)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 12 for CSI-RS resource #9  13 for CSI-RS resource #10 | for test 1-1, 1-2  l0=12 for CSI-RS resource #9  l0=13 for CSI-RS resource #10 |  |
| } |  |  |  |

Table 5.2.2.1.10\_1.3.3\_1-9: CSI-ResourcePeriodicityAndOffset for CSI Acquisition (Table 5.2.2.1.10\_1.3.3\_1-7)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-16 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots20 | 0 | For test 1-1, 1-2:  periodicity = 20 slots.  offset = 0 slots |  |
| } |  |  |  |

Table 5.2.2.1.10\_1.3.3\_1-10: NZP-CSI-RS-ResourceSet for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-18 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-ResourceSet ::= SEQUENCE { |  |  |  |
| nzp\_CSI\_ResourceSetId | 2 for Resource set #3  3 for Resource set #4 | For test 1-1, 1-2 |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry | For test 1-1, 1-2 | Resource set #3 |
| NZP-CSI-RS-ResourceId[1] | 8 | entry 1  CSI-RS resource #9 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry | For test 1-1, 1-2 | Resource set #4 |
| NZP-CSI-RS-ResourceId[1] | 9 | entry 1  CSI-RS resource #10 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.1.10\_1.3.3\_1-10: *TCI-State*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-190 | | | |
| Information Element | Value/remark | Comment | Condition |
| TCI-State ::= SEQUENCE { |  |  |  |
| tci-StateId | 0 for TCI state #0  1 for TCI state #1  2 for TCI state #2  3 for TCI state #3 | For test 1-1, 1-2 |  |
| qcl-Type1 SEQUENCE { |  |  |  |
| bwp-Id | BWP-Id of active BWP |  | TCI state #0, TCI state #1 |
|  | Not present |  | TCI state #2, TCI state #3 |
| referenceSignal CHOICE { |  |  |  |
| csi-rs | 0 | CSI-RS resource #1 | TCI state #0 |
|  | 4 | CSI-RS resource #5 | TCI state #1 |
| ssb | 0 | SSB #0 | TCI state #2 |
|  | 1 | SSB #1 | TCI state #3 |
| } |  |  |  |
| qcl-Type | typeA |  | TCI state #0, TCI state #1 |
|  | typeC |  | TCI state #2, TCI state #3 |
| } |  |  |  |
| } |  |  |  |

5.2.2.1.10\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.2.1.10\_1.3.3\_1

5.2.2.1.10\_1.4 Test requirement

Tables 5.2.2.1.10\_1.4-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.10\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.10\_1.4-1: Test Requirements for HST-DPS

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Number of active PDSCH TCI states | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-8.4 FDD | 10 / 15 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 14.0 |
| 1-2 | R.PDSCH.1-8.4 FDD | 10 / 15 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 14.0 |

##### 5.2.2.1.11 2Rx FDD FR1 PDSCH Single-DCI based SDM scheme performance

5.2.2.1.11.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.11.0-3, with the addition of test parameters in Table 5.2.2.1.11.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.11.0-1.

Table 5.2.2.1.11.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH performance with Single-DCI based SDM scheme under 2 receive antenna conditions | 1-1,1-2 |

Table 5.2.2.1.11.0-2: Test parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | |
| TRxP #1(Note 1) | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | |  | TRxP #1 | |
| PDCCH configuration | | TCI state | |  | TCI State #1 | |
| CORESETPoolIndex | |  | 0 | |
| CSI-RS for tracking | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | |
| Density | |  | 3 | |
| CSI-RS periodicity | | Slots | 20 | |
| CSI-RS offset | | Slots | 10 for CSI-RS resources 1 and 2  11 for CSI-RS resources 3 and 4 | 10 for CSI-RS resources 5 and 6  11 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | |
| Duplex mode | | | |  | FDD | |
| Active DL BWP index | | | |  | 1 | |
| PDSCH configuration | Mapping type | | |  | Type A | |
| k0 | | |  | 0 | |
| Starting symbol (S) | | |  | 2 | |
| Length (L) | | |  | 12 | |
| PRB bundling type | | |  | Static | |
| PRB bundling size | | |  | 2 | |
| Resource allocation type | | |  | Type 1 | |
| RBG size | | |  | Config2 | |
| VRB-to-PRB mapping type | | |  | Non-interleaved | |
| VRB-to-PRB mapping interleaver bundle size | | |  | N/A | |
| PDSCH DMRS configuration | Antenna port indexes | | |  | 1000 | 1002 |
| TCI state | | |  | TCI State #1 | TCI State #2 |
| DMRS Type | | |  | Type 1 | |
| Number of additional DMRS | | |  | 1 | |
| Maximum number of OFDM symbols for DL front loaded DMRS | | |  | 1 | |
| TCI State #1 | Type 1 QCL information | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | N/A |
| QCL Type |  | Type A | N/A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| TCI State #2 | Type 1 QCL information | | CSI-RS resource |  | N/A | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | Type A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| Resource allocation | | | |  | Full-overlapping | |
| Timing offset of the second TRxP from the first TRxP | | | | us | -0.5 for test 1-1  2 for test 1-2 | |
| Frequency offset of the second TRxP from the first TRxP | | | | Hz | 200 for test 1-1  0 for test 1-2 | |
| Number of HARQ Processes | | | |  | 4 | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | | |  | 2 | |
| Precoding configuration | | | |  | SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity | |
| Note 1: PDSCH transmission is done from both TRxPs (PDSCH Layer 0 is transmitted from TRxP #1 and PDSCH layer 1 is transmitted from TRxP #2) | | | | | | |

Table 5.2.2.1.11.0-3: Minimum performance

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition(Note 1) | Correlation matrix and antenna configuration(Note 2) | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB)(Note 3) |
| 1-1 | R.PDSCH.1-3.2 FDD | 10 / 15 | 64QAM, 0.50 | TDLA30-10 | 2x2, ULA Low | 70 | 20.7 |
| 1-2 | R.PDSCH.1-3.2 FDD | 10 / 15 | 64QAM, 0.50 | TDLA30-10 | 2x2, ULA Low | 70 | 20.1 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 with scaling factor as 1/sqrt(2) for transmitted signal from each TRxP | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.11.

###### 5.2.2.1.11\_1 2Rx FDD FR1 PDSCH Single-DCI based SDM scheme performance - 2x2 MIMO for both SA and NSA

5.2.2.1.11\_1.1 Test purpose

To verify the PDSCH performance with Single-DCI based SDM scheme under 2 receive antenna conditions.

5.2.2.1.11\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *singleDCI-SDM-scheme-r16*.

5.2.2.1.11\_1.3 Test description

5.2.2.1.11\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2.3 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.1.11.0-2 and Table 5.2.2.1.11.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.11\_1.3.3.

5.2.2.1.11\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.2.1.11\_1.3.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.1.11\_1.3.4-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

4. Repeat steps from 1 to 3 for each subtest in Table 5.2.2.1.11\_1.3.4-1 as appropriate.

5.2.2.1.11\_1.3.3 Message contents

5.2.2.1.11\_1.3.3\_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.2.1.11\_1.3.3\_1-1: Physical layer parameters for DCI format 1\_1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1 | | | | |
| Parameter | Value | Value in binary | Condition |
| PDSCH-to-HARQ\_feedback timing indicator | K1 = 2 | “010” |  |
| Antenna port(s) | DMRS port 0 and 2 | “1011” |  |
| Transmission configuration indication | TCI state 1 and 2 | “000” |  |

Table 5.2.2.1.11\_1.3.3\_1-2: *CellGroupConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| simultaneousTCI-UpdateList1-r16 SEQUENCE { |  |  |  |
| ServCellIndex [1] | ServCellIndex |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.1.11\_1.3.3\_1-3: *ControlResourceSet*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| tci-PresentInDCI | enabled |  |  |
| } |  |  |  |

Table 5.2.2.1.11\_1.3.3\_1-4: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-100 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| tci-StatesToAddModList SEQUENCE(SIZE (1.. maxNrofTCI-States)) OF TCI-State { | 2 entries |  |  |
| TCI-State[1] | *TCI-State* with condition TCI-state-0 |  |  |
| TCI-State[2] | *TCI-State* with condition TCI-state-1 |  |  |
| TCI-State[3] | *TCI-State* with condition TCI-state-2 |  |  |
| } |  |  |  |
| rbg-Size | config2 |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.1.11\_1.3.3\_1-5: *TCI-State*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-190 | | | |
| Information Element | Value/remark | Comment | Condition |
| TCI-State ::= SEQUENCE { |  |  |  |
| tci-StateId | 0 |  | TCI-state-0 |
|  | 1 |  | TCI-state-1 |
|  | 2 |  | TCI-state-2 |
| qcl-Type1 SEQUENCE { |  |  |  |
| cell | Not present |  |  |
| bwp-Id | Not present |  |  |
| referenceSignal CHOICE { |  |  |  |
| ssb | SSB-Index |  | TCI-state-0 |
| csi-rs | 1 |  | TCI-state-1 |
|  | 5 |  | TCI-state-2 |
| } |  |  |  |
| qcl-Type | typeA |  |  |
| } |  |  |  |
| qcl-Type2 | Not present |  |  |
| } |  |  |  |

Table 5.2.2.1.11\_1.3.3\_1-6: *NZP-CSI-RS-Resource*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-85 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| resourceMapping SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| row1 | 0000 | For CSI-RS resources 1, 2, 3, 4 |  |
|  | 0001 | For CSI-RS resources 5,6,7,8 |  |
| } |  |  |  |
| nrofPorts | p1 |  |  |
| firstOFDMSymbolInTimeDomain | 6 | For CSI-RS resources 1,3,5,7 |  |
|  | 10 | For CSI-RS resources 2,4,6,8 |  |
| cdm-Type | noCDM |  |  |
| density CHOICE { |  |  |  |
| three | NULL |  |  |
| } |  |  |  |
| } |  |  |  |
| periodicityAndOffset CHOICE { |  |  |  |
| slots20 | 10 | For CSI-RS resources 1,2,5,6 |  |
| slots20 | 11 | For CSI-RS resources 3,4,7,8 |  |
| } |  |  |  |
| qcl-InfoPeriodicCSI-RS | 0 |  |  |
| } |  |  |  |

5.2.2.1.11\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.2.1.11\_1.3.3\_1.

5.2.2.1.11\_1.3.4 Test requirement

Table 5.2.2.1.11.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.11\_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.11\_1.3.4-1: Test requirement

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition(Note 1) | Correlation matrix and antenna configuration(Note 2) | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB)(Note 3) |
| 1-1 | R.PDSCH.1-3.2 FDD | 10 / 15 | 64QAM, 0.50 | TDLA30-10 | 2x2, ULA Low | 70 | 21.7 |
| 1-2 | R.PDSCH.1-3.2 FDD | 10 / 15 | 64QAM, 0.50 | TDLA30-10 | 2x2, ULA Low | 70 | 21.1 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 with scaling factor as 1/sqrt(2) for transmitted signal from each TRxP | | | | | | | |

##### 5.2.2.1.12 2Rx FDD FR1 PDSCH Multi-DCI based transmission scheme performance

5.2.2.1.12.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.12.0-3, with the addition of test parameters in Table 5.2.2.1.12.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.12.0-1.

Table 5.2.2.1.12.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH performance when UE is configured two different values of CORESETPoolIndex in ControlResourceSet and when UE receives multiple PDCCHs scheduling PDSCHs | 1-1 |

Table 5.2.2.1.12.0-2: Test parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | |
| TRxP #1(Note 1) | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | |  | TRxP #1 | |
| PDCCH configuration | | TCI state | |  | TCI State #1 | TCI State #2 |
| CORESETPoolIndex | |  | 0,1 | |
| CSI-RS for tracking | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | |
| Density | |  | 3 | |
| CSI-RS periodicity | | Slots | 20 | |
| CSI-RS offset | | Slots | 10 for CSI-RS resources 1 and 2  11 for CSI-RS resources 3 and 4 | 10 for CSI-RS resources 5 and 6  11 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | |
| Duplex mode | | | |  | FDD | |
| Active DL BWP index | | | |  | 1 | |
| PDSCH configuration | Mapping type | | |  | Type A | |
| k0 | | |  | 0 | |
| Starting symbol (S) | | |  | 2 | |
| Length (L) | | |  | 12 | |
| PRB bundling type | | |  | Static | |
| PRB bundling size | | |  | 2 | |
| Resource allocation type | | |  | Type 1 | |
| RBG size | | |  | Config2 | |
| VRB-to-PRB mapping type | | |  | Non-interleaved | |
| VRB-to-PRB mapping interleaver bundle size | | |  | N/A | |
| PDSCH DMRS configuration | Antenna port indexes | | |  | {1000,1001} | {1002,1003} |
| TCI state | | |  | TCI State #1 | TCI State #2 |
| DMRS Type | | |  | Type 1 | |
| Number of additional DMRS | | |  | 1 | |
| Maximum number of OFDM symbols for DL front loaded DMRS | | |  | 1 | |
| TCI State #1 | Type 1 QCL information | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | N/A |
| QCL Type |  | Type A | N/A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| TCI State #2 | Type 1 QCL information | | CSI-RS resource |  | N/A | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | Type A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| Resource allocation | | | |  | Non-overlapping | |
| Timing offset of the second TRxP from the first TRxP | | | | us | -0.5 | |
| Frequency offset of the second TRxP from the first TRxP | | | | Hz | 200 | |
| Number of HARQ Processes | | | |  | 4 | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | | |  | 2 | |
| Precoding configuration | | | |  | SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity | |
| Note 1: PDSCH transmission is done from both TRxPs. Transmission from TRxP #1 uses CORESETPoolIndex 0 and transmission from TRxP #2 uses CORESETPoolIndex 1 | | | | | | |

Table 5.2.2.1.12.0-3: Minimum performance

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition(Note 1) | Correlation matrix and antenna configuration(Note 2) | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB)(Note 3) |
|  | TRxP #1 | TRxP #2 |  |  |  |  |  |  |
| 1-1 | R.PDSCH.1-3.3 FDD | R.PDSCH.1-3.4 FDD | 10 / 15 | 64QAM, 0.50 | TDLA30-10 | 2x2, ULA Low | 70 | 20.6 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 | | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.12.

###### 5.2.2.1.12\_1 2Rx FDD FR1 PDSCH Multiple-DCI based transmission scheme performance - 2x2 MIMO for both SA and NSA

5.2.2.1.12\_1.1 Test purpose

To verify the PDSCH performance when UE is configured two different values of CORESETPoolIndex in ControlResourceSet and when UE receives multiple PDCCHs scheduling PDSCHs.

5.2.2.1.12\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *multiDCI-MultiTRP-r16*.

5.2.2.1.12\_1.3 Test description

5.2.2.1.12\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.9 for TE diagram and section A.3.2.3 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.1.12.0-2 and Table 5.2.2.1.12.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.12\_1.3.3.

5.2.2.1.12\_1.3.2 Test procedure

1. SS transmits PDSCH in TRxP#1 via PDCCH DCI format 1\_1 for C\_RNTI in ControlResourceSetid1 (Table 5.2.2.1.12\_1.3.3\_1-2), and transmits PDSCH in TRxP#2 via PDCCH DCI format 1\_1 for C\_RNTI in ControlResourceSetid2 (Table 5.2.2.1.12\_1.3.3\_1-3), to transmit the DL RMC according to Table 5.2.2.1.12\_1.3.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR for TRxP#1 and TRxP#2 according to Table 5.2.2.1.12\_1.4-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.2.1.12\_1.3.3 Message contents

5.2.2.1.12\_1.3.3\_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.2.1.12\_1.3.3\_1-1: *PDCCH-Config* (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4],Table 4.6.3-95 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-Config::= SEQUENCE { |  |  |  |
| controlResourceSetToAddModList SEQUENCE(SEQUENCE(SIZE (1..3)) OF ControlResourceSet { | 2 entries |  |  |
| ControlResourceSet[1] | ControlResourceSetid1 | entry 1 |  |
| ControlResourceSet[2] | ControlResourceSetid2 | entry 2 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.1.12\_1.3.3\_1-2: *ControlResourceSetId1* (Table 5.2.2.1.12\_1.3.3\_1-1: *PDCCH-Config*)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 1 |  |  |
| frequencyDomainResources | 11110000 00000000 00000000 00000000 00000000 00000 | CORESET to use the least significant 24 RBs of the BWP |  |
| tci-StatesPDCCH-ToAddList SEQUENCE(SIZE (1..maxNrofTCI-StatesPDCCH)) OF TCI-StateId { |  |  |  |
| TCI-StateId[1] | 1 |  |  |
| } |  |  |  |
| tci-PresentInDCI | enabled |  |  |
| coresetPoolIndex-r16 | 0 |  |  |
| } |  |  |  |

Table 5.2.2.1.12\_1.3.3\_1-3: *ControlResourceSetId2* (Table 5.2.2.1.12\_1.3.3\_1-1: *PDCCH-Config*)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 2 |  |  |
| frequencyDomainResources | 00001111 00000000 00000000 00000000 00000000 00000 | CORESET to use the RBs 24~47 of the BWP |  |
| tci-StatesPDCCH-ToAddList SEQUENCE(SIZE (1..maxNrofTCI-StatesPDCCH)) OF TCI-StateId { |  |  |  |
| TCI-StateId[1] | 2 |  |  |
| } |  |  |  |
| tci-PresentInDCI | enabled |  |  |
| coresetPoolIndex-r16 | 1 |  |  |
| } |  |  |  |

Table 5.2.2.1.12\_1.3.3\_1-4: Physical layer parameters for DCI format 1\_1 in ControlResourceSetid1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1 | | | | |
| Parameter | Value | Value in binary | Condition |
| Antenna port(s) | DMRS port 0 and 1 | “0111” |  |
| Transmission configuration indication | TCI State #1 | “000” |  |

Table 5.2.2.1.12\_1.3.3\_1-5: Physical layer parameters for DCI format 1\_1 in ControlResourceSetid2

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1 | | | |
| Parameter | Value | Value in binary | Condition |
| Antenna port(s) | DMRS port 2 and 3 | “1000” |  |
| Transmission configuration indication | TCI State #2 | “001” |  |

Table 5.2.2.1.12\_1.3.3\_1-6: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| tci-StatesToAddModList SEQUENCE(SIZE (1.. maxNrofTCI-States)) OF TCI-State { | 2 entries |  |  |
| TCI-State[1] SEQUENCE { |  | TCI-state-0 |  |
| tci-StateId | 0 |  |  |
| qcl-type1 SEQUENCE { |  |  |  |
| cell | Not present |  |  |
| bwp-Id | Not present |  |  |
| referenceSignal CHOICE { |  |  |  |
| ssb | SSB-Index |  |  |
| } |  |  |  |
| qcl-Type | typeC |  |  |
| } |  |  |  |
| } |  |  |  |
| TCI-State[2] |  | TCI-state-1 |  |
| tci-StateId | 1 |  |  |
| qcl-type1 SEQUENCE { |  |  |  |
| cell | Not present |  |  |
| bwp-Id | Not present |  |  |
| referenceSignal CHOICE { |  |  |  |
| csi-rs | 1 |  |  |
| } |  |  |  |
| qcl-Type | typeA |  |  |
| } |  |  |  |
| } |  |  |  |
| TCI-State[3] |  | TCI-state-2 |  |
| tci-StateId | 2 |  |  |
| qcl-type1 SEQUENCE { |  |  |  |
| cell | Not present |  |  |
| bwp-Id | Not present |  |  |
| referenceSignal CHOICE { |  |  |  |
| csi-rs | 5 |  |  |
| } |  |  |  |
| qcl-Type | typeA |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.1.12\_1.3.3\_1-7: *CSI-RS-ResourceMapping* for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| row1 | 0000 | For CSI-RS resources 1, 2, 3, 4 |  |
|  | 0001 | For CSI-RS resources 5,6,7,8 |  |
| } |  |  |  |
| nrofPorts | p1 |  |  |
| firstOFDMSymbolInTimeDomain | 6 | For CSI-RS resources 1,3,5,7 |  |
|  | 10 | For CSI-RS resources 2,4,6,8 |  |
| } |  |  |  |

Table 5.2.2.1.12\_1.3.3\_1-8: *CSI-ResourcePeriodicityAndOffset* for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots20 | 10 | For CSI-RS resources 1,2,5,6 |  |
| slots20 | 11 | For CSI-RS resources 3,4,7,8 |  |
| } |  |  |  |

5.2.2.1.12\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.2.1.12\_1.3.3\_1.

5.2.2.1.12\_1.4 Test requirement

Table 5.2.2.1.12.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.12\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.12\_1.4-1: Test requirement

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition(Note 1) | Correlation matrix and antenna configuration(Note 2) | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB)(Note 3) |
|  | TRxP #1 | TRxP #2 |  |  |  |  |  |  |
| 1-1 | R.PDSCH.1-3.3 FDD | R.PDSCH.1-3.4 FDD | 10 / 15 | 64QAM, 0.50 | TDLA30-10 | 2x2, ULA Low | 70 | 21.6 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 | | | | | | | | |

##### 5.2.2.1.13 2Rx FDD FR1 PDSCH Single-DCI based FDM scheme A performance

5.2.2.1.13.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.13.0-3, with the addition of test parameters in Table 5.2.2.1.13.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.13.0-1.

Table 5.2.2.1.13.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH performance under 2 receive antenna conditions when UE is configured with “FDMSchemeA” in “RepetitionScheme-r16” defined in clause 5.1 of TS 38.214 [12] | 1-1 |

Table 5.2.2.1.13.0-2: Test parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | |
| TRxP #1(Note 1) | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | |  | TRxP #1 | |
| PDCCH configuration | | TCI state | |  | TCI State #1 | |
| CORESETPoolIndex | |  | Not configured | |
| CSI-RS for tracking | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | |
| Density | |  | 3 | |
| CSI-RS periodicity | | Slots | 20 | |
| CSI-RS offset | | Slots | 10 for CSI-RS resources 1 and 2  11 for CSI-RS resources 3 and 4 | 10 for CSI-RS resources 5 and 6  11 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | |
| Duplex mode | | | |  | FDD | |
| Active DL BWP index | | | |  | 1 | |
| PDSCH configuration | Mapping type | | |  | Type A | |
| k0 | | |  | 0 | |
| Starting symbol (S) | | |  | 2 | |
| Length (L) | | |  | 12 | |
| PRB bundling type | | |  | Static | |
| PRB bundling size | | |  | Wideband | |
| Resource allocation type | | |  | Type 0 | |
| RBG size | | |  | Config2 | |
| VRB-to-PRB mapping type | | |  | Non-interleaved | |
| VRB-to-PRB mapping interleaver bundle size | | |  | N/A | |
| PDSCH DMRS configuration | Antenna port indexes | | |  | 1000,1001 | 1000,1001 |
| TCI state | | |  | TCI State #1 | TCI State #2 |
| DMRS Type | | |  | Type 1 | |
| Number of additional DMRS | | |  | 1 | |
| Maximum number of OFDM symbols for DL front loaded DMRS | | |  | 1 | |
| TCI State #1 | Type 1 QCL information | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | N/A |
| QCL Type |  | Type A | N/A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| TCI State #2 | Type 1 QCL information | | CSI-RS resource |  | N/A | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | Type A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| Timing offset of the second TRxP from the first TRxP | | | | us | -0.5 | |
| Frequency offset of the second TRxP from the first TRxP | | | | Hz | 200 | |
| Number of HARQ Processes | | | |  | 4 | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | | |  | 2 | |
| Precoding configuration | | | |  | SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity | |
| Note 1: PDSCH transmission is done from both TRxPs | | | | | | |

Table 5.2.2.1.13.0-3: Minimum performance for Rank 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition(Note 1) | Correlation matrix and antenna configuration (Note 2) | Reference value | |
| Fraction of  maximum  throughput  (%) | SNR (dB) (Note 3) |
| 1-1 | R.PDSCH.1-2.5 FDD | 10 / 15 | 16QAM, 0.54 | TDLA30-10 | 2x2, ULA Low | 70 | 17.3 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.13.

###### 5.2.2.1.13\_1 2Rx FDD FR1 PDSCH Single-DCI based FDM scheme A performance - 2x2 MIMO for both SA and NSA

5.2.2.1.13\_1.1 Test purpose

To verify the PDSCH performance under 2 receive antenna conditions when UE is configured with “FDMSchemeA” in “RepetitionScheme-r16”.

5.2.2.1.13\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *supportFDM-SchemeA-r16*.

5.2.2.1.13\_1.3 Test description

5.2.2.1.13\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.9 for TE diagram and section A.3.2.3 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.1.13.0-2 and Table 5.2.2.1.13.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.13\_1.3.3.

5.2.2.1.13\_1.3.2 Test procedure

1. SS transmits PDSCH in TRxP#1 and TRxP#2 via PDCCH DCI format 1\_1 for C\_RNTI (Table 5.2.2.1.13\_1.3.3\_1-2), to transmit the DL RMC according to Table 5.2.2.1.13\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR for TRxP#1 and TRxP#2 according to Table 5.2.2.1.13\_1.4-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.2.1.13\_1.3.3 Message contents

5.2.2.1.13\_1.3.3\_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.2.1.13\_1.3.3\_1-1: *PDCCH-ControlResourceSet* (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4],Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| tci-PresentInDCI | enabled |  |  |
| } |  |  |  |

Table 5.2.2.1.13\_1.3.3\_1-2: Physical layer parameters for DCI format 1\_1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1 | | | | |
| Parameter | Value | Value in binary | Condition |
| Antenna port(s) | DMRS port 0 and 1 | “0111” |  |
| Transmission configuration indication | TCI codepoint 0, corresponding to TCI State #1 and #2 | “000” |  |

Table 5.2.2.1.13\_1.3.3\_1-3: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| tci-StatesToAddModList SEQUENCE(SIZE (1.. maxNrofTCI-States)) OF TCI-State { | 2 entries |  |  |
| TCI-State[1] SEQUENCE { |  | TCI-state-0 |  |
| tci-StateId | 0 |  |  |
| qcl-type1 SEQUENCE { |  |  |  |
| cell | Not present |  |  |
| bwp-Id | Not present |  |  |
| referenceSignal CHOICE { |  |  |  |
| ssb | SSB-Index |  |  |
| } |  |  |  |
| qcl-Type | typeC |  |  |
| } |  |  |  |
| } |  |  |  |
| TCI-State[2] |  | TCI-state-1 |  |
| tci-StateId | 1 |  |  |
| qcl-type1 SEQUENCE { |  |  |  |
| cell | Not present |  |  |
| bwp-Id | Not present |  |  |
| referenceSignal CHOICE { |  |  |  |
| csi-rs | 1 |  |  |
| } |  |  |  |
| qcl-Type | typeA |  |  |
| } |  |  |  |
| } |  |  |  |
| TCI-State[3] |  | TCI-state-2 |  |
| tci-StateId | 2 |  |  |
| qcl-type1 SEQUENCE { |  |  |  |
| cell | Not present |  |  |
| bwp-Id | Not present |  |  |
| referenceSignal CHOICE { |  |  |  |
| csi-rs | 5 |  |  |
| } |  |  |  |
| qcl-Type | typeA |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | wideband |  |  |
| } |  |  |  |
| } |  |  |  |
| repetitionSchemeConfig-r16 CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| fdm-TDM-r16 CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| repetitionScheme-r16 | fdmSchemeA |  |  |
| startingSymbolOffsetK-r16 | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.1.13\_1.3.3\_1-4: *CSI-RS-ResourceMapping* for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| row1 | 0000 | For CSI-RS resources 1, 2, 3, 4 |  |
|  | 0001 | For CSI-RS resources 5,6,7,8 |  |
| } |  |  |  |
| nrofPorts | p1 |  |  |
| firstOFDMSymbolInTimeDomain | 6 | For CSI-RS resources 1,3,5,7 |  |
|  | 10 | For CSI-RS resources 2,4,6,8 |  |
| } |  |  |  |

Table 5.2.2.1.13\_1.3.3\_1-5: *CSI-ResourcePeriodicityAndOffset* for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots20 | 10 | For CSI-RS resources 1,2,5,6 |  |
| slots20 | 11 | For CSI-RS resources 3,4,7,8 |  |
| } |  |  |  |

5.2.2.1.13\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.2.1.13\_1.3.3\_1.

5.2.2.1.13\_1.4 Test requirement

Table 5.2.2.1.13.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.13\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.13\_1.4-1: Test requirement for Rank 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition(Note 1) | Correlation matrix and antenna configuration (Note 2) | Reference value | |
| Fraction of  maximum  throughput  (%) | SNR (dB) (Note 3) |
| 1-1 | R.PDSCH.1-2.5 FDD | 10 / 15 | 16QAM, 0.54 | TDLA30-10 | 2x2, ULA Low | 70 | 18.3 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 | | | | | | | |

##### 5.2.2.1.14 2Rx FDD FR1 PDSCH Single-DCI based Inter-slot TDM scheme performance

5.2.2.1.14.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.14.0-3, with the addition of test parameters in Table 5.2.2.1.14.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.14.0-1.

Table 5.2.2.1.14.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH performance under 2 receive antenna conditions when UE is configured with repetitionNumber-r16 with multiple slot level PDSCH transmission occasions of the same TB with two TCI states defined in clause 5.1 of TS 38.214 [12] | 1-1 |

Table 5.2.2.1.14.0-2: Test parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | |
| TRxP #1(Note 1) | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | |  | TRxP #1 | |
| PDCCH configuration | | TCI state | |  | TCI State #1 | |
| CORESETPoolIndex | |  | Not configured | |
| CSI-RS for tracking | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | |
| Density | |  | 3 | |
| CSI-RS periodicity | | Slots | 20 | |
| CSI-RS offset | | Slots | 10 for CSI-RS resources 1 and 2  11 for CSI-RS resources 3 and 4 | 10 for CSI-RS resources 5 and 6  11 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | |
| Duplex mode | | | |  | FDD | |
| Active DL BWP index | | | |  | 1 | |
| PDSCH configuration | Mapping type | | |  | Type A | |
| k0 | | |  | 0 | |
| Starting symbol (S) | | |  | 2 | |
| Length (L) | | |  | 12 | |
| Repetition number | | |  | 2 | |
| PRB bundling type | | |  | Static | |
| PRB bundling size | | |  | 2 | |
| Resource allocation type | | |  | Type 0 | |
| RBG size | | |  | Config2 | |
| VRB-to-PRB mapping type | | |  | Non-interleaved | |
| VRB-to-PRB mapping interleaver bundle size | | |  | N/A | |
| PDSCH DMRS configuration | Antenna port indexes | | |  | 1000 | 1000 |
| TCI state | | |  | TCI State #1 | TCI State #2 |
| DMRS Type | | |  | Type 1 | |
| Number of additional DMRS | | |  | 1 | |
| Maximum number of OFDM symbols for DL front loaded DMRS | | |  | 1 | |
| TCI State #1 | Type 1 QCL information | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | N/A |
| QCL Type |  | Type A | N/A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| TCI State #2 | Type 1 QCL information | | CSI-RS resource |  | N/A | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | Type A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| Timing offset of the second TRxP from the first TRxP | | | | us | 2 | |
| Frequency offset of the second TRxP from the first TRxP | | | | Hz | 200 | |
| Number of HARQ Processes | | | |  | 4 | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | | |  | 2 | |
| Precoding configuration | | | |  | SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity | |
| Note 1: PDSCH transmission is done from both TRxPs | | | | | | |

Table 5.2.2.1.14.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition (Note 1) | Correlation matrix and antenna configuration Note 2) | Reference value | |
| BLER (%) | SNR (dB) (Note 4) |
| 1-1 | R.PDSCH.1-11.2 FDD | 10 / 15 | 16QAM, 0.54 | TDLA30-10 | 2x2, ULA Low | 1 (Note 3) | 2.9 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block.  Note 4: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.14.

###### 5.2.2.1.14\_1 2Rx FDD FR1 PDSCH Single-DCI based Inter-slot TDM scheme performance - 2x2 MIMO for both SA and NSA

5.2.2.1.14\_1.1 Test purpose

To verify the PDSCH performance under 2 receive antenna conditions when UE is configured with repetitionNumber-r16 with multiple slot level PDSCH transmission occasions of the same TB with two TCI states.

5.2.2.1.14\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *supportTDM-SchemeA-r16*.

5.2.2.1.14\_1.3 Test description

5.2.2.1.14\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.9 for TE diagram and section A.3.2.3 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.1.14.0-2 and Table 5.2.2.1.14.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.14\_1.3.3.

5.2.2.1.14\_1.3.2 Test procedure

1. SS transmits PDSCH in TRxP#1 and TRxP#2 via PDCCH DCI format 1\_1 for C\_RNTI (Table 5.2.2.1.14\_1.3.3\_1-2), to transmit the DL RMC according to Table 5.2.2.1.14\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR for TRxP#1 and TRxP#2 according to Table 5.2.2.1.14\_1.4-1.

3. Measure the residual BLER for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of correctly and incorrectly received transport blocks based on ACK/NACK feedback on the UL during each subtest and decide pass or fail according to clause G.1.4 and Table G.1.5-1a in Annex G clause G.1.5.

5.2.2.1.14\_1.3.3 Message contents

5.2.2.1.14\_1.3.3\_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.2.1.14\_1.3.3\_1-1: *PDCCH-ControlResourceSet* (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4],Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| tci-PresentInDCI | enabled |  |  |
| } |  |  |  |

Table 5.2.2.1.14\_1.3.3\_1-2: Physical layer parameters for DCI format 1\_1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1 | | | | |
| Parameter | Value | Value in binary | Condition |
| Antenna port(s) | DMRS port 0 | “0000” |  |
| Transmission configuration indication | TCI codepoint 0, corresponding to TCI State #1 and #2 | “000” |  |

Table 5.2.2.1.14\_1.3.3\_1-3: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| tci-StatesToAddModList SEQUENCE(SIZE (1.. maxNrofTCI-States)) OF TCI-State { | 2 entries |  |  |
| TCI-State[1] SEQUENCE { |  | TCI-state-0 |  |
| tci-StateId | 0 |  |  |
| qcl-type1 SEQUENCE { |  |  |  |
| cell | Not present |  |  |
| bwp-Id | Not present |  |  |
| referenceSignal CHOICE { |  |  |  |
| ssb | SSB-Index |  |  |
| } |  |  |  |
| qcl-Type | typeC |  |  |
| } |  |  |  |
| } |  |  |  |
| TCI-State[2] |  | TCI-state-1 |  |
| tci-StateId | 1 |  |  |
| qcl-type1 SEQUENCE { |  |  |  |
| cell | Not present |  |  |
| bwp-Id | Not present |  |  |
| referenceSignal CHOICE { |  |  |  |
| csi-rs | 1 |  |  |
| } |  |  |  |
| qcl-Type | typeA |  |  |
| } |  |  |  |
| } |  |  |  |
| TCI-State[3] |  | TCI-state-2 |  |
| tci-StateId | 2 |  |  |
| qcl-type1 SEQUENCE { |  |  |  |
| cell | Not present |  |  |
| bwp-Id | Not present |  |  |
| referenceSignal CHOICE { |  |  |  |
| csi-rs | 5 |  |  |
| } |  |  |  |
| qcl-Type | typeA |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| pdsch-TimeDomainAllocationList | Not present |  |  |
| pdsch-TimeDomainAllocationList-r16 CHOICE { |  |  |  |
| setup SEQUENCE (SIZE(1..maxNrofDL-Allocations)) OF PDSCH-TimeDomainResourceAllocation-r16 { |  |  |  |
| PDSCH-TimeDomainResourceAllocation-r16[1] SEQUENCE { |  |  |  |
| k0-r16 | Not present |  |  |
| mappingType-r16 | typeA |  |  |
| startSymbolAndLength-r16 | 44 | Start symbol(S)=2, Length(L)=4 | For Slot i, if mod(i, 10) = 7 for i from {0,…,39} |
| repetitionNumber-r16 | 2 |  |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation-r16[2] SEQUENCE { |  |  |  |
| k0-r16 | Not present |  |  |
| mappingType-r16 | typeA |  |  |
| startSymbolAndLength-r16 | 53 | Start symbol(S)=2, Length(L)=12 | For Slot i, if mod(i, 10) = {0,1,2,3,4,5,}) for i from {1,…,39} |
| repetitionNumber-r16 | 2 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.1.14\_1.3.3\_1-4: *CSI-RS-ResourceMapping* for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| row1 | 0000 | For CSI-RS resources 1, 2, 3, 4 |  |
|  | 0001 | For CSI-RS resources 5,6,7,8 |  |
| } |  |  |  |
| nrofPorts | p1 |  |  |
| firstOFDMSymbolInTimeDomain | 6 | For CSI-RS resources 1,3,5,7 |  |
|  | 10 | For CSI-RS resources 2,4,6,8 |  |
| } |  |  |  |

Table 5.2.2.1.14\_1.3.3\_1-5: *CSI-ResourcePeriodicityAndOffset* for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots20 | 10 | For CSI-RS resources 1,2,5,6 |  |
| slots20 | 11 | For CSI-RS resources 3,4,7,8 |  |
| } |  |  |  |

5.2.2.1.14\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.2.1.14\_1.3.3\_1.

5.2.2.1.14\_1.4 Test requirement

Table 5.2.2.1.14.0-3 defines the primary level settings.

The residual BLER specified in Note 3 of Table 5.2.2.1.14\_1.4-1 test shall meet or be lower than the specified value in Table 5.2.2.1.14\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.14\_1.4-1: Test requirement for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition (Note 1) | Correlation matrix and antenna configuration Note 2) | Reference value | |
| BLER (%) | SNR (dB) (Note 4) |
| 1-1 | R.PDSCH.1-11.2 FDD | 10 / 15 | 16QAM, 0.54 | TDLA30-10 | 2x2, ULA Low | 1 (Note 3) | 3.9 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block.  Note 4: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 | | | | | | | |

##### 5.2.2.1.15 2Rx FDD FR1 PDSCH with inter-cell interference

5.2.2.1.15.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.15.0-3, with the addition of test parameters in Table 5.2.2.1.15.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.15.0-1.

Table 5.2.2.1.15.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH performance under 2 receive antenna conditions, when transmission from the serving cell is interfered by 1 or 2 interfering cells. | 1-1, 1-2 |

Table 5.2.2.1.15.0-2: Test parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | | |
|  | |  | Cell 1 | Cell 2 | Cell 3 |
|  | |  | Enabled | Enabled | Enabled for Test 1-1 Disabled for Test 1-2 |
| Duplex mode | |  | FDD | | |
| Active DL BWP index | |  | 1 | | |
| Physical cell ID | |  | 0 | 1 | 2 |
| Transmission rank | |  | 1 | Random rank with 70% and 30% probability for rank 1 and rank 2 | Random rank with 70% and 30% probability for rank 1 and rank 2 for Test 1-1  N/A for Test 1-2 |
| Time offset to Cell1 | | us | N/A | 3 | -1 |
| Frequency offset to Cell 1 | | Hz | N/A | 300 | -100 |
| Interference Model | |  | N/A | As specified in B.6.2 | |
| INR (Note 2) | | dB | N/A | 7.77 for Test 1-1  7.58 for Test 1-2 | 2.29 for Test 1-1  N/A for Test 1-2 |
| SSB configuration | SSB position in burst |  | First SSB in Slot #0 | 1st SSB in Slot#0 for Test 1-1 2nd SSB in Slot #0 for Test 1-2 | 1st SSB in Slot#0 for Test 1-1 N/A for Test 1-2 |
| SSB periodicity | ms | 20 | 20 | 20 |
| PDSCH configuration | Mapping type |  | Type A | | |
|  | k0 |  | 0 | | |
|  | Starting symbol (S) |  | 2 | | |
|  | Length (L) |  | 12 | | |
|  | PDSCH aggregation factor |  | 1 | | |
|  | PRB bundling type |  | Static | | |
|  | PRB bundling size |  | 2 | | |
|  | Resource allocation type |  | Type 0 | | |
|  | RBG size |  | Config2 | | |
|  | VRB-to-PRB mapping type |  | Non-interleaved | | |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A | | |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 | | |
|  | Number of additional DMRS |  | 1 | | |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 | | |
| Number of HARQ Processes | |  | 4 | | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 | | |
| Note1: Cell 1 is the serving cell; Cells 2, 3 are interfering cells  Note 2: INR is defined in Annex B.6.1 | | | | | |

Table 5.2.2.1.15.0-3: Minimum performance for PDSCH with rank 1 and with inter-cell interference

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-2.1 FDD | 10 / 15 | 16QAM, 0.48 | TDLC300-100 | 2x2, ULA Low | 70 | 15.4 |
| 1-2 | R.PDSCH.1-2.1 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 12.5 |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: Bandwidth/ Sub carrier spacing, Propagation Condition, Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.15.

###### 5.2.2.1.15\_1 2Rx FDD FR1 PDSCH with inter-cell interference performance - 2x2 MIMO for both SA and NSA

5.2.2.1.15\_1.1 Test purpose

Verify the PDSCH performance under 2 receive antenna conditions, when transmission from the serving cell is interfered by 1 or 2 interfering cells.

5.2.2.1.15\_1.2 Test applicability

Test 1-1 and test 1-2 applies to all types of release 15 and release 16 NR UEs and E-UTRAN UEs supporting EN-DC and supporting MMSE-IRC processing for scenarios with inter-cell and intra-cell inter-user interference.

Test 1-1 and test 1-2 applies to all types of release 17 and forward NR UEs and E-UTRAN UEs supporting EN-DC.

5.2.2.1.15\_1.3 Test description

5.2.2.1.15\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [8].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.6.2 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the serving cell and interfering cells are set up according to Table 5.2-1 and Table 5.2.2.1.15.0-2 as appropriate.

3. Downlink signals for NR serving cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.15\_1.3.3.

5.2.2.1.15\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.2.1.15\_1.4-2. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR for the serving cell and interfering cells according to Table 5.2.2.1.15\_1.4-2.

3. Measure the average throughput on the serving cell for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Annex G.1.4.

4. Repeat steps from 1 to 3 for each subtest in Table 5.2.2.1.15\_1.4-2 as appropriate.

5.2.2.1.15\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.2.1.15\_1.3.3\_1 Message exceptions for SA

No message exceptions for SA

5.2.2.1.15\_1.3.3\_2 Message exceptions for NSA

No message exceptions for NSA

5.2.2.1.15\_1.4 Test requirement

Tables 5.2.2.1.15\_1.4-1 and 5.2.2.1.15\_1.4-2 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.15\_1.4-2 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.15\_1.4-1: Test parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | | |
|  | |  | Cell 1 | Cell 2 | Cell 3 |
|  | |  | Enabled | Enabled | Enabled for Test 1-1 Disabled for Test 1-2 |
| Duplex mode | |  | FDD | | |
| Active DL BWP index | |  | 1 | | |
| Physical cell ID | |  | 0 | 1 | 2 |
| Transmission rank | |  | 1 | Random rank with 70% and 30% probability for rank 1 and rank 2 | Random rank with 70% and 30% probability for rank 1 and rank 2 for Test 1-1  N/A for Test 1-2 |
| Time offset to Cell1 | | us | N/A | 3 | -1 |
| Frequency offset to Cell 1 | | Hz | N/A | 300 | -100 |
| Interference Model | |  | N/A | As specified in B.6.2 | |
| INR (Note 2) | | dB | N/A | 7.77+0.8 for Test 1-1  7.58+0.8 for Test 1-2 | 2.29+0.8 for Test 1-1  N/A for Test 1-2 |
| SSB configuration | SSB position in burst |  | First SSB in Slot #0 | 1st SSB in Slot#0 for Test 1-1 2nd SSB in Slot #0 for Test 1-2 | 1st SSB in Slot#0 for Test 1-1 N/A for Test 1-2 |
| SSB periodicity | ms | 20 | 20 | 20 |
| PDSCH configuration | Mapping type |  | Type A | | |
|  | k0 |  | 0 | | |
|  | Starting symbol (S) |  | 2 | | |
|  | Length (L) |  | 12 | | |
|  | PDSCH aggregation factor |  | 1 | | |
|  | PRB bundling type |  | Static | | |
|  | PRB bundling size |  | 2 | | |
|  | Resource allocation type |  | Type 0 | | |
|  | RBG size |  | Config2 | | |
|  | VRB-to-PRB mapping type |  | Non-interleaved | | |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A | | |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 | | |
|  | Number of additional DMRS |  | 1 | | |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 | | |
| Number of HARQ Processes | |  | 4 | | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 | | |
| Note1: Cell 1 is the serving cell; Cells 2, 3 are interfering cells  Note 2: INR is defined in Annex B.6.1 | | | | | |

Table 5.2.2.1.15\_1.4-2: Test Requirements for PDSCH with rank 1 and with inter-cell interference

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-2.1 FDD | 10 / 15 | 16QAM, 0.48 | TDLC300-100 | 2x2, ULA Low | 70 | 17.1 |
| 1-2 | R.PDSCH.1-2.1 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.3 |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: Bandwidth/ Sub carrier spacing, Propagation Condition, Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | |

##### 5.2.2.1.16 2Rx FDD FR1 for PDSCH with intra-cell inter user interference

5.2.2.1.16.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.16.0-3, with the addition of test parameters in Table 5.2.2.1.16.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.16.0-1.

Table 5.2.2.1.16.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH performance under 2 receive antenna conditions when the PDSCH transmission of target UE is interfered by co-scheduled UE | 1-1 |

Table 5.2.2.1.16.0-2: Test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Target UE | Co-scheduled UE |
| Duplex mode | |  | FDD | |
| Active DL BWP index | |  | 1 | |
| PDSCH configuration | Mapping type |  | Type A | |
| k0 |  | 0 | |
| Starting symbol (S) |  | 2 | |
| Length (L) |  | 12 | |
| PDSCH aggregation factor |  | 1 | |
| PRB bundling type |  | Static | |
| PRB bundling size |  | 2 | |
| Resource allocation type |  | Type 0 | |
| RBG size |  | Config2 | |
| VRB-to-PRB mapping type |  | Non-interleaved | |
| VRB-to-PRB mapping interleaver bundle size |  | N/A | |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 | |
| Number of additional DMRS |  | 1 | |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 | |
| Antenna ports indexes |  | 1000 | 1001 |
| Number of PDSCH DMRS CDM group(s) without data |  | 1 | 1 |
| PDSCH & PDSCH DMRS Precoding configuration | |  | Single Panel Type I, Randomized precoder selection for every PRB bundle and updated per slot, with equal probability of each applicable i1/i2 combination or codebook  Index, chosen from section 5.2.2.2.1 of TS 38.214 [12]. | Single Panel Type I, Randomized precoder selection for every PRB bundle and updated per slot, with equal probability of each applicable i1/i2 combination or codebook  Index, chosen from section 5.2.2.2.1 of TS 38.214 [12].Any column of precoder matrix is not equal to any column of precoder matrix of Target UE |
| MU-MIMO Beamforming Model | |  | As specified in B.4.2 | |
| Number of HARQ Processes | |  | 4 | N/A |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 | N/A |
| Note 1: The DMRS scrambling ID is same for both target UE and Co-scheduled UE. | | | | |

Table 5.2.2.1.16.0-3: Minimum performance for PDSCH of target UE with intra-cell inter user interference

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target UE | Co-scheduled UE | Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-2.1 FDD | 10 / 15 | 16QAM, 0.48 | Random 16QAM symbols | TDLC300-100 | 2x2, ULA Low | 70 | 18.0 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.16.

###### 5.2.2.1.16\_1 2Rx FDD FR1 for PDSCH with intra cell inter user interference performance – 2x2 MIMO for both NSA and SA

5.2.2.1.16\_1.1 Test purpose

To verify the PDSCH performance under 2 receive antenna conditions, when the PDSCH transmission of target UE is interfered by co-scheduled UE.

5.2.2.1.16\_1.2 Test applicability

Test 1-1 applies to all types of NR UEs and E-UTRAN UEs supporting EN-DC for release 15 and release 16 supporting MMSE-IRC processing for scenarios with inter-cell and intra-cell inter-user interference.

Test 1-1 applies to all types of release 17 and forward NR UEs and E-UTRAN UEs supporting EN-DC.

5.2.2.1.16\_1.3 Test description

5.2.2.1.16\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.2.1.16.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.16\_1.3.3.

5.2.2.1.16\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.2.1.16\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.1.16\_1.4-1 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

4. Repeat steps from 1 to 3 for each subtest in Tables 5.2.2.1.16\_1.4-1 as appropriate.

5.2.2.1.16\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.2.1.16\_1.3.3\_1 Message exceptions for SA

No message exceptions for SA

5.2.2.1.16\_1.3.3\_1 Message exceptions for NSA

No message exceptions for NSA

5.2.2.1.16\_1.4 Test requirement

Table 5.2.2.1.16\_1.4-1: Test requirement for PDSCH of target UE with intra-cell inter user interference

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target UE | Co-scheduled UE | Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-2.1 FDD | 10 / 15 | 16QAM, 0.48 | Random 16QAM symbols | TDLC300-100 | 2x2, ULA Low | 70 | 18.9 |

##### 5.2.2.1.17 2Rx FDD FR1 PDSCH performance for RedCap

5.2.2.1.17.1 Test Purpose

To verify the PDSCH performance mapping Type A under 2 receive antenna conditions with different channel models and MCSs for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput.

5.2.2.1.17.2 Test applicability

This test case applies to all types of NR UE release 17 and forward that support NR RedCap.

5.2.2.1.17.3 Minimum conformance requirements

The performance requirements are specified in Tables 5.2.2.1.17.3-3 and 5.2.2.1.17.3-4, with the addition of test parameters in Table 5.2.2.1.17.3-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.17.3-1.

Table 5.2.2.1.17.3-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and with different channel models, MCSs for RedCap | 1-1, 1-2, 1-3, 2-1 |

Table 5.2.2.1.17.3-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 12 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 4 for Test 1-1  2 for other tests |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 2 for Test 1-1  1 for other tests |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CSI-RS for tracking | CSI-RS periodicity | Slots | Table 5.2-1 |
|  | CSI-RS offset | Slots | Table 5.2-1 |
| Number of HARQ Processes | |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 |

Table 5.2.2.1.17.3-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel (Note 1) | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
|  |  |  |  |  |  | Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-1.1 FDD  R.PDSCH. 1-1.1 HD-FDD | 10 / 15 | QPSK, 0.30 | TDLB100-400 | 2x2, ULA Low | 70 | -0.8 |
| 1-2 | R.PDSCH.1-2.1 FDD  R.PDSCH. 1-1.2 HD-FDD | 10 / 15 | 16QAM, 0.48 | TDLC300-100 | 2x2, ULA Low | 70 | 8.1 |
| 1-3 | R.PDSCH.1-4.1 FDD  R.PDSCH. 1-1.5 HD-FDD | 10 / 15 | 256QAM, 0.82 | TDLA30-10 | 2x2, ULA Low | 70 | 24.6 |
| Note 1: Applied reference channel depends on the supported operation mode: FDD or HD-FDD. | | | | | | | |

Table 5.2.2.1.17.3-4: Minimum performance for Rank 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel (Note 1) | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
|  |  |  |  |  |  | Fraction of maximum throughput (%) | SNR (dB) |
| 2-1 | R.PDSCH.1-3.1 FDD  R.PDSCH. 1-2.1 HD-FDD | 10 / 15 | 64QAM, 0.50 | TDLA30-10 | 2x2, ULA Low | 70 | 19.4 |
| Note 1: Applied reference channel depends on the supported operation mode: FDD or HD-FDD. | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.17.

5.2.2.1.17.4 Test description

5.2.2.1.17.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2.3 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2A-1 to Table 5.2A-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.2.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.17.4.3.

5.2.2.1.17.4.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.2.1.17.5-1 and 5.2.2.1.17.5-2. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.1.17.5-1 and 5.2.2.1.17.5-2 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail according to Table G.1.5-1 in Annex G.1.5.

4. Repeat steps from 1 to 3 for each test points in Tables 5.2.2.1.17.5-1 and 5.2.2.1.17.5-2 as appropriate.

5.2.2.1.17.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2 with the following exceptions:

Table 5.2.2.1.17.4.3-1: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | n4, n2 | n4 for test 1-1 | test 1-1 |
|  | Not present | n2 will be used by default | test point other than test 1-1 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.1.17.4.3-2: CSI-ResourcePeriodicityAndOffset for CSI Tracking

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots40 | 20 (for CSI-RS resources 1 and 2)  21 (for CSI-RS resources 3 and 4) | CSI-RS offset:  20 for CSI-RS resources 1 and 2  21 for CSI-RS resources 3 and 4  CSI-RS periodicity: 40 slots |  |
| slots20 | 10 (for CSI-RS resources 1 and 2)  11 (for CSI-RS resources 3 and 4) | CSI-RS offset:  10 for CSI-RS resources 1 and 2  11 for CSI-RS resources 3 and 4  CSI-RS periodicity: 20 slots |  |
| } |  |  |  |

Table 5.2.2.1.17.4.3-3: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | n4 |  |  |
| } |  |  |  |

5.2.2.1.17.5 Test Requirement

Tables 5.2.2.1.17.5-1 and 5.2.2.1.17.5-2 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Tables 5.2.2.1.17.5-1 and 5.2.2.1.17.5-2 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.17.5-1: Test Requirements for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel (Note 1) | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
|  |  |  |  |  |  | Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-1.1 FDD  R.PDSCH. 1-1.1 HD-FDD | 10 / 15 | QPSK, 0.30 | TDLB100-400 | 2x2, ULA Low | 70 | 0.1 |
| 1-2 | R.PDSCH.1-2.1 FDD  R.PDSCH. 1-1.2 HD-FDD | 10 / 15 | 16QAM, 0.48 | TDLC300-100 | 2x2, ULA Low | 70 | 9.0 |
| 1-3 | R.PDSCH.1-4.1 FDD  R.PDSCH. 1-1.5 HD-FDD | 10 / 15 | 256QAM, 0.82 | TDLA30-10 | 2x2, ULA Low | 70 | 25.6 |
| Note 1: Applied reference channel depends on the supported operation mode: FDD or HD-FDD. | | | | | | | |

Table 5.2.2.1.17.5-2: Test Requirements for Rank 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel (Note 1) | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
|  |  |  |  |  |  | Fraction of maximum throughput (%) | SNR (dB) |
| 2-1 | R.PDSCH.1-3.1 FDD  R.PDSCH. 1-2.1 HD-FDD | 10 / 15 | 64QAM, 0.50 | TDLA30-10 | 2x2, ULA Low | 70 | 20.4 |
| Note 1: Applied reference channel depends on the supported operation mode: FDD or HD-FDD. | | | | | | | |

##### 5.2.2.1.18 2Rx FDD FR1 for PDSCH CRS interference mitigation under NR-LTE coexistence scenario

5.2.2.1.18.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.18.0-4, with the addition of test parameters in Tables 5.2.2.1.18.0-2 and 5.2.2.1.18.0-3 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.18.0-1.

Table 5.2.2.1.18.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH CRS interference mitigation performance under 2 receive antenna conditions with CRS rate matching configured for the serving cell | 1-1 |

Table 5.2.2.1.18.0-2: Test parameters for the serving cell

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
| NR UL transmission with a 7.5 kHz shift to the LTE raster | |  | true |
| PDCCH configuration | Symbols with PDCCH |  | Symbol# 2 | |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 3 |
|  | Length (L) |  | 9 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Position of the first DM-RS for downlink |  | 3 |
|  | Number of additional DMRS |  | 1 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CRS for rate matching (Note 1) | LTE carrier centre subcarrier location |  | Same as NR carrier centre subcarrier location |
|  | LTE carrier BW | MHz | 10 |
|  | Number of antenna ports |  | 2 |
|  | v-shift |  | 0 |
| Number of HARQ Processes | |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 |
| Note 1: No MBSFN is configured on LTE carrier.  Note 2: Network-based CRS interference mitigation is disabled on LTE carrier. | | | |

Table 5.2.2.1.18.0-3: Test parameters for the LTE interference cells

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Cell 1** | **Cell 2** |
| Propagation conditions and MIMO configuration (Note 1) | |  | TDLA30-10 ULA Low | TDLA30-10 ULA Low |
| INR (Note 2) | | dB | 10.45 | 4.6 |
| Cell-specific reference signals | |  | Antenna ports 0,1 | Antenna ports 0,1 |
| Carrier centre subcarrier location | |  | Same as the serving carrier centre subcarrier location | Same as the serving carrier centre subcarrier location |
| BWChannel | | MHz | 10 | 10 |
| Cyclic Prefix | |  | Normal | Normal |
| Physical cell ID | |  | 1 | 2 |
| Number of control OFDM symbols | |  | 2 | 2 |
| PDSCH transmission mode | |  | 4 | 4 |
| Interference model | |  | As specified in clause B.7 | As specified in clause B.7 |
| Probability of occurrence of PDSCH data | | % | 20 | 20 |
| Probability of occurrence of transmission rank | Rank 1 | % | 80 | 80 |
| Rank 2 | % | 20 | 20 |
| Downlink power allocation |  | dB | -3 | -3 |
|  | dB | -3 | -3 |
| σ | dB | 0 | 0 |
| Precoding granularity | | PRB | 6 | 6 |
| Time offset to the serving cell | | us | 3 | -1 |
| Frequency offset to the serving cell | | Hz | 300 | -100 |
| MBSFN | |  | Not configured | Not configured |
| Network-based CRS interference mitigation | |  | Disabled | Disabled |
| Note 1: The channel for the LTE interference cells and the serving cell are independent.  Note 2: Defined in B.6.1. | | | | |

Table 5.2.2.1.18.0-4: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of  maximum  throughput  (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-7.3 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 11.9 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.18.

##### 5.2.2.1.18\_1 2Rx FDD FR1 for PDSCH CRS interference mitigation under NR-LTE coexistence scenario – 2x2 MIMO for both NSA and SA

Editor’s Note: This test case is incomplete in following aspects

- Message exceptions are FFS

- MU/TT analysis is pending

5.2.2.1.18\_1.1 Test purpose

To verify PDSCH CRS interference mitigation performance under 2 receive antenna conditions with CRS rate matching configured for the serving cell.

5.2.2.1.18\_1.2 Test applicability

This test applies to all types of NR UE release 17 and forward that support *CRS-IM-DSS-15kHzSCS-r17.*

5.2.2.1.18\_1.3 Test description

5.2.2.1.18\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Tables 5.2.2.1.18.0-2 and 5.2.2.1.18.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.18\_1.3.3.

5.2.2.1.18\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.2.1.18\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.1.18\_1.4-1 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

4. Repeat steps from 1 to 3 for each subtest in Table 5.2.2.1.18\_1.4-1 as appropriate.

5.2.2.1.18\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.2.1.18\_1.3.3\_1 Message exceptions for SA

FFS

5.2.2.1.18\_1.3.3\_1 Message exceptions for NSA

FFS

5.2.2.1.18\_1.4 Test requirement

Table 5.2.2.1.18\_1.4-1: Test requirement for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of  maximum  throughput  (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-7.3 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 11.9+TT |

##### 5.2.2.1.19 2Rx FDD FR1 for PDSCH with inter cell CRS interference

5.2.2.1.19.0 Minimum conformance requirements

The performance requirements are specified in Tables 5.2.2.1.19.0-4 and 5.2.2.1.19.0-6, with the addition of test parameters in Tables 5.2.2.1.19.0-2 and 5.2.2.1.19.0-3 and the downlink physical channel setup according to Annex C.3.1.

The requirements for UE capable of performing CRS-IM with the assistance of network signalling on LTE channel bandwidth are specified in Table 5.2.2.1.19.0-4.

The requirements for UE capable of performing CRS-IM without the assistance of network signalling on LTE channel bandwidth are specified in Table 5.2.2.1.19.0-6.

The test purposes are specified in Table 5.2.2.1.19.0-1.

Table 5.2.2.1.19.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH performance under 2 receive antenna conditions when PDSCH is interfered by inter cell CRS signal | 1-1, 2-1 |

Table 5.2.2.1.19.0-2: Tests parameter for serving cell PDSCH

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 12 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 1 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Number of HARQ Processes | |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 |

Table 5.2.2.1.19.0-3: Tests parameter for interference cells

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1 | Cell 2 |
| Duplex mode | |  | FDD | FDD |
| INR | | dB | 10.45 | 4.6 |
| LTE Bandwidth (Note 5) | | MHz | 20 | 20 |
| Carrier centre subcarrier location (Note 6) | |  | Same as the NR serving carrier centre subcarrier location | Same as the NR serving carrier centre subcarrier location |
| Cyclic Prefix | |  | Normal | Normal |
| Physical cell ID | |  | 1 | 2 |
| CRS pattern | Number of antenna ports |  | 4 | 4 |
| v-shift |  | 1 | 2 |
| Downlink power allocation |  | dB | -6 | -6 |
|  | dB | -6 | -6 |
| σ | dB | 0 | 0 |
| PDSCH transmission mode | |  | TM4 | TM4 |
| PDSCH loading level | | % | 20% probability of occurrence of LTE data transmission in time domain, and full bandwidth allocation in frequency domain for test 1-1. | 20% probability of occurrence of LTE data transmission in time domain, and full bandwidth allocation in frequency domain for test 1-1. |
| Transmission rank | | % | 80% and 20% probability for rank 1 and rank 2 respectively | 80% and 20% probability for rank 1 and rank 2 respectively |
| Interference model | |  | As specified in clause B.7 | As specified in clause B.7 |
| Time offset to the serving cell | | us | 3 | -1 |
| Frequency offset to the serving cell | | Hz | 300 | -100 |
| Propagation conditions and MIMO configuration (Note 1) | |  | TDLA30-10 ULA Low | TDLA30-10 ULA Low |
| Precoding granularity | | PRB | 8 | 8 |
| Note 1: The channel for the LTE interference cells and the serving cell are independent.  Note 2: No MBSFN is configured on LTE carrier.  Note 3: Network-based CRS interference mitigation is disabled on LTE carrier.  Note 4: The start of transmission of LTE frame is delayed by 2 LTE subframes with respect to the start of transmission of NR frame  Note 5: This parameter is informed to UE via network assistance signalling for Test 1-1 in Table 5.2.2.1.19.0-4.  Note 6: Single entry is included in IE *LTE-NeighCellsCRS-AssistInfoList-r17* that applies for both cells for cases | | | | |

Table 5.2.2.1.19.0-4: Minimum performance for Rank 1 with the assistance of network signalling on LTE channel bandwidth

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation  condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-18.1 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 4x2, ULA Low | 70 | 11.9 |

Table 5.2.2.1.19.0-5: Measurement Gap configurations

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Value |
| Measurement Gap Length | ms | 6 |
| Measurement Gap Repetition Period | ms | 40 |
| Gap offset | ms | 7 |
| Measurement gap timing advance | ms | 0 |

Table 5.2.2.1.19.0-6: Minimum performance for Rank 1 without the assistance of network signalling on LTE channel bandwidth

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation  condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 2-1 | R.PDSCH.1-17.2 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 4x2, ULA Low | 70 | 11.9 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.19.

##### 5.2.2.1.19\_1 2Rx FDD FR1 for PDSCH with inter cell CRS interference scenario – 4x2 MIMO for both NSA and SA

Editor’s Note: This test case is incomplete in following aspects

- Message exceptions are FFS

- MU/TT analysis is pending

5.2.2.1.19\_1.1 Test purpose

To verify PDSCH performance under 2 receive antenna conditions when PDSCH is interfered by inter cell CRS signal.

5.2.2.1.19\_1.2 Test applicability

Test 2-1 applies to all types of NR UE release 17 and forward that support *CRS-IM-nonDSS-15kHzSCS-r17.*

Test 1-1 applies to all types of NR UE release 17 and forward that support *CRS-IM-nonDSS-NWA-15kHzSCS-r17.*

5.2.2.1.19\_1.3 Test description

5.2.2.1.19\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Tables 5.2.2.1.19.0-2 and 5.2.2.1.19.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.19\_1.3.3.

6. For UE capable of performing CRS-IM without the assistance of network signalling on LTE channel bandwidth, ensure the network configures an inter-RAT LTE measurement object of the interfering cells to the tested UE. Inter-RAT measurement is configured at the beginning of the test and applied throughout the test with gap pattern configurations according to Table 5.2.2.1.19.0-5. PDSCH is not scheduled, and throughput is not counted during 4.64s after the beginning of test. PDSCH is not scheduled in the measurement gaps.

5.2.2.1.19\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.2.1.19\_1.4-1 and 5.2.2.1.19\_1.4-2 as appropriate. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.1.19\_1.4-1 and 5.2.2.1.19\_1.4-2 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

4. Repeat steps from 1 to 3 for each subtest in Tables 5.2.2.1.19\_1.4-1 and 5.2.2.1.19\_1.4-2 as appropriate.

5.2.2.1.19\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.2.1.19\_1.3.3\_1 Message exceptions for SA

FFS

5.2.2.1.19\_1.3.3\_1 Message exceptions for NSA

FFS

5.2.2.1.19\_1.4 Test requirement

Table 5.2.2.1.19\_1.4-1: Test requirement for Rank 1 with the assistance of network signalling on LTE channel bandwidth

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation  condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-18.1 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 4x2, ULA Low | 70 | 11.9+TT |

Table 5.2.2.1.19\_1.4-2: Test requirement for Rank 1 without the assistance of network signalling on LTE channel bandwidth

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation  condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 2-1 | R.PDSCH.1-17.2 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 4x2, ULA Low | 70 | 11.9+TT |

##### 5.2.2.1.20 2Rx FDD FR1 PDSCH HST-SFN Scheme A performance - 2x2 MIMO for both SA and NSA

Editor's Note: This test cases is incomplete in following aspects:

- Minimum test time is FFS.

- RMC is within square brackets.

5.2.2.1.20.1 Test Purpose

To verify the UE performance in the HST-SFN Scheme A scenario.

5.2.2.1.20.2 Test applicability

This test case applies to all types of NR UE release 17 and forward that support SFN scheme A for PDCCH scheduling SFN Scheme A PDSCH.

This test case applies to all types of EUTRA UE release 17 and forward that support EN-DC and SFN scheme A for PDCCH scheduling SFN Scheme A PDSCH.

5.2.2.1.20.3 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.20.3-3, with the addition of test parameters in Table 5.2.2.1.20.3-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.20.3-1.

**Table 5.2.2.1.20.3-1: Tests purpose**

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify UE performance in the HST-SFN Scheme A scenario defined in B.3. 5 | 1-1 |

**Table 5.2.2.1.20.3-2: Test parameters**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Value** |
| Duplex mode | | |  | FDD |
| Active DL BWP index | | |  | 1 |
| PDCCH configuration | TCI state | |  | Note 1 |
| PDSCH configuration | Mapping type | |  | Type A |
| k0 | |  | 0 |
| Starting symbol (S) | |  | 2 |
| Length (L) | |  | 12 |
| PDSCH aggregation factor | |  | 1 |
| PRB bundling type | |  | Static |
| PRB bundling size | |  | 2 |
| Resource allocation type | |  | Type 0 |
| RBG size | |  | Config2 |
| VRB-to-PRB mapping type | |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size | |  | N/A |
| TCI state | |  | Note 1 |
| PDSCH DMRS configuration | DMRS Type | |  | Type 1 |
| Number of additional DMRS | |  | 2 |
| Maximum number of OFDM symbols for DL front loaded DMRS | |  | 1 |
| CSI-RS for tracking | Resource set #1 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 5 for CSI-RS resource 1 and 3  l0 = 9 for CSI-RS resource 2 and 4 |
| CSI-RS periodicity | Slots | 10 for CSI-RS resource 1,2,3,4. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4 |
| QCL info |  | TCI state #3 |
| Resource set #2 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 6 for CSI-RS resource 5 and 6  l0 = 10 for CSI-RS resource 7 and 8 |
| CSI-RS periodicity | Slots | 10 for CSI-RS resource 5,6,7,8. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8 |
| QCL info |  | TCI state #4 |
| Resource set #3 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 4 for CSI-RS resource 9 and 10  l0 = 8 for CSI-RS resource 11 and 12 |
| CSI-RS periodicity | Slots | 10 for CSI-RS resource 9,10,11,12. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 9 and 10 2 for CSI-RS resource 11 and 12 |
| QCL info |  | TCI state #5 |
| NZP CSI-RS for CSI acquisition | Resource set #4 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 12 |
| CSI-RS periodicity | Slots | 20 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #0 |
| Resource set #5 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 13 |
| CSI-RS periodicity | Slots | 20 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #1 |
| Resource set #6 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 7 |
| CSI-RS periodicity | Slots | 20 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #2 |
| TCI state #0 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking Resource set #1' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #2 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 9 from 'CSI-RS for tracking Resource set #3' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #3 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #4 | Type 1 QCL information | SSB index |  | SSB #1 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #5 | Type 1 QCL information | SSB index |  | SSB #2 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| Number of HARQ Processes | | |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | |  | 2 |
| Note 1: SSB # (k mod 3), CSI-RS (for tracking) resource set # ((k mod 3) + 1) and CSI-RS (for CSI acquisition) resource set # ((k mod 3) + 4) are transmitted by kth RRH.  Codepoint #0 is activated when UE receives PDCCH/PDSCH from RRH#3k and RRH#3k+1 with TCI States TCI state #0, TCI State #1.  Codepoint #1 is activated when UE receives PDCCH/PDSCH from RRH#3k+1 and RRH#3k+2 with TCI States TCI state #1, TCI State #2.  Codepoint #2 is activated when UE receives PDCCH/PDSCH from RRH#3k+2 and RRH#3k+3 with TCI States TCI state #2, TCI State #0. | | | | |

**Table 5.2.2.1.20.3-3: Minimum performance for HST-SFN Scheme A**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | | |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | [R.PDSCH.1-8.5 FDD] | 10 / 15 | 16QAM, 0.48 | HST-SFN Scheme A | 2x2 | 70 | 11.8 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.20.

5.2.2.1.20.4 Test description

5.2.2.1.20.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.2.1.20.3-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.3.5.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.20.4.3.

5.2.2.1.20.4.2 Test procedure

1. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.1.20.5-1 as appropriate.

2. SS is configured to transmit SSB and CSI-RS continuously and schedule PDSCH and PDCCH transmission according to Note 1 in 5.2.2.1.20.3-2. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.2.1.20.5-1. The SS sends downlink MAC padding bits on the DL RMC.

Note: All TCI states are known to the UE through configuration inside RrcReconfiguration. There is no need to configure additional L1-RSRP measurements.

3. Send MAC CE command “Enhanced TCI States Indication for UE-specific PDCCH MAC CE” according to the timing described in Note 1 of Table 5.2.2.1.20.3-2 to active TCI state codepoint 0, 1 or 2 for PDCCH periodically. PDSCH is automatically associated with TCI state codepoint 0, 1 or 2 as tci-PresentInDCI is not present. TCI states 3, 4 and 5 for SSBs are automatically activated through relation of QCL-Info in NZP CSI-RS.

4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.2.1.20.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.2.1.20.4.3.1 Message exceptions for SA

Table 5.2.2.1.20.4.3.1-1: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | Not present | n2 is used | Test 1-1 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.1.20.4.3.1-2: DMRS-DownlinkConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24 | | | |
| Information Element | Value/remark | Comment | Condition |
| DMRS-DownlinkConfig ::= SEQUENCE { |  |  |  |
| dmrs-AdditionalPosition | pos2 |  | Test 1-1 |
| } |  |  |  |

Table 5.2.2.1.20.4.3.1-3: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | n4 |  | Test 1-1 |
| } |  |  |  |

Table 5.2.2.1.20.4.3.1-4: NZP-CSI-RS-Resource for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| nzp-CSI-RS-ResourceId | i-1 for CSI-RS resource #i, i=1,2,3,4,5,6,7,8,9,10,11,12 | for test 1-1 |  |
| qcl-InfoPeriodicCSI-RS | 3 for CSI-RS resource #1, #2, #3, #4  4 for CSI-RS resource #5, #6, #7, #8  5 for CSI-RS resource #9, #10, #11, #12 | for test 1-1:  TCI-StateId for TCI-State #3 for CSI-RS resource #1, #2, #3, #4  TCI-StateId for TCI-State #4 for CSI-RS resource #5, #6, #7, #8  TCI-StateId for TCI-State #5 for CSI-RS resource #9, #10, #11, #12 |  |
| } |  |  |  |

Table 5.2.2.1.20.4.3.1-5: CSI-RS-ResourceMapping for TRS (Table 5.2.2.1.20.4.3.1-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 with condition TRS | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 5 for CSI-RS resource #1 and #3  9 for CSI-RS resource #2 and #4  6 for CSI-RS resource #5 and #6  10 for CSI-RS resource #7 and #8  4 for CSI-RS resource #9 and #10  8 for CSI-RS resource #11 and #12 | for test 1-1:  l0 = 5 for CSI-RS resource 1 and 3  l0 = 9 for CSI-RS resource 2 and 4  l0 = 6 for CSI-RS resource 5 and 6  l0 = 10 for CSI-RS resource 7 and 8  l0 = 4 for CSI-RS resource 9 and 10  l0 = 8 for CSI-RS resource 11 and 12 |  |
| } |  |  |  |

Table 5.2.2.1.20.4.3.1-6: CSI-ResourcePeriodicityAndOffset for CSI Tracking (Table 5.2.2.1.20.4.3.1-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots10 | 1 for CSI-RS resource #1, #2, #5, #6, #9, #10  2 for CSI-RS resource #3 #4, #7, #8, #11, #12 | For test 1-1:  periodicity:  10 slots.  offset:  1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4  1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8  1 for CSI-RS resource 9 and 10 2 for CSI-RS resource 11 and 12 |  |
| } |  |  |  |

Table 5.2.2.1.20.4.3.1-7: NZP-CSI-RS-ResourceSet for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-12 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-ResourceSet ::= SEQUENCE { |  |  |  |
| nzp\_CSI\_ResourceSetId | 0 for Resource set #1  1 for Resource set #2  2 for Resource set #3 | For test 1-1 |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 4 entries | For test 1-1 | Resource set #1 |
| NZP-CSI-RS-ResourceId[1] | 0 | entry 1  CSI-RS resource #1 |  |
| NZP-CSI-RS-ResourceId[2] | 1 | entry 2  CSI-RS resource #2 |  |
| NZP-CSI-RS-ResourceId[3] | 2 | entry 3  CSI-RS resource #3 |  |
| NZP-CSI-RS-ResourceId[4] | 3 | entry 4  CSI-RS resource #4 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 4 entries | For test 1-1 | Resource set #2 |
| NZP-CSI-RS-ResourceId[1] | 4 | entry 1  CSI-RS resource #5 |  |
| NZP-CSI-RS-ResourceId[2] | 5 | entry 2  CSI-RS resource #6 |  |
| NZP-CSI-RS-ResourceId[3] | 6 | entry 3  CSI-RS resource #7 |  |
| NZP-CSI-RS-ResourceId[4] | 7 | entry 4  CSI-RS resource #8 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 4 entries | For test 1-1 | Resource set #3 |
| NZP-CSI-RS-ResourceId[1] | 8 | entry 1  CSI-RS resource #9 |  |
| NZP-CSI-RS-ResourceId[2] | 9 | entry 2  CSI-RS resource #10 |  |
| NZP-CSI-RS-ResourceId[3] | 10 | entry 3  CSI-RS resource #11 |  |
| NZP-CSI-RS-ResourceId[4] | 11 | entry 4  CSI-RS resource #12 |  |
| } |  |  |  |
| trs-Info | true |  |  |
| } |  |  |  |

Table 5.2.2.1.20.4.3.1-8: NZP-CSI-RS-Resource for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-14 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| nzp-CSI-RS-ResourceId | 12 for CSI-RS resource #13  13 for CSI-RS resource #14  14 for CSI-RS resource #15 | for test 1-1 |  |
| qcl-InfoPeriodicCSI-RS | 0 for CSI-RS resource #13  1 for CSI-RS resource #14  2 for CSI-RS resource #15 | for test 1-1:  TCI-State #0 for CSI-RS resource #13  TCI-State #1 for CSI-RS resource #14  TCI-State #2 for CSI-RS resource #15 |  |
| } |  |  |  |

Table 5.2.2.1.20.4.3.1-9: CSI-RS-ResourceMapping for CSI Acquisition (Table 5.2.2.1.20.4.3.1-8)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 12 for CSI-RS resource #13  13 for CSI-RS resource #14  7 for CSI-RS resource #15 | for test 1-1  l0=12 for CSI-RS resource #13  l0=13 for CSI-RS resource #14  l0=7 for CSI-RS resource #15 |  |
| } |  |  |  |

Table 5.2.2.1.20.4.3.1-10: CSI-ResourcePeriodicityAndOffset for CSI Acquisition (Table 5.2.2.1.20.4.3.1-8)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-16 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots20 | 0 | For test 1-1  periodicity = 20 slots.  offset = 0 slots |  |
| } |  |  |  |

Table 5.2.2.1.20.4.3.1-11: NZP-CSI-RS-ResourceSet for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-18 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-ResourceSet ::= SEQUENCE { |  |  |  |
| nzp\_CSI\_ResourceSetId | 3 for Resource set #4  4 for Resource set #5  5 for Resource set #6 | For test 1-1 |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry | For test 1-1 | Resource set #4 |
| NZP-CSI-RS-ResourceId[1] | 12 | entry 1  CSI-RS resource #13 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry | For test 1-1 | Resource set #5 |
| NZP-CSI-RS-ResourceId[1] | 13 | entry 1  CSI-RS resource #14 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry | For test 1-1 | Resource set #5 |
| NZP-CSI-RS-ResourceId[1] | 14 | entry 1  CSI-RS resource #15 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.1.20.4.3.1-12: *TCI-State*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-190 | | | |
| Information Element | Value/remark | Comment | Condition |
| TCI-State ::= SEQUENCE { |  |  |  |
| tci-StateId | 0 for TCI state #0  1 for TCI state #1  2 for TCI state #2  3 for TCI state #3  4 for TCI state #4  5 for TCI state #5 | For test 1-1 |  |
| qcl-Type1 SEQUENCE { |  |  |  |
| bwp-Id | BWP-Id of active BWP |  | TCI state #0, TCI state #1, TCI state #2 |
|  | Not present |  | TCI state #3, TCI state #4, TCI state #5 |
| referenceSignal CHOICE { |  |  |  |
| csi-rs | 0 | CSI-RS resource #1 | TCI state #0 |
|  | 4 | CSI-RS resource #5 | TCI state #1 |
|  | 8 | CSI-RS resource #9 | TCI state #2 |
| ssb | 0 | SSB #0 | TCI state #3 |
|  | 1 | SSB #1 | TCI state #4 |
|  | 2 | SSB #2 | TCI state #5 |
| } |  |  |  |
| qcl-Type | typeA |  | TCI state #0, TCI state #1, TCI state #2 |
|  | typeC |  | TCI state #3, TCI state #4, TCI state #5 |
| } |  |  |  |
| } |  |  |  |

5.2.2.1.20.4.3.2 Message exceptions for NSA

Same as 5.2.2.1.20.4.3.1.

5.2.2.1.20.5 Test Requirement

Tables 5.2.2.1.20.3-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.20.5-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.20.5-1: Test Requirements for HST-SFN Scheme A

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | | |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | [R.PDSCH.1-8.5 FDD] | 10 / 15 | 16QAM, 0.48 | HST-SFN Scheme A | 2x2 | 70 | 12.4 |

##### 5.2.2.1.21 2Rx FDD FR1 PDSCH HST-SFN Scheme B performance - 2x2 MIMO for both SA and NSA

Editor's Note: This test cases is incomplete in following aspects:

- Minimum test time is FFS.

5.2.2.1.21.1 Test Purpose

To verify the UE performance in the HST-SFN Scheme B scenario.

5.2.2.1.21.2 Test applicability

This test case applies to all types of NR UE release 17 and forward that support SFN scheme B for PDCCH scheduling SFN Scheme B PDSCH.

This test case applies to all types of EUTRA UE release 17 and forward that support EN-DC and SFN scheme B for PDCCH scheduling SFN Scheme B PDSCH.

This test case could be skipped if UE has passed 5.2.2.1.20.

5.2.2.1.21.3 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.1.21.3-3, with the addition of test parameters in Table 5.2.2.1.21.3-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.21.3-1.

**Table 5.2.2.1.21.3-1: Tests purpose**

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify UE performance in the HST-SFN Scheme B scenario defined in B.3.6 | 1-1 |

**Table 5.2.2.1.21.3-2: Test parameters**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Value** |
| Duplex mode | | |  | FDD |
| Active DL BWP index | | |  | 1 |
| PDCCH configuration | TCI state | |  | Note 1 |
| PDSCH configuration | Mapping type | |  | Type A |
| k0 | |  | 0 |
| Starting symbol (S) | |  | 2 |
| Length (L) | |  | 12 |
| PDSCH aggregation factor | |  | 1 |
| PRB bundling type | |  | Static |
| PRB bundling size | |  | 2 |
| Resource allocation type | |  | Type 0 |
| RBG size | |  | Config2 |
| VRB-to-PRB mapping type | |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size | |  | N/A |
| TCI state | |  | Note 1 |
| PDSCH DMRS configuration | DMRS Type | |  | Type 1 |
| Number of additional DMRS | |  | 2 |
| Maximum number of OFDM symbols for DL front loaded DMRS | |  | 1 |
| CSI-RS for tracking | Resource set #1 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 5 for CSI-RS resource 1 and 3  l0 = 9 for CSI-RS resource 2 and 4 |
| CSI-RS periodicity | Slots | 10 for CSI-RS resource 1,2,3,4. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4 |
| QCL info |  | TCI state #3 |
| Resource set #2 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 6 for CSI-RS resource 5 and 6  l0 = 10 for CSI-RS resource 7 and 8 |
| CSI-RS periodicity | Slots | 10 for CSI-RS resource 5,6,7,8. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8 |
| QCL info |  | TCI state #4 |
| Resource set #3 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 4 for CSI-RS resource 9 and 10  l0 = 8 for CSI-RS resource 11 and 12 |
| CSI-RS periodicity | Slots | 10 for CSI-RS resource 9,10,11,12. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 9 and 10 2 for CSI-RS resource 11 and 12 |
| QCL info |  | TCI state #5 |
| NZP CSI-RS for CSI acquisition | Resource set #4 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 12 |
| CSI-RS periodicity | Slots | 20 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #0 |
| Resource set #5 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 13 |
| CSI-RS periodicity | Slots | 20 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #1 |
| Resource set #6 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 7 |
| CSI-RS periodicity | Slots | 20 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #2 |
| TCI state #0 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking Resource set #1' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #2 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 9 from 'CSI-RS for tracking Resource set #3' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #3 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #4 | Type 1 QCL information | SSB index |  | SSB #1 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #5 | Type 1 QCL information | SSB index |  | SSB #2 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| Number of HARQ Processes | | |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | |  | 2 |
| Note 1: SSB # (k mod 3), CSI-RS (for tracking) resource set # ((k mod 3) + 1) and CSI-RS (for CSI acquisition) resource set # ((k mod 3) + 4) are transmitted by kth RRH.  Codepoint#0 {TCI state #0, TCI State #1} is activated when UE receives PDCCH/PDSCH from RRH#3k and RRH#3k+1.  Codepoint#1 {TCI state #1, TCI State #2} is activated when UE receives PDCCH/PDSCH from RRH#3k+1 and RRH#3k+2.  Codepoint#2 {TCI state #2, TCI State #0} is activated when UE receives PDCCH/PDSCH from RRH#3k+2 and RRH#3k+3.  The second indicated TCI state in each codepoint is not used for quasi co-location parameters {Doppler shift, Doppler spread}. | | | | |

**Table 5.2.2.1.21.3-3: Minimum performance for HST-SFN Scheme B**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | | |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.1-8.5 FDD | 10/15 | 16QAM, 0.48 | HST-SFN-Scheme B | 2x2 | 70 | 11.3 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.1.21.

5.2.2.1.21.4 Test description

5.2.2.1.21.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.2.1.21.3-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.3.6.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.21.4.3.

5.2.2.1.21.4.2 Test procedure

1. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.1.21.5-1 as appropriate.

2. SS is configured to transmit SSB and CSI-RS continuously and schedule PDSCH and PDCCH transmission according to Note 1 in 5.2.2.1.21.3-2. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.2.1.21.5-1. The SS sends downlink MAC padding bits on the DL RMC.

Note: All TCI states are known to the UE through configuration inside RrcReconfiguration. There is no need to configure additional L1-RSRP measurements.

3. Send MAC CE command “Enhanced TCI States Indication for UE-specific PDCCH MAC CE” according to the timing described in Note 1 of table 5.2.2.1.21.5-1 to active TCI state codepoint 0, 1 or 2 for PDCCH periodically. PDSCH is automatically associated with TCI state codepoint 0, 1 or 2 as tci-PresentInDCI is not present. TCI states 3, 4 and 5 for SSBs are automatically activated through relation of QCL-Info in NZP CSI-RS.

4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.2.1.21.4.3 Message contents

Same as message contents in 5.2.2.1.20.4.3.

5.2.2.1.21.5 Test Requirement

Tables 5.2.2.1.21.3-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.2.1.21.5-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.1.21.5-1: Test Requirements for HST-SFN Scheme B

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | | |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.1-8.5 FDD | 10/15 | 16QAM, 0.48 | HST-SFN-Scheme B | 2x2 | 70 | 11.9 |

#### 5.2.2.2 TDD

##### 5.2.2.2.1 2Rx TDD FR1 PDSCH mapping Type A performance

5.2.2.2.1.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.1.0-3 and Table 5.2.2.2.1.0-4, with the addition of test parameters in Table 5.2.2.2.1.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.2.2.1.0-1.

Table 5.2.2.2.1.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and with different channel models, MCSs and number of MIMO layers | 1-1, 1-2, 1-3, 1-5, 1-6, 1-7, 1-8, 1-9, 1-10, 1-11, 1-12, 2-1, 2-2 |
| Verify the PDSCH mapping Type A HARQ soft combining performance under 2 receive antenna conditions. | 1-4 |
| Verify the PDSCH mapping Type A performance requirements for Enhanced Receiver Type 1 under 2 receive antenna conditions. | 3-1 |

Table 5.2.2.2.1.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S) |  | 2 |
| Length (L) |  | Specific to each Reference channel |
| PDSCH aggregation factor |  | 1 |
| PRB bundling type |  | Static |
| PRB bundling size |  | 4 for Tests 1-1, 1-8, 1-9  2 for other tests |
| Resource allocation type |  | Test 1-2: Type 1 with start RB = 50, LRBs = 6  Other tests: Type 0 |
| RBG size |  | Test 1-2: N/A  Other tests: Config2 |
| VRB-to-PRB mapping type |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
| Number of additional DMRS |  | 2 for Tests 1-1 , 1-7, 1-8, 1-9, 1-10, 1-11  1 for other tests |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CSI-RS for tracking | First OFDM symbol in the PRB used for CSI-RS |  | Tests 1-8, 1-9:  l0 = 4 for CSI-RS resource 1 and 3  l0 = 8 for CSI-RS resource 2 and 4  Other tests; Table 5.2-1. |
| CSI-RS periodicity | Slots | Test 1-7, 1-10, 1-11: 20 for CSI-RS resource 1,2,3,4.  Other tests: Table 5.2-1. |
| CSI-RS offset | Slots | Test 1-7: 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4.  Other tests: Table 5.2-1. |
| Frequency Occupation |  | Test 1-7, 1-10, 1-11: Start PRB 0 Number of PRB = 52  Other tests: Table 5.2-1. |
| Number of HARQ Processes | |  | 16 for Test 1-4  10 for Test 1-9  8 for other tests |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |

Table 5.2.2.2.1.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-1.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-1A | TDLB100-400 | 2x2, ULA Low | 70 | -1.1 |
| 1-2 | R.PDSCH.2-1.2 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-1 | TDLC300-100 | 2x2, ULA Low | 70 | 0.2 |
| 1-3 | R.PDSCH.2-4.1 TDD | 40 / 30 | 256QAM, 0.82 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 70 | 25.3 |
| 1-4 | R.PDSCH.2-2.1 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLC300-100 | 2x2, ULA Low | 30 | 1.6 |
| 1-5 | R.PDSCH.2-5.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-2 | TDLA30-10 | 2x2, ULA Low | 70 | -0.9 |
| 1-6 | R.PDSCH.2-6.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-3 | TDLA30-10 | 2x2, ULA Low | 70 | -0.8 |
| 1-7 | R.PDSCH.2-10.1 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | HST-1000 | 1x2 | 70 | 6.4 |
| 1-8 | R.PDSCH.2-11.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-5 | TDLB100-400 | 2x2, ULA Low | 70 | -1.0 |
| 1-9 | R.PDSCH.2-12.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-6 | TDLB100-400 | 2x2, ULA Low | 70 | -1.1 |
| 1-10 | R.PDSCH.2-10.2 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLC300-1200 | 2x2 | 70 | 9.5 |
| 1-11 | R.PDSCH.2-10.3 TDD | 40 / 30 | 64QAM, 0.43 | FR1.30-1 | HST-1667 | 1x2 | 70 | 9.6 |
| 1-12 | R.PDSCH.2-25.1 TDD | 40 / 30 | 1024QAM, 0.79 | FR1.30-1 | TDLD30-5 | 2x2, ULA Low | 70 | 29.4 |

Table 5.2.2.2.1.0-4: Minimum performance for Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 2-1 | R.PDSCH.2-3.1 TDD | 40 / 30 | 64QAM, 0.50 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 70 | 19.8 |
| 2-2 | R.PDSCH.2-9.1 TDD | 20 / 30 | 64QAM, 0.50 | FR1.30-4 | TDLA30-10 | 2x2, ULA Low | 70 | 19.8 |

Table 5.2.2.2.1.0-5: Minimum performance for Rank 2 and EnhancedReceiver Type 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 3-1 | R.PDSCH.2-2.2 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLA30-10 | 2x2, ULA Medium | 70 | 18.0 |

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2.2.2.1.0.

###### 5.2.2.2.1\_1 2Rx TDD FR1 PDSCH mapping Type A performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.2.1\_1.1 Test Purpose

Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and with different channel models, MCSs and number of MIMO layers

5.2.2.2.1\_1.2 Test Applicability

This test applies to all types of NR UE release 15 and forward.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC.

5.2.2.2.1\_1.3 Test Description

5.2.2.2.1\_1.3.1 Initial Conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 of TS 38.521-1.

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 5.2-1 and Table 5.2.2.2.1.0-2 and as appropriate.

3. Downlink signals for the NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions for the NR cell are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* Onfor NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.1\_1.4.3.

5.2.2.2.1\_1.3.2 Test Procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.2.2.1\_1.4-1 and Table 5.2.2.2.1\_1.4-2. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.2.1\_1.4-1 and 5.2.2.2.1\_1.4-2 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Tables G.1.5-2 in Annex G clause G.1.5.

4. Repeat steps from 1 to 3 for each subtest in Table 5.2.2.2.1\_1.4-1 and Table 5.2.2.2.1\_1.4-2 as appropriate.

5.2.2.2.1\_1.3.3 Message Contents

Message contents are according to TS 38.508-1 [6] subclauses 4.6.1 and 5.4.2.

5.2.2.2.1\_1.3.3\_1 Message exceptions for SA

Table 5.2.2.2.1\_1.3.3\_1-1: Void

Table 5.2.2.2.1\_1.3.3\_1-2: Void

Table 5.2.2.2.1\_1.3.3\_1-3: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| dmrs-DownlinkForPDSCH-MappingTypeA CHOICE { |  |  |  |
| setup | DMRS-DownlinkConfig |  |  |
| } |  |  |  |
| mcs-Table | qam256 | 256qam table for test 1-3 |  |
| Not present | 64qam table for all tests except test 1-3 |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | n4 | n4 for test 1-1  n2 for other tests | test 1-1 |
|  | Not present | n2 is used by default | all test points except test 1-1 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.2.1\_1.3.3\_1-4: DMRS-DownlinkConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24 | | | |
| Information Element | Value/remark | Comment | Condition |
| DMRS-DownlinkConfig ::= SEQUENCE { |  |  |  |
| dmrs-AdditionalPosition | pos2 | For tests 1-1, 1-7, 1-8, 1-9, 1-10, and 1-11 |  |
| pos1 | For other tests |  |
| } |  |  |  |

Table 5.2.2.2.1\_1.3.3\_1-5: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | n16, n10, n8 | n16 for Test 1-4, n10 for Test 1-9  n8 for other tests |  |
| } |  |  |  |

Table 5.2.2.2.1\_1.3.3\_1-6: RACH-ConfigGeneric

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-130 | | | |
| Information Element | Value/remark | Comment | Condition |
| RACH-ConfigGeneric ::= SEQUENCE { |  |  |  |
| prach-ConfigurationIndex | 163 | Only for test 2-2 |  |
| } |  |  |  |

Table 5.2.2.2.1\_1.3.3\_1-7: CSI-ResourcePeriodicityAndOffset for CSI Tracking

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots20 | 1 (for CSI-RS resources 1 and 2)  2 (for CSI-RS resources 3 and 4) | For test 1-7, 1-10, 1-11:  CSI-RS offset:  1 for CSI-RS resources 1 and 2  2 for CSI-RS resources 3 and 4  CSI-RS periodicity: 20 slots |  |
| Slots40 | 20 (for CSI-RS resources 1 and 2)  21 (for CSI-RS resources 3 and 4) | For other tests:  CSI-RS offset:  20 for CSI-RS resources 1 and 2  21 for CSI-RS resources 3 and 4  CSI-RS  periodicity: 40 slots |  |
| } |  |  |  |

Table 5.2.2.2.1\_1.3.3\_1-8: CSI-FrequencyOccupation for CSI Tracking

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-11 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-FrequencyOccupation ::= SEQUENCE { |  |  |  |
| nrofRBs | 52 | 52 for tests 1-7, 1-10, 1-11, 2-2 |  |
| 108 | 108 for other tests |  |
| } |  |  |  |

Table 5.2.2.2.1\_1.3.3\_1-9: SchedulingRequestResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-157 | | | |
| Information Element | Value/remark | Comment | Condition |
| SchedulingRequestResourceConfig ::= SEQUENCE { |  |  |  |
| periodicityAndOffset CHOICE { |  |  |  |
| sl20 | 7 | For test 1-9 |  |
| sl20 | 5 | For test 2-2 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.2.1\_1.3.3\_1-10: Physical layer parameters for DCI format 1\_1

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-1 | | | |
| Parameter | Value | Value in binary | Condition |
| PUCCH resource indicator | *PUCCH-ResourceId[1]* = 6 in pucch-ResourceSetID[1] or  *PUCCH-ResourceId[1]* = 14 in pucch-ResourceSetID[2] as defined in Table 4.6.3-112 (Mapping as per Table 9.2.3-2 in TS 38.213) | ‘110’B | Slot S1 for test 1-9 |

Table 5.2.2.2.1\_1.3.3\_1-11: PDSCH-TimeDomainResourceAllocationList

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-27 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF { | 3 entry |  | Test 1-5, Test 1-6 |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 44 | Start symbol(S)=2, Length(L)=4 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[2] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[3] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF { | 5 entry |  | Test 1-9 |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[2] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 100 | Start symbol(S)=2, Length(L)=8 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[3] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 81 | Start symbol(S)=2, Length(L)=10 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[4] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[5] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| } |  |  |  |

5.2.2.2.1\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.2.2.1\_1.3.3\_1.

5.2.2.2.1\_1.4 Test Requirements

Table 5.2.2.2.1\_1.3-2 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.2 for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.1\_1.4-1 and 1 and Table 5.2.2.2.1\_1.4-2 for the specified SNR including test tolerances for all throughput tests

Table 5.2.2.2.1\_1.4-1: Test requirement for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-1.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-1A | TDLB100-400 | 2x2, ULA Low | 70 | -0.2 |
| 1-2 | R.PDSCH.2-1.2 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-1 | TDLC300-100 | 2x2, ULA Low | 70 | 1.1 |
| 1-3 | R.PDSCH.2-4.1 TDD | 40 / 30 | 256QAM, 0.82 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 70 | 26.3 |
| 1-4 | R.PDSCH.2-2.1 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLC300-100 | 2x2, ULA Low | 30 | 2.5 |
| 1-5 | R.PDSCH.2-5.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-2 | TDLA30-10 | 2x2, ULA Low | 70 | 0.1 |
| 1-6 | R.PDSCH.2-6.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-3 | TDLA30-10 | 2x2, ULA Low | 70 | 0.2 |
| 1-7 | R.PDSCH.2-10.1 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | HST-1000 | 1x2 | 70 | 7.3 |
| 1-8 | R.PDSCH.2-11.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-5 | TDLB100-400 | 2x2, ULA Low | 70 | -0.1 |
| 1-9 | R.PDSCH.2-12.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-6 | TDLB100-400 | 2x2, ULA Low | 70 | -0.2 |
| 1-10 | R.PDSCH.2-10.2 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLC300-1200 | 2x2 | 70 | 10.4 |
| 1-11 | R.PDSCH.2-10.3 TDD | 40 / 30 | 64QAM, 0.43 | FR1.30-1 | HST-1667 | 1x2 | 70 | 10.2 |

Table 5.2.2.2.1\_1.4-2: Test requirement for Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 2-1 | R.PDSCH.2-3.1 TDD | 40 / 30 | 64QAM, 0.50 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 70 | 20.8 |
| 2-2 | R.PDSCH.2-9.1 TDD | 20 / 30 | 64QAM, 0.50 | FR1.30-4 | TDLA30-10 | 2x2, ULA Low | 70 | 20.8 |

###### 5.2.2.2.1\_2 2Rx TDD FR1 PDSCH mapping Type A performance - 2x2 MIMO with enhanced receiver type 1 for both SA and NSA

5.2.2.2.1\_2.1 Test Purpose

Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and with different channel models, MCSs and number of MIMO layers

5.2.2.2.1\_2.2 Test Applicability

This test applies to all types of NR UE release 15 and forward supporting NR enhanced receiver type 1.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and NR enhanced receiver type 1.

5.2.2.2.1\_2.3 Test Description

Same test description as in clause 5.2.2.2.1\_1.4 with the following exception:

- Table 5.2.2.2.1\_2.4-1 instead of 5.2.2.2.1\_1.4-1

5.2.2.2.1\_2.4 Test Requirements

Table 5.2.2.2.1\_1.3-2 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.2 for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.1.4.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.1\_2.4-1: Test requirement for Rank 2 and EnhancedReceiver Type 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 3-1 | R.PDSCH.2-2.2 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLA30-10 | 2x2, ULA Medium | 70 | 19.0 |

###### 5.2.2.2.1\_3 2Rx TDD FR1 PDSCH mapping Type A performance - 2x2 MIMO with baseline receiver for DL1024QAM for both SA and NSA

Editor's Note: Following aspects needs further investigation

- DL EVM of <= 2.5% for f > 4.2 GHz pending further analysis by the TE vendors

5.2.2.2.1\_3.1 Test Purpose

Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions with DL1024QAM for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput for Rank 1 scenario.

5.2.2.2.1\_3.2 Test Applicability

This test applies to all types of UE release 17 and forward supporting NR/5GC and DL1024QAM.

This test also applies to all types of UE release 17 and forward supporting EN-DC and DL1024QAM.

5.2.2.2.1\_3.3 Test Description

5.2.2.2.1\_3.3.1 Initial Conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 of TS 38.521-1.

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 5.2-1 and Table 5.2.2.2.1.0-2 and as appropriate.

3. Downlink signals for the NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions for the NR cell are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* Onfor NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.1\_3.3.3.

5.2.2.2.1\_3.3.2 Test Procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.2.2.1\_3.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.2.1\_3.4-1 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Tables G.1.5-2 in Annex G clause G.1.5.

5.2.2.2.1\_3.3.3 Message Contents

Message contents are according to 38.508-1 [6] subclauses 4.6.1 and 5.4.2.

5.2.2.2.1\_3.3.3\_1 Message exceptions for NR/5GC

Same as 5.2.2.2.1\_1.3.3\_1 with the following exceptions.

Table 5.2.2.2.1\_3.3.3\_1-1: PDSCH-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| mcs-Table-r17 | qam1024 |  | Test 1-12 |
| } |  |  |  |

5.2.2.2.1\_3.3.3\_2 Message exceptions for EN-DC

Same as 5.2.2.2.1\_3.3.3\_1.

5.2.2.2.1\_3.4 Test Requirements

Table 5.2.2.2.1\_3.4-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.2 for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.1\_3.4-1 for the specified SNR including test tolerances for all throughput tests

Table 5.2.2.2.1\_3.4-1: Test requirement for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-12 | R.PDSCH.2-25.1 TDD | 40 / 30 | 1024QAM, 0.79 | FR1.30-1 | TDLD30-5 | 2x2, ULA Low | 70 | 30.3 |

##### 5.2.2.2.2 2Rx TDD FR1 PDSCH mapping Type A and CSI-RS overlapped with PDSCH performance

###### 5.2.2.2.2\_1 2Rx TDD FR1 PDSCH mapping Type A and CSI-RS overlapped with PDSCH performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.2.2\_1.1 Test Purpose

Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and CSI-RS overlapped with PDSCH

5.2.2.2.2\_1.2 Test Applicability

This test applies to all types of NR UE release 15 and forward.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC.

5.2.2.2.2\_1.3 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.2\_1.3-3, with the addition of test parameters in table 5.2.2.2.2\_1.3-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.2.2.2\_1.3-1.

Table 5.2.2.2.2\_1.3-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and CSI-RS overlapped with PDSCH | 1-1 |

Table 5.2.2.2.2\_1.3-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S) |  | 2 |
| Length (L) |  | Specific to each Reference channel |
| PDSCH aggregation factor |  | 1 |
| PRB bundling type |  | Static |
| PRB bundling size |  | 2 |
| Resource allocation type |  | Type 0 |
| RBG size |  | Config2 |
| VRB-to-PRB mapping type |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
| Number of additional DMRS |  | 1 |
| Length |  | 1 |
| NZP CSI-RS for CSI acquisition | OFDM symbols in the PRB used for CSI-RS |  | l0 = 13 |
| CSI-RS periodicity | Slots | 5 |
| ZP CSI-RS for CSI acquisition | Subcarrier index in the PRB used for CSI-RS |  | (k0, k1, k2, k3)=(2, 4, 6, 8) |
| Number of CSI-RS ports (X) |  | 8 |
| CSI-RS periodicity | Slots | 5 |
| Number of HARQ Processes | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |

Table 5.2.2.2.2\_1.3-3: Minimum performance for Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-7.1 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLC300-100 | 2x2, ULA Low | 70 | 14.8 |

The normative reference for this requirement is TS 38.101-4 [2] clause 5.2.2.1.2

5.2.2.2.2\_1.4 Test Description

5.2.2.2.2\_1.4.1 Initial Conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 of 38.521-1.

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 5.1.2.1 and 5.1.2.2.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 5.2-1 and Table 5.2.2.2.2\_1.3-2 and as appropriate.

3. Downlink signals for the NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions for the NR cell are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* Onfor NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.2\_1.4.3.

5.2.2.2.2\_1.4.2 Test Procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.2.2.2\_1.1-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.2.2\_1.5-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Tables G.1.5-2 in Annex G clause G.1.5.

5.2.2.2.2\_1.4.3 Message Contents

Message contents are according to TS 38.508-1 [6] subclauses 4.6.1 and 5.4.2.

5.2.2.2.2\_1.4.3\_1 Message exceptions for SA

Table 5.2.2.2.2\_1.4.3\_1-1: Void

Table 5.2.2.2.2\_1.4.3\_1-2: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| dataScramblingIdentityPDSCH | 0 |  |  |
| dmrs-DownlinkForPDSCH-MappingTypeA CHOICE { |  |  |  |
| Setup | DMRS-DownlinkConfig |  |  |
| } |  |  |  |
| resourceAllocation | resourceAllocationType0 |  | Used\_for\_Type0 |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize |  | If a bundleSize(Set) value is absent, the UE applies the value n2. |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.2.2\_1.4.3\_1-3: Void

Table 5.2.2.2.2\_1.4.3\_1-4: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| frequencyDomainResources | 11111111 11111111 10000000 00000000 00000000 00000 | CORESET to use the least significant 102 RBs of the BWP |  |
| tci-StatesPDCCH-ToAddList { |  |  |  |
|  | 0 | TCI State #0 |  |
|  | 1 | TCI State #1 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.2.2\_1.4.3\_1-5: Void

Table 5.2.2.2.2\_1.4.3\_1-6: NZP CSI-RS-ResourceMapping for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 13 | l0 = 13 |  |
| } |  |  |  |

Table 5.2.2.2.2\_1.4.3\_1-7: CSI-ResourcePeriodicityAndOffset for CSI Acquisition for NZP CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-16 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots5 | 0 | Periodicity 5 slots and offset 0 |  |
| } |  |  |  |

Table 5.2.2.2.2\_1.4.3\_1-8: ZP CSI-RS-ResourceMapping for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-21 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| nrofPorts | P8 | Eight Ports |  |
| } |  |  |  |

Table 5.2.2.2.2\_1.4.3\_1-9: DMRS-DownlinkConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508 [6], Table 5.4.2.0-24 | | | |
| Information Element | Value/remark | Comment | Condition |
| DMRS-DownlinkConfig ::= SEQUENCE { |  |  |  |
| dmrs-AdditionalPosition | Not present | pos2  If the field is absent, the UE applies the value pos2 | FR1\_TDD, |
| } |  |  |  |

Table 5.2.2.2.2\_1.4.3\_1-10: CSI-ResourcePeriodicityAndOffset for CSI Acquisition for ZP CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-22 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots5 | 0 | Periodicity 5 slots and offset 0 |  |
| } |  |  |  |

5.2.2.2.2\_1.4.3\_2 Message exceptions for NSA

Same as 5.2.2.2.2\_1.4.3\_2

5.2.2.2.2\_1.5 Test Requirements

Table 5.2.2.2.2\_1.3-2 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.2 for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.2\_1.3-3 for the specified SNR including test tolerances for all throughput tests

Table 5.2.2.2.2\_1.5-1: Test requirement for Rank 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-7.1 TDD | 16QAM, 0.48 | FR1.30-1 | TDLC300-100 | 2x2, ULA Low | 70 | 15.7 |

##### 5.2.2.2.3 2Rx TDD FR1 PDSCH mapping Type B performance

5.2.2.2.3.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.3.0-3, with the addition of test parameters in Table 5.2.2.2.3.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.3.0-1.

Table 5.2.2.2.3.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH mapping Type B performance under 2 receive antenna conditions | 1-1 |

Table 5.2.2.2.3.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
|  | Mapping type |  | Type B |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 5 |
|  | Length (L) |  | 7 |
| PDSCH configuration | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
|  | DMRS Type |  | Type 1 |
| PDSCH DMRS configuration | Number of additional DMRS |  | 1 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Number of HARQ Processes | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |

Table 5.2.2.2.3.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation  condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-1.3 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 70 | -0.9 |

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2.2.2.3.

###### 5.2.2.2.3\_1 2Rx TDD FR1 PDSCH mapping Type B performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.2.3\_1.1 Test purpose

To verify the PDSCH mapping Type B normal performance under 2 receive antenna conditions for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput with baseline receiver configuration.

5.2.2.2.3\_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting PDSCH mapping type B.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and PDSCH mapping type B.

5.2.2.2.3\_1.3 Test description

5.2.2.2.3\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2.3 for UE diagram.

2. The parameter settings for the cell are set up according to Tables 5.2-1 and 5.2.2.2.3.0-2 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, C.3.1 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 5.2.3.2.3\_1.3.3.

5.2.2.2.3\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.2.2.3.0-2. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.2.3\_1.4-1 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.2.2.3\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 4.6.1 and 5.4.2.

5.2.2.2.3\_1.3.3\_1 Message exceptions for SA

Table 5.2.2.2.3\_1.3.3\_1-1: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-102 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | Not present |  |  |
| } |  |  |  |

Table 5.2.2.2.3\_1.3.3\_1-2: PDSCH-TimeDomainResourceAllocationList

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-103 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF { | 2 entry |  |  |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeB |  |  |
| startSymbolAndLength | 89 | Start symbol(S)=5, Length(L)=7 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[2] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| } |  |  |  |

5.2.2.2.3\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.2.2.3\_1.3.3\_1

5.2.2.2.3\_1.4 Test requirement

Table 5.2.2.2.3.0-3 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.2 for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.3\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.3\_1.4-1: Test Requirement for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation  condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-1.3 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 70 | 0.1 |

##### 5.2.2.2.4 2Rx TDD FR1 PDSCH mapping Type A and LTE-NR coexistence performance

5.2.2.2.4.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.4.0-3, with the addition of test parameters in Table 5.2.2.2.4.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.2.2.4.0-1.

Table 5.2.2.2.4.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions with CRS rate matching configured | 1-1, 1-2 |

Table 5.2.2.2.4.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| NR UL transmission with a 7.5 kHz shift to the LTE raster | |  | true |
| PDCCH configuration | Symbols with PDCCH |  | Symbol# 2 |
|  | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 3 |
|  | Length (L) |  | 9 for Test 1-1 11 for Test 1-2 |
| PDSCH configuration | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
|  | DMRS Type |  | Type 1 |
| PDSCH DMRS configuration | Position of the first DM-RS for downlink |  | 3 |
|  | Number of additional DMRS |  | 1 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
|  | LTE carrier centre subcarrier location |  | Same as NR carrier centre subcarrier location |
| CRS for rate matching (Note 1) | LTE carrier BW | MHz | 10 |
|  | Number of antenna ports |  | 4 |
|  | v-shift |  | 0 |
| Number of HARQ Processes | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |
| Note 1: No MBSFN is configured on LTE carrier | | | |

Table 5.2.2.2.4.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-1.1 TDD | 10 / 15 | QPSK, 0.30 | FR1.15-1 | TDLA30-10 | 4x2, ULA Low | 70 | -0.8 |
| 1-2 | R.PDSCH.1-1.2 TDD | 10 / 15 | QPSK, 0.30 | FR1.15-1 | TDLA30-10 | 4x2, ULA Low | 70 | -0.8 |

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2.2.2.4.

###### 5.2.2.2.4\_1 2Rx TDD FR1 PDSCH Mapping Type A and LTE-NR coexistence performance - 4x2 MIMO with baseline receiver for both SA and NSA

5.2.2.2.4\_1.1 Test purpose

To verify the PDSCH mapping Type A coexistence performance under 2 receive antenna conditions for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput with baseline receiver configuration.

5.2.2.2.4\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 15 and forward supporting capability IE *rateMatchingLTE-CRS* but not supporting capability IE *additionalDMRS-DL-Alt*.

Test 1-1 also applies to all types of E-UTRA UE release 15 and forward supporting EN-DC and capability IE *rateMatchingLTE-CRS* but not supporting capability IE *additionalDMRS-DL-Alt*.

Test 1-2 applies to all types of NR UE release 15 and forward supporting capability IE *additionalDMRS-DL-Alt* and *rateMatchingLTE-CRS*.

Test 1-2 also applies to all types of E-UTRA UE release 15 and forward supporting EN-DC and capability IE *additionalDMRS-DL-Alt* and *rateMatchingLTE-CRS*.

5.2.2.2.4\_1.3 Test description

5.2.2.2.4\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.6 for TE diagram and clause A.3.2.3 for UE diagram.

2. The parameter settings for the cell are set up according to Tables 5.2-1 and 5.2.2.2.4.0-2 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, *Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 5.2.2.2.4\_1.3.3.

5.2.2.2.4\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.2.2.4.0-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.2.4\_1.4-1 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

NOTE: In the test using the NR/5GC connectivity option, collisions between NR SIB1 scheduling and LTE CRS can occur. However, these do not impact the throughput.

5.2.2.2.4\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 4.6.1 and 5.4.2.

5.2.2.2.4\_1.3.3\_1 Message exceptions for SA

Table 5.2.2.2.4\_1.3.3\_1-1: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-102 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | n8 |  |  |
| } |  |  |  |

Table 5.2.2.2.4\_1.3.3\_1-2: PDSCH-TimeDomainResourceAllocationList

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-103 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF { | 2 entry |  |  |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 94 | Start symbol(S)=3, Length(L)=9 | Test 1-1 |
|  | 66 | Start symbol(S)=3, Length(L)=11 | Test 1-2 |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[2] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 66 | Start symbol(S)=3, Length(L)=11 | Test 1-2 |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.2.4\_1.3.3\_1-3: *SearchSpace*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-162 and5.4.2.0-7 using condition USS, FR1\_10MHz, Long\_DCI | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 2 |  |  |
| monitoringSymbolsWithinSlot | 00100000000000 |  |  |
| } |  |  |  |

Table 5.2.2.2.4\_1.3.3\_1-4: ServingCellConfigCommon

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfigCommon ::= SEQUENCE { |  |  |  |
| dmrs-TypeA-Position | pos3 |  |  |
| lte-CRS-ToMatchAround | RateMatchPatternLTE-CRS |  |  |
| } |  |  |  |

Table 5.2.2.2.4\_1.3.3\_1-5: RateMatchPatternLTE-CRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| RateMatchPatternLTE-CRS ::= SEQUENCE { |  |  |  |
| carrierFreqDL | Same as NR carrier centre subcarrier location |  |  |
| carrierBandwidthDL | n50 | 10MHz |  |
| mbsfn-SubframeConfigList | Not present |  |  |
| nrofCRS-Ports | n4 |  |  |
| v-Shift | n0 |  |  |
| } |  |  |  |

Table 5.2.2.2.4\_1.3.3\_1-6: FrequencyInfoUL-SIB

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-62 | | | |
| Information Element | Value/remark | Comment | Condition |
| FrequencyInfoUL-SIB SEQUENCE { |  |  |  |
| frequencyShift7p5khz | true | For bands n34, n38, n39, n40, n48 |  |
|  | Not present | For other TDD bands |  |
| } |  |  |  |

Table 5.2.2.2.4\_1.3.3\_1-7: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 2 |  |  |
| duration | 1 | SearchSpace duration of 1 symbol from third symbol |  |
| } |  |  |  |

Table 5.2.2.2.4\_1.3.3\_1-8: *PDCCH-ConfigCommon*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-96 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-ConfigCommon ::= SEQUENCE { |  |  |  |
| commonControlResourceSet ::= SEQUENCE { |  |  | SA |
| controlResourceSetId | 1 |  |  |
| frequencyDomainResources | 01110000 00000000 00000000 00000000 00000000 00000 |  |  |
| Duration | 1 |  |  |
| cce-REG-MappingType CHOICE { |  |  |  |
| nonInterleaved | Null |  |  |
| } |  |  |  |
| precoderGranularity | sameAsREG-bundle |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.2.4\_1.3.3\_1-9: *SearchSpace for CSS*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-162 and 5.4.2.0-7 using condition CSS, FR1\_10MHz, Long\_DCI | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| searchSpaceId | SearchSpaceId with condition CSS |  | CSS |
| controlResourceSetId | 1 |  |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| duration | Not present | 1 slot per default |  |
| monitoringSymbolsWithinSlot | 00100000000000 |  |  |
| nrofCandidates SEQUENCE { |  |  | SA |
| aggregationLevel2 | n1 |  |  |
| aggregationLevel8 | n0 |  |  |
| } |  |  |  |

Table 5.2.2.2.4\_1.3.3\_1-10: *SearchSpace for USS*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-162 and 5.4.2.0-7 using condition USS, FR1\_10MHz, Long\_DCI | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  | SA |
| searchSpaceId | 2 |  |  |
| controlResourceSetId | 2 |  |  |
| monitoringSymbolsWithinSlot | 00100000000000 |  |  |
| } |  |  |  |

Table 5.2.2.2.4\_1.3.3\_1-11: *PUCCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-112 and Table 5.4.2.0-41 using condition FR1.15-1 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUCCH-Config ::= SEQUENCE { |  |  |  |
| dl-DataToUL-ACK SEQUENCE (SIZE (1..8)) OF INTEGER { | 5 entries |  | FR1.15-1 |
| INTEGER[1] | 2 | entry 1 |  |
| INTEGER[2] | 3 | entry 2 |  |
| INTEGER[3] | 4 | entry 3 |  |
| INTEGER[4] | 6 | entry 4 |  |
| INTEGER[5] | 7 | entry 5  This is a dummy setting for adjusting the bit length of "PDSCH-to-HARQ\_feedback timing indicator" of DCI Format Format 1\_1. |  |
| } |  |  |  |
| } |  |  |  |

5.2.2.2.4\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.2.2.4\_1.3.3\_1 with the following exceptions:

Table 5.2.2.2.4\_1.3.3\_2-1: *SearchSpace*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-162 and 5.4.2.0-7 using condition USS, FR1\_10MHz, Long\_DCI | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 1 |  |  |
| monitoringSymbolsWithinSlot | 00100000000000 |  |  |
| } |  |  |  |

Table 5.2.2.2.4\_1.3.3\_2-2: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 1 |  |  |
| duration | 1 | SearchSpace duration of 1 symbol from third symbol |  |
| } |  |  |  |

5.2.2.2.4\_1.4 Test requirement

Table 5.2.2.2.4.0-3 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.2 for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.4\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.4\_1.4-1: Test Requirement for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-1.1 TDD | 10 / 15 | QPSK, 0.30 | FR1.15-1 | TDLA30-10 | 4x2, ULA Low | 70 | 0.1 |
| 1-2 | R.PDSCH.1-1.2 TDD | 10 / 15 | QPSK, 0.30 | FR1.15-1 | TDLA30-10 | 4x2, ULA Low | 70 | 0.1 |

##### 5.2.2.2.5 2Rx TDD FR1 PDSCH 0.001% BLER performance

5.2.2.2.5.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.5.0-3, with the addition of test parameters in Table 5.2.2.2.5.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.5.0-1.

Table 5.2.2.2.5.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH 0.001% BLER performance under 2 receive antenna conditions | 1-1 |

Table 5.2.2.2.5.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 12 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 1 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Maximum number of HARQ transmission | |  | 1 |
| Number of HARQ Processes | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Defined in Annex A.1.2 for TDD pattern FR1.30-1 |

Table 5.2.2.2.5.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target BLER | SNR (dB) |
| 1-1 | R.PDSCH.2-1.4 TDD | 40 / 30 | QPSK, 0.59 | FR1.30-1 | AWGN | 1x2, ULA Low | 0.001% | 3.3 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.5.

###### 5.2.2.2.5\_1 2Rx TDD FR1 PDSCH 0.001% BLER performance - 1x2 MIMO with baseline receiver for both SA and NSA

5.2.2.2.5\_1.1 Test purpose

To verify the PDSCH 0.001% BLER performance under 2 receive antenna conditions.

5.2.2.2.5\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *dl-64QAM-MCS-TableAlt* and capability IE *cqi-TableAlt*.

5.2.2.2.5\_1.3 Test description

5.2.2.2.5\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.2 for TE diagram and section A.3.2.3 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.2.5.0-2 and Table 5.2.2.2.5.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.5\_1.3.3.

5.2.2.2.5\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.2.2.5.0-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.2.5\_1.3.4-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.4. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.4.3-1 in Annex G.

5.2.2.2.5\_1.3.3 Message contents

5.2.2.2.5\_1.3.3\_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.2.2.5\_1.3.3\_1-1: PDSCH-TimeDomainResourceAllocationList

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF { | 2 entry |  | FR1 |
| mcs-Table | qam64LowSE |  |  |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  |  |  |
| k0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| } |  |  |  |

5.2.2.2.5\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.2.2.5\_1.3.3\_1.

5.2.2.2.5\_1.3.4 Test requirement

Table 5.2.2.2.5.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.5\_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.5\_1.3.4-1: Test requirement for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target BLER | SNR (dB) |
| 1-1 | R.PDSCH.2-1.4 TDD | 40 / 30 | QPSK, 0.59 | FR1.30-1 | AWGN | 1x2, ULA Low | 0.001% | 4.4 |

##### 5.2.2.2.6 2Rx TDD FR1 PDSCH repetitions over multiple slots performance

5.2.2.2.6.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.6.0-3, with the addition of test parameters in Table 5.2.2.2.6.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.6.0-1.

Table 5.2.2.2.6.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH repetitions over multiple slots performance under 2 receive antenna conditions | 1-1 |

Table 5.2.2.2.6.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 12 |
|  | PDSCH aggregation factor |  | 2 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 1 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Number of HARQ Processes | |  | 4 |
| The number of slots between final repetition of PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 (Note 1) |
| Note 1: ACK/NACK feedback is generated for PDSCH on slot i, where mod(i,10) = {2, 4, 6}. | | | |

Table 5.2.2.2.6.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target BLER | SNR (dB) |
| 1-1 | R.PDSCH.2-16.1 TDD | 40 / 30 | 16QAM, 0.54 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 1%(Note 1) | 1.4 |
| Note 1: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block. | | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.6.

###### 5.2.2.2.6\_1 2Rx TDD FR1 PDSCH repetitions over multiple slots performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.2.6\_1.1 Test purpose

To Verify the PDSCH repetitions over multiple slots performance under 2 receive antenna conditions.

5.2.2.2.6\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE dl-64QAM-MCS-TableAlt and *pdsch-RepetitionMultiSlots-r16*.

Test 1-1 also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and capability IE dl-64QAM-MCS-TableAlt and pdsch-RepetitionMultiSlots-r16.

5.2.2.2.6\_1.3 Test description

5.2.2.2.6\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.1.6.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.6\_1.3.3.

5.2.2.2.6\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.2.2.6.0-3. The SS sends downlink MAC padding bits on the DL RMC. The UE may expect that the TB is repeated with same symbol allocation among each of the *pdsch-AggregationFactor* consecutive slots.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.2.6\_1.3.4-1.

3. Measure the BLER for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of correctly and incorrectly received transport bloks based on ACK/NACK feedback on the UL during each subtest and decide pass or fail according to clause G.1.5 and Table G.1.5-1a in Annex G clause G.1.5.

5.2.2.2.6\_1.3.3 Message contents

5.2.2.2.6\_1.3.3\_1 Message exceptions for SA

Same as 5.2.2.1.6\_1.3.3\_1.

5.2.2.2.6\_1.3.3\_2 Message exceptions for SA

Same as 5.2.2.1.6\_1.3.3\_1.

5.2.2.2.6\_1.3.4 Test requirement

Table 5.2.2.2.6.0-3 defines the primary level settings.

The target BLER percentage for the downlink reference measurement channels specified in Annex A.3.2.2 for each BLER test shall meet or exceed the specified value in Table 5.2.2.2.6\_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.6\_1.3.4-1: Test requirement for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target BLER | SNR (dB) |
| 1-1 | R.PDSCH.2-16.1 TDD | 40 / 30 | 16QAM, 0.54 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 1%(Note 1) | 2.3 |
| Note 1: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block. | | | | | | | | |

##### 5.2.2.2.7 2Rx TDD FR1 PDSCH Mapping Type B and UE processing capability 2 performance

5.2.2.2.7.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.7.0-3, with the addition of test parameters in Table 5.2.2.2.7.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.7.0-1.

Table 5.2.2.2.7.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH mapping Type B performance and UE processing capability 2 under two receive antenna conditions | 1-1 |

Table 5.2.2.2.7.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type B |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 2 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 0 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Maximum number of HARQ transmission | |  | 1 |
| Number of HARQ Processes | |  | 2 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 0 |

Table 5.2.2.2.7.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation  condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-17.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-2 | TDLA30-10 | 2x2, ULA Low | 70 | 0.6 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.7.

###### 5.2.2.2.7\_1 2Rx TDD FR1 PDSCH Mapping Type B and UE processing capability 2 performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.2.7\_1.1 Test purpose

To verify PDSCH mapping Type B performance and UE processing capability 2 under two receive antenna conditions.

5.2.2.2.7\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *pdsch-ProcessingType2*.

5.2.2.2.7\_1.3 Test description

5.2.2.2.7\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.2.7.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.7\_1.3.3.

5.2.2.2.7\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.2.2.7.0-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.2.7\_1.4-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.2.2.7\_1.3.3 Message contents

5.2.2.2.7\_1.3.3\_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.2.2.7\_1.3.3\_1-1: PDSCH-TimeDomainResourceAllocationList

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF { | 2 entries |  | FR1 |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  |  |  |
| k0 | Not present |  |  |
| mappingType | typeB |  |  |
| startSymbolAndLength | 16 | Start symbol(S)=2, Length(L)=2 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.2.7\_1.3.3\_1-2: *PUCCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-112 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUCCH-Config ::= SEQUENCE { |  |  | FR1 |
| dl-DataToUL-ACK SEQUENCE (SIZE (1)) OF INTEGER { | 1 entry |  |  |
| INTEGER[1] | 0 | entry 1 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.2.7\_1.3.3\_1-3: Physical layer parameters for DCI format 1\_1

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1 | | | |
| Parameter | Value | Value in binary | Condition |
| PDSCH-to-HARQ\_feedback timing indicator | K1=0 as per dl-DataToUL-ACK in Table 5.2.2.2.7\_1.3.3\_1-3 | “000” |  |

Table 5.2.2.2.7\_1.3.3\_1-4: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| processingType2Enabled | true |  |  |
| } |  |  |  |

5.2.2.2.7\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.2.2.7\_1.3.3\_1.

5.2.2.2.7\_1.4 Test requirement

Table 5.2.2.2.7.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.7\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.7\_1.4-1: Test requirement for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation  condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-17.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-2 | TDLA30-10 | 2x2, ULA Low | 70 | 1.6 |

##### 5.2.2.2.8 2Rx TDD FR1 PDSCH pre-emption performance

5.2.2.2.8.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.8.0-3, with the addition of test parameters in Table 5.2.2.2.8.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.8.0-1.

Table 5.2.2.2.8.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH pre-emption performance under 2 receive antenna conditions | 1-1 |

Table 5.2.2.2.8.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| PDCCH configuration (Note 4) | Symbols with PDCCH |  | 0, 1 |
| DCI format |  | 2\_1 |
| timeFrequencySet |  | 14x1 |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S) |  | 2 |
| Length (L) |  | 12 |
| PDSCH aggregation factor |  | 1 |
| PRB bundling type |  | Static |
| PRB bundling size |  | 2 |
| Resource allocation type |  | Type 0 |
| RBG size |  | Config2 |
| VRB-to-PRB mapping type |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
| Number of additional DMRS |  | 1 |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Pre-emption configuration (Note 2) | Starting symbol (S) |  | 3 |
| Length (L) |  | 2 |
| Pre-emption periodicity and offset | Slots | 40/(1,12,23,34) (Note 3) |
| Number of HARQ Processes | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | FR1.30-1 |
| Note 1: Void  Note 2: Interference modelled as random data on pre-empted REs.  Note 3: Pre-emption is scheduled with 10% probability within 20ms periodicity.  Note 4: In addition to PDCCH configuration in Table 5.2-1. | | | |

Table 5.2.2.2.8.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH. 2-2.5 TDD | 40 / 30 | 16QAM  0.48 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 70 | 12.5 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.8.

###### 5.2.2.2.8\_1 2Rx TDD FR1 PDSCH pre-emption performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.2.8\_1.1 Test purpose

To Verify the PDSCH pre-emption performance under 2 receive antenna conditions.

5.2.2.2.8\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *pre-EmptIndication-DL-r16*.

5.2.2.2.8\_1.3 Test description

5.2.2.2.8\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.2.8.0-2 and Table 5.2.2.2.8.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.8\_1.3.3.

5.2.2.2.8\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.2.2.8.0-3. The SS sends downlink MAC padding bits on the DL RMC.

2. SS transmits PDCCH DCI format 2\_1 for int\_RNTI with 10% probability to transmit the DL Preemption indication according to Table 5.2.2.2.8.0-2. In the time and frequency set indicated by PDCCH DCI format 2\_1, SS stops transmission of PDSCH.

3. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.2.8\_1.3.4-1.

4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.2.2.8\_1.3.3 Message contents

5.2.2.2.8\_1.3.3\_1 Message exceptions for SA

Same as 5.2.2.1.8\_1.3.3\_1

5.2.2.2.8\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.2.1.8\_1.3.3\_1

5.2.2.2.8\_1.3.4 Test requirement

Table 5.2.2.2.8.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.8\_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.8\_1.3.4-1: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH. 2-2.5 TDD | 40 / 30 | 16QAM  0.48 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 70 | 13.5 |

##### 5.2.2.2.9 2Rx TDD FR1 HST-SFN performance

5.2.2.2.9.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.9.0-3, with the test parameters defined in Table 5.2.2.2.9.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.9.0-1.

Table 5.2.2.2.9.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH performance under 2 receive antenna conditions in the HST-SFN scenario defined in B.3.2 when *highSpeedDemodFlag-r16* [17] is configured | 1-1 |

Table 5.2.2.2.9.0-2: Test Parameters for Testing

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S) |  | 2 |
| Length (L) |  | 12 |
| PDSCH aggregation factor |  | 1 |
| PRB bundling type |  | Static |
| PRB bundling size |  | 2 |
| Resource allocation type |  | Type 0 |
| RBG size |  | Config2 |
| VRB-to-PRB mapping type |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
| Number of additional DMRS |  | 2 |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CSI-RS for tracking | CSI-RS periodicity | Slots | 20 for CSI-RS resource 1,2,3,4 |
| CSI-RS offset | Slots | 1 for CSI-RS resource 1 and 2  2 for CSI-RS resource 3 and 4 |
| Frequency Occupation |  | Start PRB 0  Number of PRB = 52 |
| Number of HARQ Processes | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |

Table 5.2.2.2.9.0-3: Minimum performance for Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-10.4 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | HST-SFN | 2x2 | 70 | 14.2 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.9.

###### 5.2.2.2.9\_1 2Rx TDD FR1 HST-SFN performance - 2x2 MIMO with baseline receiver for both SA and NSA

Editor's note: The minimum test time value is in []

5.2.2.2.9\_1.1 Test purpose

To verify the PDSCH performance under 4 receive antenna conditions in the HST-SFN scenario defined in B.3.2 when *highSpeedDemodFlag-r16* IE [20] is configured and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 2 scenarios.

5.2.2.2.9\_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting enhanced demodulation processing for HST-SFN joint transmission scheme.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC that supporting enhanced demodulation processing for HST-SFN joint transmission scheme.

5.2.2.2.9\_1.3 Test description

5.2.2.2.9\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.2.2.9.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.9\_1.3.3.

5.2.2.2.9\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.2.2.9\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.2.9\_1.4-1 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

4. Repeat steps from 1 to 3 for each subtest in Tables 5.2.2.2.9\_1.4-1 as appropriate.

5.2.2.2.9\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.2.2.9\_1.3.3\_1 Message exceptions for SA

Table 5.2.2.2.9\_1.3.3\_1-1: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | Not present | n2 for test 1-1 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.2.9\_1.3.3\_1-2: DMRS-DownlinkConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24 | | | |
| Information Element | Value/remark | Comment | Condition |
| DMRS-DownlinkConfig ::= SEQUENCE { |  |  |  |
| dmrs-AdditionalPosition | pos2 | for test 1-1 |  |
| } |  |  |  |

Table 5.2.2.2.9\_1.3.3\_1-3: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | n8 | for test 1-1 |  |
| } |  |  |  |

Table 5.2.2.2.9\_1.3.3\_1-4: CSI-ResourcePeriodicityAndOffset for CSI Tracking

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots20 | 1 for CSI-RS resource #1 and #2  2 for CSI-RS resource #3 and #4 | For test 1-1:  offset = 1 for CSI-RS resource 1 and 2  offset =2 for CSI-RS resource 3 and 4. |  |
| } |  |  |  |

5.2.2.2.9\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.2.2.9\_1.3.3\_1

5.2.2.2.9\_1.4 Test requirement

Tables 5.2.2.2.9\_1.4-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.9\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.9\_1.4-1: Test Requirements for Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-10.4 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | HST-SFN | 2x2 | 70 | 14.8 |

##### 5.2.2.2.10 2Rx TDD FR1 HST DPS performance

5.2.2.2.10.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.10.0-3, with the test parameters defined in Table 5.2.2.2.10.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.10.0-1.

Table 5.2.2.2.10.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify UE performance in the HST-DPS scenario defined in B.3.3 | 1-1, 1-2 |

Table 5.2.2.2.10.0-2: Test Parameters for Testing

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Value |
| Duplex mode | | |  | TDD |
| Active DL BWP index | | |  | 1 |
| PDCCH configuration | TCI state | |  | Note 1 |
|  | Mapping type | |  | Type A |
|  | k0 | |  | 0 |
|  | Starting symbol (S) | |  | 2 |
| PDSCH configuration | Length (L) | |  | Specific to each Reference channel |
|  | PDSCH aggregation factor | |  | 1 |
|  | PRB bundling type | |  | Static |
|  | PRB bundling size | |  | 2 |
|  | Resource allocation type | |  | Type 0 |
|  | RBG size | |  | Config2 |
|  | VRB-to-PRB mapping type | |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size | |  | N/A |
|  | TCI state | |  | Note 1 |
|  | DMRS Type | |  | Type 1 |
| PDSCH DMRS configuration | Number of additional DMRS | |  | 2 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS | |  | 1 |
| CSI-RS for tracking | Resource set #1 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 5 for CSI-RS resource 1 and 3 |
| l0 = 9 for CSI-RS resource 2 and 4 |
| CSI-RS periodicity | Slots | 20 for CSI-RS resource 1,2,3,4 |
| CSI-RS offset | Slots | 1 for CSI-RS resource 1 and 2 |
| 2 for CSI-RS resource 3 and 4 |
| QCL info |  | TCI state #2 |
| Frequency Occupation |  | Start PRB 0 |
| Number of PRB = 52 |
|  | Resource set #2 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 6 for CSI-RS resource 5 and 6 |
| l0 = 10 for CSI-RS resource 7 and 8 |
| CSI-RS periodicity | Slots | 20 for CSI-RS resource 5,6,7,8. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 5 and 6 |
| 2 for CSI-RS resource 7 and 8 |
| QCL info |  | TCI state #3 |
| Frequency Occupation |  | Start PRB 0 |
| Number of PRB = 52 |
| NZP CSI-RS for CSI acquisition | Resource set #3 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 12 |
| CSI-RS periodicity | Slots | 40 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #0 |
|  | Resource set #4 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 13 |
| CSI-RS periodicity | Slots | 40 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #1 |
| TCI state #0 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking Resource set #1' configuration |
| QCL Type |  | Type A |
|  | Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration |
| QCL Type |  | Type A |
|  | Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #2 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
|  | Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #3 | Type 1 QCL information | SSB index |  | SSB #1 |
| QCL Type |  | Type C |
|  | Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| Number of HARQ Processes | | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |
| Note 1: SSB # (k mod 2) , CSI-RS (for tracking) resource set # ((k mod 2) + 1) and CSI-RS (for CSI acquisition) resource set # ((k mod 2) + 3) are transmitted by kth RRH.  For Test 1-1, TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy.  PDCCH and PDSCH associated with TCI # (k mod 2) is transmitted by kth RRH from.  slot#  to  slot#  ,  PDCCH and PDSCH are DTXed in other slots in which throughput statistics are not considered.  For Test 1-2, TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy.  PDCCH and PDSCH associated with TCI # (k mod 2) is transmitted by kth RRH from.  slot#  to  slot#  PDCCH and PDSCH are DTXed in other slots in which throughput statistics are not considered.  Where k=0, 1, 2… is the RRH number, n = 5040 is half of the number of slots between two RRH, = 8 is the number of slots between PDSCH and corresponding HARQ-ACK information, = 6 is the number of slots for MAC CE processing, = 7 is the number of slots to first TRS transmission occasion after MAC CE command is decoded by the UE, = 4 is the number of slots for TRS processing. | | | | |

Table 5.2.2.2.10.0-3: Minimum performance for HST-DPS

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Number of active PDSCH TCI states | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-10.5 TDD | 40 / 30 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.0 |
| 1-2 | R.PDSCH.2-10.5 TDD | 40 / 30 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.0 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.10.

###### 5.2.2.2.10\_1 2Rx TDD FR1 HST-DPS performance - 2x2 MIMO with baseline receiver for both SA and NSA

5.2.2.2.10\_1.1 Test purpose

To verify UE performance in the HST-DPS scenario defined in B.3.3 and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 2 scenarios.

5.2.2.2.10\_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC.

5.2.2.2.10\_1.3 Test description

5.2.2.2.10\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.2.2.10.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.10\_1.3.3.

5.2.2.2.10\_1.3.2 Test procedure

Test 1-1:

1. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.1.10\_1.4-1 as appropriate.

2. SS is configured to transmit SSB and CSI-RS continuously and schedule PDSCH and PDCCH transmission according to Note 1 in 5.2.2.1.10\_1.4-1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.2.1.10\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

Note: All TCI states are known to the UE through configuration inside RrcReconfiguration. There is no need to configure additional L1-RSRP measurements.

3. Send MAC CE command “TCI State Indication for UE-specific PDCCH” according to the timing described in Note 1 of table 5.2.2.1.10\_1.4-1 to switch from active TCI state 0 to 1 for PDCCH and vice versa periodically. PDSCH is automatically associated with TCI state 0 or 1 as tci-PresentInDCI is not present. TCI states 3 and 4 for SSBs are automatically activated through relation of QCL-Info in NZP CSI-RS.

4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

Test 1-2:

1. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.1.10\_1.4-1 as appropriate.

2. SS activates TCI state 0 and TCI 1 for PDSCH at the same time via MAC CE command “TCI States Activation/Deactivation for UE-specific PDSCH”.

3. SS is configured to transmit SSB and CSI-RS continuously and schedule PDSCH and PDCCH transmission according to Note 1 in 5.2.2.1.10\_1.4-1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.2.1.10\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

Note: All TCI states are known to the UE through configuration inside RrcReconfiguration. There is no need to configure additional L1-RSRP measurements.

4. Send MAC CE command “TCI State Indication for UE-specific PDCCH” according to the timing described in Note 1 of table 5.2.2.1.10\_1.4-1 to switch from active TCI state 0 to 1 for PDCCH and vice versa periodically. PDSCH is automatically associated with TCI state 0 or 1 as tci-PresentInDCI is not present. TCI states 3 and 4 for SSBs are automatically activated through relation of QCL-Info in NZP CSI-RS.

5. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.5.2.2.2.10\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.2.2.10\_1.3.3\_1 Message exceptions for SA

Table 5.2.2.2.10\_1.3.3\_1-1: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | Not present | n2 is used | test 1-1, 1-2 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.2.10\_1.3.3\_1-2: DMRS-DownlinkConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24 | | | |
| Information Element | Value/remark | Comment | Condition |
| DMRS-DownlinkConfig ::= SEQUENCE { |  |  |  |
| dmrs-AdditionalPosition | pos2 | for test 1-1, 1-2 |  |
| } |  |  |  |

Table 5.2.2.2.10\_1.3.3\_1-3: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | n8 | for test 1-1, 1-2 |  |
| } |  |  |  |

Table 5.2.2.2.10\_1.3.3\_1-4: NZP-CSI-RS-Resource for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| nzp-CSI-RS-ResourceId | i-1 for CSI-RS resource #i, i=1,2,3,4,5,6,7,8 | for test 1-1, 1-2 |  |
| qcl-InfoPeriodicCSI-RS | 2 for CSI-RS resource #1, #2, #3, #4  3 for CSI-RS resource #5, #6, #7, #8 | for test 1-1, 1-2:  TCI-StateId for TCI-State #2 for CSI-RS resource #1, #2, #3, #4  TCI-StateId for TCI-State #3 for CSI-RS resource #5, #6, #7, #8 |  |
| } |  |  |  |

Table 5.2.2.2.10\_1.3.3\_1-5: CSI-RS-ResourceMapping for TRS (Table 5.2.2.2.10\_1.3.3\_1-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 with condition TRS | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 5 for CSI-RS resource #1 and #3  9 for CSI-RS resource #2 and #4  6 for CSI-RS resource #5 and #6  10 for CSI-RS resource #7 and #8 | for test 1-1, 1-2:  l0 = 5 for CSI-RS resource 1 and 3  l0 = 9 for CSI-RS resource 2 and 4  l0 = 6 for CSI-RS resource 5 and 6  l0 = 10 for CSI-RS resource 7 and 8 |  |
| } |  |  |  |

Table 5.2.2.2.10\_1.3.3\_1-5: CSI-ResourcePeriodicityAndOffset for CSI Tracking (Table 5.2.2.2.10\_1.3.3\_1-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots20 | 1 for CSI-RS resource #1, #2, #5, #6  2 for CSI-RS resource #3 #4, #7, #8 | For test 1-1, 1-2:  periodicity:  20 slots.  offset:  1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4  1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8 |  |
| } |  |  |  |

Table 5.2.2.2.10\_1.3.3\_1-6: NZP-CSI-RS-ResourceSet for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-12 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-ResourceSet ::= SEQUENCE { |  |  |  |
| nzp\_CSI\_ResourceSetId | 0 for Resource set #1  1 for Resource set #2 | For test 1-1, 1-2 |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 4 entries | For test 1-1, 1-2 | Resource set #1 |
| NZP-CSI-RS-ResourceId[1] | 0 | entry 1  CSI-RS resource #1 |  |
| NZP-CSI-RS-ResourceId[2] | 1 | entry 2  CSI-RS resource #2 |  |
| NZP-CSI-RS-ResourceId[3] | 2 | entry 3  CSI-RS resource #3 |  |
| NZP-CSI-RS-ResourceId[4] | 3 | entry 4  CSI-RS resource #4 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 4 entries | For test 1-1, 1-2 | Resource set #2 |
| NZP-CSI-RS-ResourceId[1] | 4 | entry 1  CSI-RS resource #5 |  |
| NZP-CSI-RS-ResourceId[2] | 5 | entry 2  CSI-RS resource #6 |  |
| NZP-CSI-RS-ResourceId[3] | 6 | entry 3  CSI-RS resource #7 |  |
| NZP-CSI-RS-ResourceId[4] | 7 | entry 4  CSI-RS resource #8 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.2.10\_1.3.3\_1-7: NZP-CSI-RS-Resource for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-14 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| nzp-CSI-RS-ResourceId | 8 for CSI-RS resource #9  9 for CSI-RS resource #10 | for test 1-1, 1-2 |  |
| qcl-InfoPeriodicCSI-RS | 0 for CSI-RS resource #9  1 for CSI-RS resource #10 | for test 1-1, 1-2:  TCI-State #0 for CSI-RS resource #9  TCI-State #1 for CSI-RS resource #10 |  |
| } |  |  |  |

Table 5.2.2.2.10\_1.3.3\_1-8: CSI-RS-ResourceMapping for CSI Acquisition (Table 5.2.2.2.10\_1.3.3\_1-7)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 12 for CSI-RS resource #9  13 for CSI-RS resource #10 | for test 1-1, 1-2  l0=12 for CSI-RS resource #9  l0=13 for CSI-RS resource #10 |  |
| } |  |  |  |

Table 5.2.2.2.10\_1.3.3\_1-9: CSI-ResourcePeriodicityAndOffset for CSI Acquisition (Table 5.2.2.2.10\_1.3.3\_1-7)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-16 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots40 | 0 | For test 1-1, 1-2:  periodicity = 40 slots.  offset = 0 slots |  |
| } |  |  |  |

Table 5.2.2.2.10\_1.3.3\_1-10: NZP-CSI-RS-ResourceSet for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-18 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-ResourceSet ::= SEQUENCE { |  |  |  |
| nzp\_CSI\_ResourceSetId | 2 for Resource set #3  3 for Resource set #4 | For test 1-1, 1-2 |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry | For test 1-1, 1-2 | Resource set #3 |
| NZP-CSI-RS-ResourceId[1] | 8 | entry 1  CSI-RS resource #9 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry | For test 1-1, 1-2 | Resource set #4 |
| NZP-CSI-RS-ResourceId[1] | 9 | entry 1  CSI-RS resource #10 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.2.10\_1.3.3\_1-11: *TCI-State*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-190 | | | |
| Information Element | Value/remark | Comment | Condition |
| TCI-State ::= SEQUENCE { |  |  |  |
| tci-StateId | 0 for TCI state #0  1 for TCI state #1  2 for TCI state #2  3 for TCI state #3 | For test 1-1, 1-2 |  |
| qcl-Type1 SEQUENCE { |  |  |  |
| bwp-Id | BWP-Id of active BWP |  | TCI state #0, TCI state #1 |
|  | Not present |  | TCI state #2, TCI state #3 |
| referenceSignal CHOICE { |  |  |  |
| csi-rs | 0 | CSI-RS resource #1 | TCI state #0 |
|  | 4 | CSI-RS resource #5 | TCI state #1 |
| ssb | 0 | SSB #0 | TCI state #2 |
|  | 1 | SSB #1 | TCI state #3 |
| } |  |  |  |
| qcl-Type | typeA |  | TCI state #0, TCI state #1 |
|  | typeC |  | TCI state #2, TCI state #3 |
| } |  |  |  |
| } |  |  |  |

5.2.2.2.10\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.2.2.10\_1.3.3\_1

5.2.2.2.10\_1.4 Test requirement

Tables 5.2.2.2.10\_1.4-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.10\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.10\_1.4-1: Test Requirements for HST-DPS

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Number of active PDSCH TCI states | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-10.5 TDD | 40 / 30 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.6 |
| 1-2 | R.PDSCH.2-10.5 TDD | 40 / 30 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.6 |

##### 5.2.2.2.11 2Rx TDD FR1 PDSCH Single-DCI based SDM scheme performance

5.2.2.2.11.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.11.0-3, with the addition of test parameters in Table 5.2.2.2.11.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.11.0-1.

Table 5.2.2.2.11.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH performance with Single-DCI based SDM scheme under 2 receive antenna conditions | 1-1,1-2 |

Table 5.2.2.2.11.0-2: Test parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | |
| TRxP #1(Note 1) | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | |  | TRxP #1 | |
| PDCCH configuration | | TCI state | |  | TCI State #1 | |
| CORESETPoolIndex | |  | 0 | |
| CSI-RS for tracking | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | |
| Density | |  | 3 | |
| CSI-RS periodicity | | Slots | 40 | |
| CSI-RS offset | | Slots | 20 for CSI-RS resources 1 and 2  21 for CSI-RS resources 3 and 4 | 20 for CSI-RS resources 5 and 6  21 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | |
| Duplex mode | | | |  | TDD | |
| Active DL BWP index | | | |  | 1 | |
| PDSCH configuration | Mapping type | | |  | Type A | |
| k0 | | |  | 0 | |
| Starting symbol (S) | | |  | 2 | |
| Length (L) | | |  | 12 | |
| PRB bundling type | | |  | Static | |
| PRB bundling size | | |  | 2 | |
| Resource allocation type | | |  | Type 1 | |
| RBG size | | |  | Config2 | |
| VRB-to-PRB mapping type | | |  | Non-interleaved | |
| VRB-to-PRB mapping interleaver bundle size | | |  | N/A | |
| PDSCH DMRS configuration | Antenna port indexes | | |  | 1000 | 1002 |
| TCI state | | |  | TCI State #1 | TCI State #2 |
| DMRS Type | | |  | Type 1 | |
| Number of additional DMRS | | |  | 1 | |
| Maximum number of OFDM symbols for DL front loaded DMRS | | |  | 1 | |
| TCI State #1 | Type 1 QCL information | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | N/A |
| QCL Type |  | Type A | N/A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| TCI State #2 | Type 1 QCL information | | CSI-RS resource |  | N/A | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | Type A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| Resource allocation | | | |  | Full-overlapping | |
| Timing offset of the second TRxP from the first TRxP | | | | us | -0.25 for test 1-1  1 for test 1-2 | |
| Frequency offset of the second TRxP from the first TRxP | | | | Hz | 300 for test 1-1  0 for test 1-2 | |
| Number of HARQ Processes | | | |  | 8 | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 | |
| Precoding configuration | | | |  | SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity | |
| Note 1: PDSCH transmission is done from both TRxPs (PDSCH Layer 0 is transmitted from TRxP #1 and PDSCH layer 1 is transmitted from TRxP #2) | | | | | | |

Table 5.2.2.2.11.0-3: Minimum performance

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition(Note 1) | Correlation matrix and antenna configuration(Note 2) | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB)(Note 3) |
| 1-1 | R.PDSCH.2-3.2 TDD | 40 / 30 | 64QAM, 0.50 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 70 | 20.2 |
| 1-2 | R.PDSCH.2-3.2 TDD | 40 / 30 | 64QAM, 0.50 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 70 | 20.0 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 with scaling factor as 1/sqrt(2) for transmitted signal from each TRxP | | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.11.

###### 5.2.2.2.11\_1 2Rx TDD FR1 PDSCH Single-DCI based SDM scheme performance - 2x2 MIMO for both SA and NSA

5.2.2.2.11\_1.1 Test purpose

To verify the PDSCH performance with Single-DCI based SDM scheme under 2 receive antenna conditions.

5.2.2.2.11\_1.2 Test applicability

Test applies to all types of NR UE release 16 and forward supporting capability IE *singleDCI-SDM-scheme-r16*.

5.2.2.2.11\_1.3 Test description

5.2.2.2.11\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2.3 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.2.2.11.0-2 and Table 5.2.2.2.11.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.11\_1.3.3.

5.2.2.2.11\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.2.2.11\_1.3.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.2.11\_1.3.4-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

4. Repeat steps from 1 to 3 for each subtest in Table 5.2.2.2.11\_1.3.4-1 as appropriate.

5.2.2.2.11\_1.3.3 Message contents

5.2.2.2.11\_1.3.3\_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.2.2.11\_1.3.3\_1-1: Physical layer parameters for DCI format 1\_1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1 | | | | |
| Parameter | Value | Value in binary | Condition |
| Antenna port(s) | DMRS port 0 and 2 | “1011” |  |
| Transmission configuration indication | TCI state 1 and 2 | “000” |  |

Table 5.2.2.2.11\_1.3.3\_1-2: *CellGroupConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| simultaneousTCI-UpdateList1-r16 SEQUENCE { |  |  |  |
| ServCellIndex [1] | ServCellIndex |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.2.11\_1.3.3\_1-3: *ControlResourceSet*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| tci-PresentInDCI | enabled |  |  |
| } |  |  |  |

Table 5.2.2.2.11\_1.3.3\_1-4: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-100 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| tci-StatesToAddModList SEQUENCE(SIZE (1.. maxNrofTCI-States)) OF TCI-State { | 2 entries |  |  |
| TCI-State[1] | *TCI-State* with condition TCI-state-0 |  |  |
| TCI-State[2] | *TCI-State* with condition TCI-state-1 |  |  |
| TCI-State[3] | *TCI-State* with condition TCI-state-2 |  |  |
| } |  |  |  |
| rbg-Size | config2 |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.2.11\_1.3.3\_1-5: *TCI-State*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-190 | | | |
| Information Element | Value/remark | Comment | Condition |
| TCI-State ::= SEQUENCE { |  |  |  |
| tci-StateId | 0 |  | TCI-state-0 |
|  | 1 |  | TCI-state-1 |
|  | 2 |  | TCI-state-2 |
| qcl-Type1 SEQUENCE { |  |  |  |
| cell | Not present |  |  |
| bwp-Id | Not present |  |  |
| referenceSignal CHOICE { |  |  |  |
| ssb | SSB-Index |  | TCI-state-0 |
| csi-rs | 1 |  | TCI-state-1 |
|  | 5 |  | TCI-state-2 |
| } |  |  |  |
| qcl-Type | typeA |  |  |
| } |  |  |  |
| qcl-Type2 | Not present |  |  |
| } |  |  |  |

Table 5.2.2.2.11\_1.3.3\_1-6: *NZP-CSI-RS-Resource*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-85 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| resourceMapping SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| row1 | 0000 | For CSI-RS resources 1, 2, 3, 4 |  |
|  | 0001 | For CSI-RS resources 5,6,7,8 |  |
| } |  |  |  |
| nrofPorts | p1 |  |  |
| firstOFDMSymbolInTimeDomain | 6 | For CSI-RS resources 1,3,5,7 |  |
|  | 10 | For CSI-RS resources 2,4,6,8 |  |
| cdm-Type | noCDM |  |  |
| density CHOICE { |  |  |  |
| three | NULL |  |  |
| } |  |  |  |
| } |  |  |  |
| periodicityAndOffset CHOICE { |  |  |  |
| slots40 | 20 | For CSI-RS resources 1,2,5,6 |  |
| slots40 | 21 | For CSI-RS resources 3,4,7,8 |  |
| } |  |  |  |
| qcl-InfoPeriodicCSI-RS | 0 |  |  |
| } |  |  |  |

5.2.2.2.11\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.2.2.11\_1.3.3\_1.

5.2.2.2.11\_1.3.4 Test requirement

Table 5.2.2.2.11.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.11\_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.11\_1.3.4-1: Test requirement

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition(Note 1) | Correlation matrix and antenna configuration(Note 2) | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB)(Note 3) |
| 1-1 | R.PDSCH.2-3.2 TDD | 40 / 30 | 64QAM, 0.50 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 70 | 21.2 |
| 1-2 | R.PDSCH.2-3.2 TDD | 40 / 30 | 64QAM, 0.50 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 70 | 21.0 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 with scaling factor as 1/sqrt(2) for transmitted signal from each TRxP | | | | | | | | |

##### 5.2.2.2.12 2Rx TDD FR1 PDSCH Multi-DCI based transmission scheme performance

5.2.2.2.12.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.12.0-3, with the addition of test parameters in Table 5.2.2.2.12.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.12.0-1.

Table 5.2.2.2.12.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH performance when UE is configured two different values of CORESETPoolIndex in ControlResourceSet and when UE receives multiple PDCCHs scheduling PDSCHs | 1-1 |

Table 5.2.2.2.12.0-2: Test parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | |
| TRxP #1(Note 1) | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | |  | TRxP #1 | |
| PDCCH configuration | | TCI state | |  | TCI State #1 | TCI State #2 |
| CORESETPoolIndex | |  | 0,1 | |
| CSI-RS for tracking | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | |
| Density | |  | 3 | |
| CSI-RS periodicity | | Slots | 40 | |
| CSI-RS offset | | Slots | 20 for CSI-RS resources 1 and 2  21 for CSI-RS resources 3 and 4 | 20 for CSI-RS resources 5 and 6  21 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | |
| Duplex mode | | | |  | TDD | |
| Active DL BWP index | | | |  | 1 | |
| PDSCH configuration | Mapping type | | |  | Type A | |
| k0 | | |  | 0 | |
| Starting symbol (S) | | |  | 2 | |
| Length (L) | | |  | 12 | |
| PRB bundling type | | |  | Static | |
| PRB bundling size | | |  | 2 | |
| Resource allocation type | | |  | Type 1 | |
| RBG size | | |  | Config2 | |
| VRB-to-PRB mapping type | | |  | Non-interleaved | |
| VRB-to-PRB mapping interleaver bundle size | | |  | N/A | |
| PDSCH DMRS configuration | Antenna port indexes | | |  | {1000,1001} | {1002,1003} |
| TCI state | | |  | TCI State #1 | TCI State #2 |
| DMRS Type | | |  | Type 1 | |
| Number of additional DMRS | | |  | 1 | |
| Maximum number of OFDM symbols for DL front loaded DMRS | | |  | 1 | |
| TCI State #1 | Type 1 QCL information | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | N/A |
| QCL Type |  | Type A | N/A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| TCI State #2 | Type 1 QCL information | | CSI-RS resource |  | N/A | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | Type A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| Resource allocation | | | |  | Non-overlapping | |
| Timing offset of the second TRxP from the first TRxP | | | | us | -0.25 | |
| Frequency offset of the second TRxP from the first TRxP | | | | Hz | 300 | |
| Number of HARQ Processes | | | |  | 8 | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 | |
| Precoding configuration | | | |  | SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity | |
| Note 1: PDSCH transmission is done from both TRxPs. Transmission from TRxP #1 uses CORESETPoolIndex 0 and transmission from TRxP #2 uses CORESETPoolIndex 1 | | | | | | |

Table 5.2.2.2.12.0-3: Minimum performance

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition(Note 1) | Correlation matrix and antenna configuration(Note 2) | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB)(Note 3) |
|  | TRxP #1 | TRxP #2 |  |  |  |  |  |  |  |
| 1-1 | R.PDSCH.2-3.3 TDD | R.PDSCH.2-3.4 TDD | 40 / 30 | 64QAM, 0.50 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 70 | 20.4 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 | | | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.12.

###### 5.2.2.2.12\_1 2Rx TDD FR1 PDSCH Multiple-DCI based transmission scheme performance - 2x2 MIMO for both SA and NSA

5.2.2.2.12\_1.1 Test purpose

To verify the PDSCH performance when UE is configured two different values of CORESETPoolIndex in ControlResourceSet and when UE receives multiple PDCCHs scheduling PDSCHs.

5.2.2.2.12\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *multiDCI-MultiTRP-r16*.

5.2.2.2.12\_1.3 Test description

Same test description as in clause 5.2.2.1.12\_1.3 with the following exception:

- Table 5.2.2.2.12\_1.4-1 instead of 5.2.2.1.12\_1.4-1

- Table 5.2.2.2.12\_1.3-1 instead of Table 5.2.2.1.12\_1.3.3\_1-8

Table 5.2.2.2.12\_1.3-1: *CSI-ResourcePeriodicityAndOffset* for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots40 | 20 | For CSI-RS resources 1,2,5,6 |  |
| Slots40 | 21 | For CSI-RS resources 3,4,7,8 |  |
| } |  |  |  |

5.2.2.2.12\_1.4 Test requirement

Table 5.2.2.2.12.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.12\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.12\_1.4-1: Test requirement

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition(Note 1) | Correlation matrix and antenna configuration(Note 2) | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB)(Note 3) |
|  | TRxP #1 | TRxP #2 |  |  |  |  |  |  |  |
| 1-1 | R.PDSCH.2-3.3 TDD | R.PDSCH.2-3.4 TDD | 40 / 30 | 64QAM, 0.50 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 70 | 21.4 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 | | | | | | | | | |

##### 5.2.2.2.13 2Rx TDD FR1 PDSCH Single-DCI based FDM scheme A performance

5.2.2.2.13.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.13.0-3, with the addition of test parameters in Table 5.2.2.2.13.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.13.0-1.

Table 5.2.2.2.13.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH performance under 2 receive antenna conditions when UE is configured with “FDMSchemeA” in “RepetitionScheme-r16” defined in clause 5.1 of TS 38.214 [12] | 1-1 |

Table 5.2.2.2.13.0-2: Test parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | |
| TRxP #1(Note 1) | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | |  | TRxP #1 | |
| PDCCH configuration | | TCI state | |  | TCI State #1 | |
| CORESETPoolIndex | |  | Not configured | |
| CSI-RS for tracking | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | |
| Density | |  | 3 | |
| CSI-RS periodicity | | Slots | 40 | |
| CSI-RS offset | | Slots | 20 for CSI-RS resources 1 and 2  21 for CSI-RS resources 3 and 4 | 20 for CSI-RS resources 5 and 6  21 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | |
| Duplex mode | | | |  | TDD | |
| Active DL BWP index | | | |  | 1 | |
| PDSCH configuration | Mapping type | | |  | Type A | |
| k0 | | |  | 0 | |
| Starting symbol (S) | | |  | 2 | |
| Length (L) | | |  | 12 | |
| PRB bundling type | | |  | Static | |
| PRB bundling size | | |  | Wideband | |
| Resource allocation type | | |  | Type 0 | |
| RBG size | | |  | Config2 | |
| VRB-to-PRB mapping type | | |  | Non-interleaved | |
| VRB-to-PRB mapping interleaver bundle size | | |  | N/A | |
| PDSCH DMRS configuration | Antenna port indexes | | |  | 1000,1001 | 1000,1001 |
| TCI state | | |  | TCI State #1 | TCI State #2 |
| DMRS Type | | |  | Type 1 | |
| Number of additional DMRS | | |  | 1 | |
| Maximum number of OFDM symbols for DL front loaded DMRS | | |  | 1 | |
| TCI State #1 | Type 1 QCL information | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | N/A |
| QCL Type |  | Type A | N/A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| TCI State #2 | Type 1 QCL information | | CSI-RS resource |  | N/A | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | Type A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| Timing offset of the second TRxP from the first TRxP | | | | us | -0.25 | |
| Frequency offset of the second TRxP from the first TRxP | | | | Hz | 300 | |
| Number of HARQ Processes | | | |  | 8 | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | | |  | Specific to each TDD UL-DL pattern  and as defined in Annex A.1.2 | |
| Precoding configuration | | | |  | SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity | |
| Note 1: PDSCH transmission is done from both TRxPs | | | | | | |

Table 5.2.2.2.13.0-3: Minimum performance for Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition (Note 1) | Correlation matrix and antenna configuration (Note 2) | Reference value | |
| Fraction of  maximum  throughput  (%) | SNR (dB) (Note 3) |
| 1-1 | R.PDSCH.2-2.5 TDD | 40 / 30 | 16QAM, 0.54 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 70 | 17.6 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 | | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.13.

###### 5.2.2.2.13\_1 2Rx TDD FR1 PDSCH Single-DCI based FDM scheme A performance - 2x2 MIMO for both SA and NSA

5.2.2.2.13\_1.1 Test purpose

To verify the PDSCH performance under 2 receive antenna conditions when UE is configured with “FDMSchemeA” in “RepetitionScheme-r16”.

5.2.2.2.13\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *supportFDM-SchemeA-r16*.

5.2.2.2.13\_1.3 Test description

Same test description as in clause 5.2.2.1.13\_1.3 with the following exception:

- Table 5.2.2.2.13\_1.4-1 instead of 5.2.2.1.13\_1.4-1

- Table 5.2.2.2.13\_1.3-1 instead of Table 5.2.2.1.13\_1.3.3\_1-5

Table 5.2.2.2.13\_1.3-1: *CSI-ResourcePeriodicityAndOffset* for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots40 | 20 | For CSI-RS resources 1,2,5,6 |  |
| Slots40 | 21 | For CSI-RS resources 3,4,7,8 |  |
| } |  |  |  |

5.2.2.2.13\_1.4 Test requirement

Table 5.2.2.2.13.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.13\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.13\_1.4-1: Test requirement

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition (Note 1) | Correlation matrix and antenna configuration (Note 2) | Reference value | |
| Fraction of  maximum  throughput  (%) | SNR (dB) (Note 3) |
| 1-1 | R.PDSCH.2-2.5 TDD | 40 / 30 | 16QAM, 0.54 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 70 | 18.6 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 | | | | | | | | |

##### 5.2.2.2.14 2Rx TDD FR1 PDSCH Single-DCI based Inter-slot TDM scheme performance

5.2.2.2.14.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.14.0-3, with the addition of test parameters in Table 5.2.2.2.14.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.14.0-1.

Table 5.2.2.2.14.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH performance under 2 receive antenna conditions when UE is configured with repetitionNumber-r16 with multiple slot level PDSCH transmission occasions of the same TB with two TCI states defined in clause 5.1 of TS 38.214 [12] | 1-1 |

Table 5.2.2.2.14.0-2: Test parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | |
| TRxP #1(Note 1) | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | |  | TRxP #1 | |
| PDCCH configuration | | TCI state | |  | TCI State #1 | |
| CORESETPoolIndex | |  | Not configured | |
| CSI-RS for tracking | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | |
| Density | |  | 3 | |
| CSI-RS periodicity | | Slots | 40 | |
| CSI-RS offset | | Slots | 20 for CSI-RS resources 1 and 2  21 for CSI-RS resources 3 and 4 | 20 for CSI-RS resources 5 and 6  21 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | |
| Duplex mode | | | |  | TDD | |
| Active DL BWP index | | | |  | 1 | |
| PDSCH configuration | Mapping type | | |  | Type A | |
| k0 | | |  | 0 | |
| Starting symbol (S) | | |  | 2 | |
| Length (L) | | |  | 12 | |
| Repetition number | | |  | 2 | |
| PRB bundling type | | |  | Static | |
| PRB bundling size | | |  | 2 | |
| Resource allocation type | | |  | Type 0 | |
| RBG size | | |  | Config2 | |
| VRB-to-PRB mapping type | | |  | Non-interleaved | |
| VRB-to-PRB mapping interleaver bundle size | | |  | N/A | |
| PDSCH DMRS configuration | Antenna port indexes | | |  | 1000 | 1000 |
| TCI state | | |  | TCI State #1 | TCI State #2 |
| DMRS Type | | |  | Type 1 | |
| Number of additional DMRS | | |  | 1 | |
| Maximum number of OFDM symbols for DL front loaded DMRS | | |  | 1 | |
| TCI State #1 | Type 1 QCL information | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | N/A |
| QCL Type |  | Type A | N/A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| TCI State #2 | Type 1 QCL information | | CSI-RS resource |  | N/A | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | Type A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| Timing offset of the second TRxP from the first TRxP | | | | us | 1 | |
| Frequency offset of the second TRxP from the first TRxP | | | | Hz | 300 | |
| Number of HARQ Processes | | | |  | 4 | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | | |  | Specific to each TDD UL-DL pattern  and as defined in Annex A.1.2 (Note 2) | |
| Precoding configuration | | | |  | SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity | |
| Note 1: PDSCH transmission is done from both TRxPs  Note 2: ACK/NACK feedback is generated for PDSCH on slot i, where mod(i,10) = {2, 4, 6}. | | | | | | |

Table 5.2.2.2.14.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition (Note 1) | Correlation matrix and antenna configuration (Note 2) | Reference value | |
| BLER (%) | SNR (dB) (Note 4) |
| 1-1 | R.PDSCH.2-16.2 TDD | 40 / 30 | 16QAM, 0.54 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 1 (Note 3) | 2.8 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block.  Note 4: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 | | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.14.

###### 5.2.2.2.14\_1 2Rx TDD FR1 PDSCH Single-DCI based Inter-slot TDM scheme performance - 2x2 MIMO for both SA and NSA

5.2.2.2.14\_1.1 Test purpose

To verify the PDSCH performance under 2 receive antenna conditions when UE is configured with repetitionNumber-r16 with multiple slot level PDSCH transmission occasions of the same TB with two TCI states.

5.2.2.2.14\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *supportTDM-SchemeA-r16*.

5.2.2.2.14\_1.3 Test description

Same test description as in clause 5.2.2.1.14\_1.3 with the following exception:

- Table 5.2.2.2.14\_1.4-1 instead of 5.2.2.1.14\_1.4-1

- Table 5.2.2.2.14\_1.3-1 instead of Table 5.2.2.1.14\_1.3.3\_1-5

Table 5.2.2.2.14\_1.3-1: *CSI-ResourcePeriodicityAndOffset* for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots40 | 20 | For CSI-RS resources 1,2,5,6 |  |
| Slots40 | 21 | For CSI-RS resources 3,4,7,8 |  |
| } |  |  |  |

5.2.2.2.14\_1.4 Test requirement

Table 5.2.2.2.14.0-3 defines the primary level settings.

The residual BLER specified in Note 3 of Table 5.2.2.2.14\_1.4-1 test shall meet or be lower than the specified value in Table 5.2.2.2.14\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.14\_1.4-1: Test requirement for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition (Note 1) | Correlation matrix and antenna configuration (Note 2) | Reference value | |
| BLER (%) | SNR (dB) (Note 4) |
| 1-1 | R.PDSCH.2-16.2 TDD | 40 / 30 | 16QAM, 0.54 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 1 (Note 3) | 3.8 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block.  Note 4: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 | | | | | | | | |

##### 5.2.2.2.15 2Rx TDD FR1 PDSCH mapping type A performance on band with shared spectrum access

5.2.2.2.15.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.15-3, with the addition of test parameters in Table 5.2.2.2.15-2 and the downlink physical channel setup according to Annex C.3.1.

Table 5.2.2.2.15.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH performance for UE supporting operations in shared spectrum access | 1-1, 1-2, 1-3, 1-4 |

Table 5.2.2.2.15.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| DL transmission model | |  | As specified in B.5 |
| Downlink Model Parameters | SSB Q factor(Note 2) |  | 8 |
| Downlink transmission duration values | Slots | {2,4,6,7} |
| Occupied OFDM symbols in slot other than the last slot of the downlink duration | Symbols | 14 |
| Occupied OFDM symbols in the last slot of the downlink duration | Symbols | {6,9,12,14} (Note 1) |
| Downlink period | ms | 5 |
| LBT failure probability (*pLBT*) |  | 0.25 |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S) |  | 2 |
| PDSCH aggregation factor |  | 1 |
| PRB bundling type |  | Static |
| PRB bundling size |  | 2 |
| Resource allocation type |  | Type 0 |
| RBG size |  | Config2 |
| VRB-to-PRB mapping type |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
| dmrs-AdditionalPosition |  | pos1 |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Number of HARQ Processes | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern  and as defined in Annex A.1.2 |
| Note 1: If DL Transmission duration is 2 Slot, the occupied OFDM symbols in the last slot of the downlink duration is 14.  Note 2: SSB Q Factor indicates the QCL relation between SS/PBCH blocks, and equals (see 38.213, Section 4.1). | | | |

Table 5.2.2.2.15.0-3: Minimum performance for Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-18.1 TDD | 20 / 30 | 16QAM, 0.48 | FR1.30-7 | TDLA30-10 | 2x2, ULA Low | 70 | 13.8 |
| 1-2 | R.PDSCH.2-18.2 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-7 | TDLA30-10 | 2x2, ULA Low | 70 | 14.1 |
| 1-3 | R.PDSCH.2-18.3 TDD | 60 / 30 | 16QAM, 0.48 | FR1.30-7 | TDLA30-10 | 2x2, ULA Low | 70 | 14.2 |
| 1-4 | R.PDSCH.2-18.4 TDD | 80 / 30 | 16QAM, 0.48 | FR1.30-7 | TDLA30-10 | 2x2, ULA Low | 70 | 14.5 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.15.

##### 5.2.2.2.15\_1 2Rx TDD FR1 PDSCH mapping type A performance on band with shared spectrum access – 2x2 MIMO for both NSA and SA

5.2.2.2.15\_1.1 Test purpose

To verify the PDSCH mapping Type A performance under 2 receive antenna conditions on a band with shared spectrum access and with different channel bandwidth, for a specific fading channel model for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput.

5.2.2.2.15\_1.2 Test applicability

This test applies to all types of UE release 16 and forward supporting NR/5GC and NR-U and supporting UL shared channel access.

This test also applies to all types of UE release 16 and forward supporting EN-DC and NR-U and supporting UL shared channel access.

5.2.2.2.15\_1.3 Test description

5.2.2.2.15\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

Test point selection: largest supported channel bandwidth as per clause 5.1.1.9.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.2.2.15.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for NR/5GC with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for EN-DC according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.15\_1.3.3.

5.2.2.2.15\_1.3.2 Test procedure

For UE’s supporting semi-static channel access

1. The downlink signal transmission is as per the parameters defined in Table 5.2.2.2.15.0-2 and as referenced in B.5.1

2. SS transmits PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to Tables 5.2.2.2.15\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

3. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.2.15\_1.4-1 as appropriate.

4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause TBD. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table TBD in Annex G clause TBD.

For UE’s supporting dynamic channel access

1. The downlink signal transmission is as per the parameters defined in Table 5.2.2.2.15.0-2 and as referenced in B.5.1

2. SS transmits PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to Tables 5.2.2.2.15\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

3. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.2.15\_1.4-1 as appropriate.

4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause TBD. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table TBD in Annex G clause TBD.

5.2.2.2.15\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.2.2.15\_1.3.3\_1 Message exceptions for NR/5GC

Same as 5.2.2.2.1\_1.3.3\_1 with following exceptions.

Table 5.2.2.2.15\_1.3.3\_1-1: ServingCellConfigCommon

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-168 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfigCommon ::= SEQUENCE { |  |  |  |
| channelAccessMode-r16 CHOICE { |  |  |  |
| dynamic | NULL | gNB to configure dynamic or semi Static mode depending on UE support | SharedSpectrum-DynChAccessMode |
| semiStatic | SemiStaticChannelAccessConfig-r16 | SharedSpec-trum-Semi-StaticChAccessMode |
| ssb-PositionQCL-r16 { | SSB-PositionQCL-Relation-r16 |  | SharedSpectrum |
|  |  |  |  |
|  |  |  |  |
| } |  |  |  |

Table 5.2.2.2.15\_1.3.3\_1-2: SemiStaticChannelAccessConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-165A | | | |
| Information Element | Value/remark | Comment | Condition |
| SemiStaticChannelAccessConfig-r16 ::= SEQUENCE { |  |  |  |
| Period-r16 | ms5 |  | channelAccessMode-r16 is semiStatic |
| } |  |  |  |

Table 5.2.2.2.15\_1.3.3\_1-3: *SSB-PositionQCL-Relation*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-186A | | | |
| Information Element | Value/remark | Comment | Condition |
| SSB-PositionQCL-Relation-r16 | n8 |  |  |

5.2.2.2.15\_1.3.3\_2 Message exceptions for EN-DC

Same as in Clause 5.2.2.2.15\_1.3.3\_1

5.2.2.2.15\_1.4 Test requirement

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.15\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.15\_1.4-1: Test requirements for Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-18.1 TDD | 20 / 30 | 16QAM, 0.48 | FR1.30-7 | TDLA30-10 | 2x2, ULA Low | 70 | 14.8 |
| 1-2 | R.PDSCH.2-18.2 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-7 | TDLA30-10 | 2x2, ULA Low | 70 | 15.1 |
| 1-3 | R.PDSCH.2-18.3 TDD | 60 / 30 | 16QAM, 0.48 | FR1.30-7 | TDLA30-10 | 2x2, ULA Low | 70 | 15.2 |
| 1-4 | R.PDSCH.2-18.4 TDD | 80 / 30 | 16QAM, 0.48 | FR1.30-7 | TDLA30-10 | 2x2, ULA Low | 70 | 15.5 |

##### 5.2.2.2.16 2Rx TDD FR1 for PDSCH with inter-cell interference performance

5.2.2.2.16.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.16.0-3, with the addition of test parameters in Table 5.2.2.2.16.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.16.0-1.

Table 5.2.2.2.16.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH performance under 2 receive antenna conditions, when transmission from the serving cell is interfered by 1 or 2 interfering cells. | 1-1, 1-2 |

Table 5.2.2.2.16.0-2: Test parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | | |
|  | |  | Cell 1 | Cell 2 | Cell 3 |
|  | |  | Enabled | Enabled | Enabled for test 1-1  Disabled for test 1-2 |
| Duplex mode | |  | TDD | | |
| TDD UL-DL pattern | |  | FR1.30-1 | | |
| Active DL BWP index | |  | 1 | | |
| Physical cell ID | |  | 0 | 1 | 2 |
| Transmission rank | |  | 1 | Random rank with 70% and 30% probability for rank 1 and rank 2 | Random rank with 70% and 30% probability for rank 1 and rank 2 for Test 1-1  N/A for Test 1-2 |
| Time offset to Cell 1 | | us | N/A | 1.5 | -0.5 |
| Frequency shift to Cell 1 | | Hz | N/A | 300 | -100 |
| Interference Model | |  | N/A | As specified in B.6.2 | |
| INR (Note 2) | | dB | N/A | 7.77 for Test 1-1  7.58 for Test 1-2 | 2.29 for Test 1-1  N/A for Test 1-2 |
| SSB configuration | SSB position in burst |  | First SSB in Slot #0 | First SSB in Slot #0 for Test 1-1  Second SSB in Slot #0 for Test 1-2 | First SSB in Slot #0 for Test 1-1  N/A for Test 1-2 |
|  | SSB periodicity | ms | 20 | 20 | 20 |
| PDSCH configuration | Mapping type |  | Type A | | |
|  | k0 |  | 0 | | |
|  | Starting symbol (S) |  | 2 | | |
|  | Length (L) |  | 12 | | |
|  | PDSCH aggregation factor |  | 1 | | |
|  | PRB bundling type |  | Static | | |
|  | PRB bundling size |  | 2 | | |
|  | Resource allocation type |  | Type 0 | | |
|  | RBG size |  | Config2 | | |
|  | VRB-to-PRB mapping type |  | Non-interleaved | | |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A | | |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 | | |
|  | Number of additional DMRS |  | 1 | | |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 | | |
| Number of HARQ Processes | |  | 8 | | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 | | |
| Note 1: Cell 1 is the serving cell, Cell 2, 3 are interference cells.  Note 2: INR is defined in Annex B.6.1 | | | | | |

Table 5.2.2.2.16.0-3: Minimum performance for PDSCH with rank 1 and with inter-cell interference

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Cell1 | Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-2.1 TDD | 40 / 30 | 16QAM, 0.48 | TDLC300-100 | 2x2, ULA Low | 70 | 15.7 |
| 1-2 | R.PDSCH.2-2.1 TDD | 40 / 30 | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 12.6 |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: Bandwidth/ Subcarrier spacing, Propagation Condition, Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.16.

5.2.2.2.16\_1 2Rx TDD FR1 for PDSCH with inter-cell interference performance – 2x2 MIMO for both NSA and SA

5.2.2.2.16\_1.1 Test purpose

To verify the PDSCH performance under 2 receive antenna conditions, when transmission from the serving cell is interfered by 1 or 2 interfering cells.

5.2.2.2.16\_1.2 Test applicability

Test 1-1 and test 1-2 applies to all types of NR UEs and E-UTRAN UEs supporting EN-DC for release 15 and release 16 supporting MMSE-IRC processing for scenarios with inter-cell and intra-cell inter-user interference.

Test 1-1 and test 1-2 applies to all types of release 17 and forward NR UEs and E-UTRAN UEs supporting EN-DC.

5.2.2.2.16\_1.3 Test description

5.2.2.2.16\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the serving cell and interfering cells are set up according to Table 5.2-1 and Table 5.2.2.2.16.0-2 as appropriate.

3. Downlink signals for NR serving cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.16\_1.3.3.

5.2.2.2.16\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.2.2.16\_1.4-2. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR for the serving cell and interfering cells according to Table 5.2.2.2.16\_1.4-2.

3. Measure the average throughput on the serving cell for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

4. Repeat steps from 1 to 3 for each subtest in Tables 5.2.2.2.16\_1.4-2 as appropriate.

5.2.2.2.16\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.2.2.16\_1.3.3\_1 Message exceptions for SA

No message exceptions for SA

5.2.2.2.16\_1.3.3\_1 Message exceptions for NSA

No message exceptions for NSA

5.2.2.2.16\_1.4 Test requirement

Tables 5.2.2.2.16\_1.4-1 and 5.2.2.2.16\_1.4-2 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.16\_1.4-2 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.16\_1.4-1: Test parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | | |
|  | |  | Cell 1 | Cell 2 | Cell 3 |
|  | |  | Enabled | Enabled | Enabled for test 1-1  Disabled for test 1-2 |
| Duplex mode | |  | TDD | | |
| TDD UL-DL pattern | |  | FR1.30-1 | | |
| Active DL BWP index | |  | 1 | | |
| Physical cell ID | |  | 0 | 1 | 2 |
| Transmission rank | |  | 1 | Random rank with 70% and 30% probability for rank 1 and rank 2 | Random rank with 70% and 30% probability for rank 1 and rank 2 for Test 1-1  N/A for Test 1-2 |
| Time offset to Cell 1 | | us | N/A | 1.5 | -0.5 |
| Frequency shift to Cell 1 | | Hz | N/A | 300 | -100 |
| Interference Model | |  | N/A | As specified in B.6.2 | |
| INR (Note 2) | | dB | N/A | 7.77+0.8 for Test 1-1  7.58+0.8 for Test 1-2 | 2.29+0.8 for Test 1-1  N/A for Test 1-2 |
| SSB configuration | SSB position in burst |  | First SSB in Slot #0 | First SSB in Slot #0 for Test 1-1  Second SSB in Slot #0 for Test 1-2 | First SSB in Slot #0 for Test 1-1  N/A for Test 1-2 |
|  | SSB periodicity | ms | 20 | 20 | 20 |
| PDSCH configuration | Mapping type |  | Type A | | |
|  | k0 |  | 0 | | |
|  | Starting symbol (S) |  | 2 | | |
|  | Length (L) |  | 12 | | |
|  | PDSCH aggregation factor |  | 1 | | |
|  | PRB bundling type |  | Static | | |
|  | PRB bundling size |  | 2 | | |
|  | Resource allocation type |  | Type 0 | | |
|  | RBG size |  | Config2 | | |
|  | VRB-to-PRB mapping type |  | Non-interleaved | | |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A | | |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 | | |
|  | Number of additional DMRS |  | 1 | | |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 | | |
| Number of HARQ Processes | |  | 8 | | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 | | |
| Note 1: Cell 1 is the serving cell, Cell 2, 3 are interference cells.  Note 2: INR is defined in Annex B.6.1 | | | | | |

Table 5.2.2.2.16\_1.4-2: Test requirement for PDSCH with rank 1 and with inter-cell interference

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Cell1 | Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-2.1 TDD | 40 / 30 | 16QAM, 0.48 | TDLC300-100 | 2x2, ULA Low | 70 | 17.4 |
| 1-2 | R.PDSCH.2-2.1 TDD | 40 / 30 | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.4 |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: Bandwidth/ Subcarrier spacing, Propagation Condition, Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | |

##### 5.2.2.2.17 2Rx TDD FR1 for PDSCH with intra-cell inter user interference

5.2.2.2.17.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.17.0-3, with the addition of test parameters in Table 5.2.2.2.17.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.17.0-1.

Table 5.2.2.2.17.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH performance under 2 receive antenna conditions when the PDSCH transmission of target UE is interfered by co-scheduled UE | 1-1 |

Table 5.2.2.2.17.0-2: Test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Target UE | Co-scheduled UE |
| Duplex mode | |  | TDD | |
| Active DL BWP index | |  | 1 | |
| PDSCH configuration | Mapping type |  | Type A | |
| k0 |  | 0 | |
| Starting symbol (S) |  | 2 | |
| Length (L) |  | 12 | |
| PDSCH aggregation factor |  | 1 | |
| PRB bundling type |  | Static | |
| PRB bundling size |  | 2 | |
| Resource allocation type |  | Type 0 | |
| RBG size |  | Config2 | |
| VRB-to-PRB mapping type |  | Non-interleaved | |
| VRB-to-PRB mapping interleaver bundle size |  | N/A | |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 | |
| Number of additional DMRS |  | 1 | |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 | |
| Antenna ports indexes |  | 1000 | 1001 |
| Number of PDSCH DMRS CDM group(s) without data |  | 1 | 1 |
| PDSCH & PDSCH DMRS Precoding configuration | |  | Single Panel Type I, Randomized precoder selection for every PRB bundle and updated per slot, with equal probability of each applicable i1/i2 combination or codebook  Index, chosen from section 5.2.2.2.1 of TS 38.214 [12]. | Single Panel Type I, Randomized precoder selection for every PRB bundle and updated per slot, with equal probability of each applicable i1/i2 combination or codebook  Index, chosen from section 5.2.2.2.1 of TS 38.214 [12].Any column of precoder matrix is not equal to any column of precoder matrix of Target UE |
| MU-MIMO Beamforming Model | |  | As specified in B.4.2 | |
| Number of HARQ Processes | |  | 8 | N/A |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 | N/A |
| Note 1: The DMRS scrambling ID is same for both target UE and Co-scheduled UE. | | | | |

Table 5.2.2.2.17.0-3: Minimum performance for PDSCH of target UE with intra-cell inter user interference

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target UE | Co-scheduled UE | Fraction of  maximum  throughput  (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-2.1 TDD | 40 / 30 | 16QAM, 0.48 | Random 16QAM symbols | FR1.30-1 | TDLC300-100 | 2x2, ULA Low | 70 | 18.9 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.17.

###### 5.2.2.2.17\_1 2Rx TDD FR1 for PDSCH with intra cell inter user interference performance – 2x2 MIMO for both NSA and SA

5.2.2.2.17\_1.1 Test purpose

To verify the PDSCH performance under 2 receive antenna conditions, when the PDSCH transmission of target UE is interfered by co-scheduled UE.

5.2.2.2.17\_1.2 Test applicability

Test 1-1 applies to all types of NR UEs and E-UTRAN UEs supporting EN-DC for release 15 and release 16 supporting MMSE-IRC processing for scenarios with inter-cell and intra-cell inter-user interference.

Test 1-1 applies to all types of release 17 and forward NR UEs and E-UTRAN UEs supporting EN-DC.

5.2.2.2.17\_1.3 Test description

5.2.2.2.17\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.2.2.17.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.17\_1.3.3.

5.2.2.2.17\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.2.2.17\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.2.17\_1.4-1 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

4. Repeat steps from 1 to 3 for each subtest in Tables 5.2.2.2.17\_1.4-1 as appropriate.

5.2.2.2.17\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.2.2.17\_1.3.3\_1 Message exceptions for SA

No message exceptions for SA

5.2.2.2.17\_1.3.3\_1 Message exceptions for NSA

No message exceptions for NSA

5.2.2.2.17\_1.4 Test requirement

Table 5.2.2.2.17\_1.4-1: Test requirement for PDSCH of target UE with intra-cell inter user interference

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target UE | Co-scheduled UE | Fraction of  maximum  throughput  (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-2.1 TDD | 40 / 30 | 16QAM, 0.48 | Random 16QAM symbols | FR1.30-1 | TDLC300-100 | 2x2, ULA Low | 70 | 19.8 |

##### 5.2.2.2.18 2Rx TDD FR1 PDSCH performance for RedCap

5.2.2.2.18.1 Test Purpose

To verify the PDSCH performance mapping Type A under 2 receive antenna conditions with different channel models and MCSs for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput.

5.2.2.2.18.2 Test applicability

This test case applies to all types of NR UE release 17 and forward that support NR RedCap.

5.2.2.2.18.3 Minimum conformance requirements

The performance requirements are specified in Tables 5.2.2.2.18.3-3 and 5.2.2.2.18.3-4, with the addition of test parameters in Table 5.2.2.2.18.3-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.18.3-1.

Table 5.2.2.2.18.3-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions and with different channel models, MCSs and number of MIMO layers for RedCap UEs | 1-1, 1-2, 1-3, 2-1 |

Table 5.2.2.2.18.3-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | Specific to each Reference channel |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 4 for Test 1-1  2 for other tests |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 2 for Test 1-1  1 for other tests |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CSI-RS for tracking | First OFDM symbol in the PRB used for CSI-RS |  | Table 5.2-1 |
|  | CSI-RS periodicity | Slots | Table 5.2-1 |
|  | CSI-RS offset | Slots | Table 5.2-1 |
|  | Frequency Occupation |  | Table 5.2-1 |
| Number of HARQ Processes | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |

Table 5.2.2.2.18.3-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-1.5 TDD | 20 / 30 | QPSK, 0.30 | FR1.30-1A | TDLB100-400 | 2x2, ULA Low | 70 | 0.2 |
| 1-2 | R.PDSCH.2-4.2 TDD | 20 / 30 | 256QAM, 0.82 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 70 | 25.3 |
| 1-3 | R.PDSCH.2-26.1 TDD | 20 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLC300-100 | 2x2, ULA Low | 70 | 8.1 |

Table 5.2.2.2.18.3-4: Minimum performance for Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 2-1 | R.PDSCH.2-27.1 TDD | 20 / 30 | 64QAM, 0.50 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 70 | 20.1 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.18.

5.2.2.2.18.4 Test description

5.2.2.2.18.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2.3 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2A-1 to Table 5.2A-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.2.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.18.4.3.

5.2.2.2.18.4.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.2.2.18.5-1 and 5.2.2.2.18.5-2. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.2.18.5-1 and 5.2.2.2.18.5-2 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail according to Table G.1.5-1 in Annex G.1.5.

4. Repeat steps from 1 to 3 for each test points in Tables 5.2.2.2.18.5-1 and 5.2.2.2.18.5-2 as appropriate.

5.2.2.2.18.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2 with the following exceptions:

Table 5.2.2.2.18.4.3-1: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | n4, n2 | n4 for test 1-1 | test 1-1 |
|  | Not present | n2 will be used by default | test point other than test 1-1 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.2.18.4.3-2: CSI-ResourcePeriodicityAndOffset for CSI Tracking

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots40 | 20 (for CSI-RS resources 1 and 2)  21 (for CSI-RS resources 3 and 4) | CSI-RS offset:  20 for CSI-RS resources 1 and 2  21 for CSI-RS resources 3 and 4  CSI-RS periodicity: 40 slots |  |
| } |  |  |  |

Table 5.2.2.2.18.4.3-3: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | n8 |  |  |
| } |  |  |  |

5.2.2.2.18.5 Test Requirement

Tables 5.2.2.2.18.5-1 and 5.2.2.2.18.5-2 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.2 for each throughput test shall meet or exceed the specified value in Tables 5.2.2.2.18.5-1 and 5.2.2.2.18.5-2 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.18.5-1: Test Requirements for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-1.5 TDD | 20 / 30 | QPSK, 0.30 | FR1.30-1A | TDLB100-400 | 2x2, ULA Low | 70 | 1.1 |
| 1-2 | R.PDSCH.2-4.2 TDD | 20 / 30 | 256QAM, 0.82 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 70 | 26.3 |
| 1-3 | R.PDSCH.2-26.1 TDD | 20 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLC300-100 | 2x2, ULA Low | 70 | 9.0 |

Table 5.2.2.2.18.5-2: Test Requirements for Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 2-1 | R.PDSCH.2-27.1 TDD | 20 / 30 | 64QAM, 0.50 | FR1.30-1 | TDLA30-10 | 2x2, ULA Low | 70 | 21.1 |

##### 5.2.2.2.19 2Rx TDD FR1 for PDSCH CRS interference mitigation under NR-LTE coexistence scenario

5.2.2.2.19.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.19.0-4, with the addition of test parameters in Tables 5.2.2.2.19.0-2 and 5.2.2.2.19.0-3 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.19.0-1.

Table 5.2.2.2.19.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH CRS interference mitigation performance under 2 receive antenna conditions with CRS rate matching configured for the serving cell | 1-1 |

Table 5.2.2.2.19.0-2: Tests parameters for serving cell PDSCH

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 3 |
|  | Length (L) |  | 9 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 1 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CRS for rate  Matching (Note 1) | LTE carrier centre subcarrier location |  | Same as NR carrier centre subcarrier location |
| LTE carrier BW | Hz | 20 |
| Number of antenna ports |  | 4 |
| v-shift |  | 0 |
| Number of HARQ Processes | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |
| Note 1: No MBSFN is configured on LTE carrier.  Note 2: Network-based CRS interference mitigation is disabled on LTE carrier | | | |

Table 5.2.2.2.19.0-3: Tests parameter for interference cells

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1 | Cell 2 |
| Duplex mode | |  | TDD | TDD |
| TDD UL-DL pattern | |  | DSUDDDSUDD  S = 10D + 2G + 2U | DSUDDDSUDD  S = 10D + 2G + 2U |
| INR (Note 1) | | dB | 10.45 | 4.6 |
| LTE Bandwidth | | MHz | 20 | 20 |
| Carrier centre subcarrier location | |  | Same as the NR serving carrier centre subcarrier location | Same as the NR serving carrier centre subcarrier location |
| Cyclic Prefix | |  | Normal | Normal |
| Physical cell ID | |  | 1 | 2 |
| CRS pattern | Number of antenna ports |  | 4 | 4 |
| v-shift |  | 1 | 2 |
| Downlink power allocation |  | dB | -6 | -6 |
|  | dB | -6 | -6 |
| σ | dB | 0 | 0 |
| PDSCH transmission mode | |  | TM4 | TM4 |
| PDSCH loading level | | % | 20% probability of occurrence of LTE data transmission in time domain, and full bandwidth allocation in frequency domain. | 20% probability of occurrence of LTE data transmission in time domain, and full bandwidth allocation in frequency domain. |
| Transmission rank | | % | 80% and 20% probability for rank 1 and rank 2 respectively | 80% and 20% probability for rank 1 and rank 2 respectively |
| Interference model | |  | As specified in clause B.7 | As specified in clause B.7 |
| Time offset to the serving cell | | us | 3 | -1 |
| Frequency offset to the serving cell | | Hz | 300 | -100 |
| Propagation conditions and MIMO configuration (Note 2) | |  | TDLA30-10 ULA Low | TDLA30-10 ULA Low |
| Precoding granularity | | PRB | 8 | 8 |
| Note 1: Defined in B.6.1  Note 2: The channel for the LTE interference cells and the serving cell are independent. | | | | |

Table 5.2.2.2.19.0-4: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of  maximum  throughput  (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-1.3 TDD | 20 / 15 | 16QAM, 0.48 | FR1.15-1 | TDLA30-10 | 4x2, ULA Low | 70 | 12.5 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.19.

##### 5.2.2.2.19\_1 2Rx TDD FR1 for PDSCH CRS interference mitigation under NR-LTE coexistence scenario – 4x2 MIMO for both NSA and SA

Editor’s Note: This test case is incomplete in following aspects

- Message exceptions are FFS

- MU/TT analysis is pending

5.2.2.2.19\_1.1 Test purpose

To verify PDSCH CRS interference mitigation performance under 2 receive antenna conditions with CRS rate matching configured for the serving cell.

5.2.2.2.19\_1.2 Test applicability

This test applies to all types of NR UE release 17 and forward that support *CRS-IM-DSS-15kHzSCS-r17.*

5.2.2.2.19\_1.3 Test description

5.2.2.2.19\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Tables 5.2.2.2.19.0-2 and 5.2.2.2.19.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.19\_1.3.3.

5.2.2.2.19\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.2.2.19\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.2.2.19\_1.4-1 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

4. Repeat steps from 1 to 3 for each subtest in Table 5.2.2.2.19\_1.4-1 as appropriate.

5.2.2.2.19\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.2.2.19\_1.3.3\_1 Message exceptions for SA

FFS

5.2.2.2.19\_1.3.3\_1 Message exceptions for NSA

FFS

5.2.2.2.19\_1.4 Test requirement

Table 5.2.2.2.19\_1.4-1: Test requirement for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of  maximum  throughput  (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-1.3 TDD | 20 / 15 | 16QAM, 0.48 | FR1.15-1 | TDLA30-10 | 4x2, ULA Low | 70 | 12.5+TT |

##### 5.2.2.2.20 2Rx TDD FR1 for PDSCH with inter cell CRS interference

5.2.2.2.20.0 Minimum conformance requirements

The performance requirements are specified in Tables 5.2.2.2.20.0-4 and 5.2.2.2.20.0-6, with the addition of test parameters in Tables 5.2.2.2.20.0-2 and 5.2.2.2.20.0-3 and the downlink physical channel setup according to Annex C.3.1.

The requirements for UE capable of performing CRS-IM with the assistance of network signalling on LTE channel bandwidth are specified in Table 5.2.2.2.20.0-4.

The requirements for UE capable of performing CRS-IM without the assistance of network signalling on LTE channel bandwidth are specified in Table 5.2.2.2.20.0-6.

The test purposes are specified in Table 5.2.2.2.20.0-1.

Table 5.2.2.2.20.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH performance under 2 receive antenna conditions when PDSCH is interfered by inter cell CRS signal | 1-1, 1-2, 2-1, 2-2 |

Table 5.2.2.2.20.0-2: Tests parameters for serving cell PDSCH

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 12 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 1 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Number of HARQ Processes | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |

Table 5.2.2.2.20.0-3: Tests parameter for interference cells

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1 | Cell 2 |
| Duplex mode | |  | TDD | TDD |
| TDD UL-DL pattern | |  | DSUDDDSUDD  S = 10D + 2G + 2U | DSUDDDSUDD  S = 10D + 2G + 2U |
| INR (Note 5) | | dB | 10.45 | 4.6 |
| LTE Bandwidth (Note 6) | | MHz | 20 | 20 |
| Carrier centre subcarrier location (Note 7) | |  | Same as the NR serving carrier centre subcarrier location | Same as the NR serving carrier centre subcarrier location |
| Cyclic Prefix | |  | Normal | Normal |
| Physical cell ID | |  | 1 | 2 |
| CRS pattern | Number of antenna ports |  | 4 | 4 |
| v-shift |  | 1 | 2 |
| Downlink power allocation |  | dB | -6 | -6 |
|  | dB | -6 | -6 |
| σ | dB | 0 | 0 |
| PDSCH transmission mode | |  | TM4 | TM4 |
| PDSCH loading level | | % | 20% probability of occurrence of LTE data transmission in time domain, and full bandwidth allocation in frequency domain for test 1-1.  10% probability of occurrence of LTE data transmission in time domain, and full bandwidth allocation in frequency domain for test 1-2. | 20% probability of occurrence of LTE data transmission in time domain, and full bandwidth allocation in frequency domain for test 1-1.  10% probability of occurrence of LTE data transmission in time domain, and full bandwidth allocation in frequency domain for test 1-2. |
| Transmission rank | | % | 80% and 20% probability for rank 1 and rank 2 respectively | 80% and 20% probability for rank 1 and rank 2 respectively |
| Interference model | |  | As specified in clause B.7 | As specified in clause B.7 |
| Time offset to the serving cell | | us | 3 for test 1-1  1.5 for test 1-2 | -1 for test 1-1  -0.5 for test 1-2 |
| Frequency offset to the serving cell | | Hz | 300 | -100 |
| Propagation conditions and MIMO configuration (Note 1) | |  | TDLA30-10 ULA Low | TDLA30-10 ULA Low |
| Precoding granularity | | PRB | 8 | 8 |
| Note 1: The channel for the LTE interference cells and the serving cell are independent.  Note 2: No MBSFN is configured on LTE carrier.  Note 3: Network-based CRS interference mitigation is disabled on LTE carrier.  Note 4: The start of transmission of LTE frame is delayed by 2 LTE subframes with respect to the start of transmission of NR frame  Note 5: Defined in B.6.1  Note 6: This parameter is informed to UE via network assistance signalling for Test 1-1 and 1-2 in Table 5.2.2.2.20.0-4.  Note 7 Single entry is included in IE *LTE-NeighCellsCRS-AssistInfoList-r17* that applies for both cells for cases with network signalling assistance | | | | |

Table 5.2.2.2.20.0-4: Minimum performance for Rank 1 with the assistance of network signalling on LTE channel bandwidth

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of  maximum  throughput  (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-4.1 TDD | 20 / 15 | 16QAM, 0.48 | FR1.15-1 | TDLA30-10 | 4x2, ULA Low | 70 | 12.3 |
| 1-2 | R.PDSCH.2-25.1 TDD | 20 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLA30-10 | 4x2, ULA Low | 70 | 11.7 |

Table 5.2.2.2.20.0-5: Measurement Gap configurations

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Value |
| Measurement Gap Length (mgl) | ms | 6 |
| Measurement Gap Repetition Period (mgrp) | ms | 40 |
| Gap offset (gapoffset) | ms | 1 |
| Measurement gap timing advance (mgta) | ms | 0 |

Table 5.2.2.2.20.0-6: Minimum performance for Rank 1 without the assistance of network signalling on LTE channel bandwidth

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of  maximum  throughput  (%) | SNR (dB) |
| 2-1 | R.PDSCH.1-4.2 TDD | 20 / 15 | 16QAM, 0.48 | FR1.15-1 | TDLA30-10 | 4x2, ULA Low | 70 | 12.3 |
| 2-2 | R.PDSCH.2-26.1 TDD | 20 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLA30-10 | 4x2, ULA Low | 70 | 11.7 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.20.

##### 5.2.2.2.20\_1 2Rx TDD FR1 for PDSCH with inter cell CRS interference scenario – 4x2 MIMO for both NSA and SA

Editor’s Note: This test case is incomplete in following aspects

- Message exceptions are FFS

- MU/TT analysis is pending

5.2.2.2.20\_1.1 Test purpose

To verify PDSCH performance under 2 receive antenna conditions when PDSCH is interfered by inter cell CRS signal.

5.2.2.2.20\_1.2 Test applicability

Tests 2-1 and 2-2 apply to all types of NR UE release 17 and forward that support *CRS-IM-nonDSS-15kHzSCS-r17 and/or crs-IM-nonDSS-30kHzSCS-r17.*

Tests 1-1 and 1-2 apply to all types of NR UE release 17 and forward that support *CRS-IM-nonDSS-NWA-15kHzSCS-r17 and/or* crs*-IM-nonDSS-NWA-30kHzSCS-r17.*

5.2.2.2.20\_1.3 Test description

5.2.2.2.20\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Tables 5.2.2.2.20.0-2 and 5.2.2.2.20.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.20\_1.3.3.

6. For UE capable of performing CRS-IM without the assistance of network signalling on LTE channel bandwidth, ensure the network configures an inter-RAT LTE measurement object of the interfering cells to the tested UE. Inter-RAT measurement is configured at the beginning of the test and applied throughout the test with gap pattern configurations according to Table 5.2.2.2.20.0-5. PDSCH is not scheduled, and throughput is not counted during 4.64s after the beginning of test. PDSCH is not scheduled in the measurement gaps.

5.2.2.2.20\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.2.2.20\_1.4-1 and 5.2.2.2.20\_1.4-2 as appropriate. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.2.20\_1.4-1 and 5.2.2.2.20\_1.4-2 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

4. Repeat steps from 1 to 3 for each subtest in Tables 5.2.2.2.20\_1.4-1 and 5.2.2.2.20\_1.4-2 as appropriate.

5.2.2.2.20\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.2.2.20\_1.3.3\_1 Message exceptions for SA

FFS

5.2.2.2.20\_1.3.3\_1 Message exceptions for NSA

FFS

5.2.2.2.20\_1.4 Test requirement

Table 5.2.2.2.20\_1.4-1: Test requirement for Rank 1 with the assistance of network signalling on LTE channel bandwidth

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of  maximum  throughput  (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-4.1 TDD | 20 / 15 | 16QAM, 0.48 | FR1.15-1 | TDLA30-10 | 4x2, ULA Low | 70 | 12.3+TT |
| 1-2 | R.PDSCH.2-25.1 TDD | 20 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLA30-10 | 4x2, ULA Low | 70 | 11.7+TT |

Table 5.2.2.2.20\_1.4-2: Test requirement for Rank 1 without the assistance of network signalling on LTE channel bandwidth

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of  maximum  throughput  (%) | SNR (dB) |
| 2-1 | R.PDSCH.1-4.2 TDD | 20 / 15 | 16QAM, 0.48 | FR1.15-1 | TDLA30-10 | 4x2, ULA Low | 70 | 12.3+TT |
| 2-2 | R.PDSCH.2-26.1 TDD | 20 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLA30-10 | 4x2, ULA Low | 70 | 11.7+TT |

##### 5.2.2.2.21 2Rx TDD FR1 PDSCH HST-SFN Scheme A performance - 2x2 MIMO for both SA and NSA

Editor's Note: This test cases is incomplete in following aspects:

- Minimum test time is FFS.

- SNR requirement is within square brackets.

5.2.2.2.21.1 Test Purpose

To verify the UE performance in the HST-SFN Scheme A scenario.

5.2.2.2.21.2 Test applicability

This test case applies to all types of NR UE release 17 and forward that support SFN scheme A for PDCCH scheduling SFN Scheme A PDSCH.

5.2.2.2.21.3 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.21.3-3, with the addition of test parameters in Table 5.2.2.2.21.3-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.21.3-1.

**Table 5.2.2.2.21.3-1: Tests purpose**

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify UE performance in the HST-SFN Scheme A scenario defined in B.3.5 | 1-1 |

**Table 5.2.2.2.21.3-2: Test parameters**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Value** |
| Duplex mode | | |  | TDD |
| Active DL BWP index | | |  | 1 |
| PDCCH configuration | TCI state | |  | Note 1 |
| PDSCH configuration | Mapping type | |  | Type A |
| k0 | |  | 0 |
| Starting symbol (S) | |  | 2 |
| Length (L) | |  | 12 |
| PDSCH aggregation factor | |  | 1 |
| PRB bundling type | |  | Static |
| PRB bundling size | |  | 2 |
| Resource allocation type | |  | Type 0 |
| RBG size | |  | Config2 |
| VRB-to-PRB mapping type | |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size | |  | N/A |
| TCI state | |  | Note 1 |
| PDSCH DMRS configuration | DMRS Type | |  | Type 1 |
| Number of additional DMRS | |  | 2 |
| Maximum number of OFDM symbols for DL front loaded DMRS | |  | 1 |
| CSI-RS for tracking | Resource set #1 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 5 for CSI-RS resource 1 and 3  l0 = 9 for CSI-RS resource 2 and 4 |
| CSI-RS periodicity | Slots | 20 for CSI-RS resource 1,2,3,4. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4 |
| QCL info |  | TCI state #3 |
| Resource set #2 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 6 for CSI-RS resource 5 and 6  l0 = 10 for CSI-RS resource 7 and 8 |
| CSI-RS periodicity | Slots | 20 for CSI-RS resource 5,6,7,8. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8 |
| QCL info |  | TCI state #4 |
| Resource set #3 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 4 for CSI-RS resource 9 and 10  l0 = 8 for CSI-RS resource 11 and 12 |
| CSI-RS periodicity | Slots | 20 for CSI-RS resource 9,10,11,12. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 9 and 10 2 for CSI-RS resource 11 and 12 |
| QCL info |  | TCI state #5 |
| NZP CSI-RS for CSI acquisition | Resource set #4 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 12 |
| CSI-RS periodicity | Slots | 40 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #0 |
| Resource set #5 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 13 |
| CSI-RS periodicity | Slots | 40 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #1 |
| Resource set #6 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 7 |
| CSI-RS periodicity | Slots | 40 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #2 |
| TCI state #0 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking Resource set #1' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #2 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 9 from 'CSI-RS for tracking Resource set #3' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #3 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #4 | Type 1 QCL information | SSB index |  | SSB #1 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #5 | Type 1 QCL information | SSB index |  | SSB #2 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| Number of HARQ Processes | | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |
| Note 1: SSB # (k mod 3), CSI-RS (for tracking) resource set # ((k mod 3) + 1) and CSI-RS (for CSI acquisition) resource set # ((k mod 3) + 4) are transmitted by kth RRH.  Codepoint #0 is activated when UE receives PDCCH/PDSCH from RRH#3k and RRH#3k+1 with TCI States TCI state #0, TCI State #1.  Codepoint #1 is activated when UE receives PDCCH/PDSCH from RRH#3k+1 and RRH#3k+2 with TCI States TCI state #1, TCI State #2.  Codepoint #2 is activated when UE receives PDCCH/PDSCH from RRH#3k+2 and RRH#3k+3 with TCI States TCI state #2, TCI State #0. | | | | |

**Table 5.2.2.2.21.3-3: Minimum performance for HST-SFN Scheme A**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | | |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.2-30.1 TDD | 40 / 30 | 16QAM, 0.48 | HST-SFN Scheme A | 2x2 | 70 | [12.9] |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.21.

5.2.2.2.21.4 Test description

5.2.2.2.21.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.2.2.21.3-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.3.5.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.21.4.3.

5.2.2.2.21.4.2 Test procedure

1. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.2.21.5-1 as appropriate.

2. SS is configured to transmit SSB and CSI-RS continuously and schedule PDSCH and PDCCH transmission according to Note 1 in 5.2.2.2.21.3-2. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.2.2.21.5-1. The SS sends downlink MAC padding bits on the DL RMC.

Note: All TCI states are known to the UE through configuration inside RrcReconfiguration. There is no need to configure additional L1-RSRP measurements.

3. Send MAC CE command “Enhanced TCI States Indication for UE-specific PDCCH MAC CE” according to the timing described in Note 1 of Table 5.2.2.2.21.3-2 to active TCI state codepoint 0, 1 or 2 for PDCCH periodically. PDSCH is automatically associated with TCI state codepoint 0, 1 or 2 as tci-PresentInDCI is not present. TCI states 3, 4 and 5 for SSBs are automatically activated through relation of QCL-Info in NZP CSI-RS.

4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.2.2.21.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.2.2.21.4.3.1 Message exceptions for SA

Table 5.2.2.2.21.4.3.1-1: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | Not present | n2 is used | Test 1-1 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.2.21.4.3.1-2: DMRS-DownlinkConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24 | | | |
| Information Element | Value/remark | Comment | Condition |
| DMRS-DownlinkConfig ::= SEQUENCE { |  |  |  |
| dmrs-AdditionalPosition | pos2 |  | Test 1-1 |
| } |  |  |  |

Table 5.2.2.2.21.4.3.1-3: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | n8 |  | Test 1-1 |
| } |  |  |  |

Table 5.2.2.2.21.4.3.1-4: NZP-CSI-RS-Resource for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| nzp-CSI-RS-ResourceId | i-1 for CSI-RS resource #i, i=1,2,3,4,5,6,7,8,9,10,11,12 | for test 1-1 |  |
| qcl-InfoPeriodicCSI-RS | 3 for CSI-RS resource #1, #2, #3, #4  4 for CSI-RS resource #5, #6, #7, #8  5 for CSI-RS resource #9, #10, #11, #12 | for test 1-1:  TCI-StateId for TCI-State #3 for CSI-RS resource #1, #2, #3, #4  TCI-StateId for TCI-State #4 for CSI-RS resource #5, #6, #7, #8  TCI-StateId for TCI-State #5 for CSI-RS resource #9, #10, #11, #12 |  |
| } |  |  |  |

Table 5.2.2.2.21.4.3.1-5: CSI-RS-ResourceMapping for TRS (Table 5.2.2.2.21.4.3.1-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 with condition TRS | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 5 for CSI-RS resource #1 and #3  9 for CSI-RS resource #2 and #4  6 for CSI-RS resource #5 and #6  10 for CSI-RS resource #7 and #8  4 for CSI-RS resource #9 and #10  8 for CSI-RS resource #11 and #12 | for test 1-1:  l0 = 5 for CSI-RS resource 1 and 3  l0 = 9 for CSI-RS resource 2 and 4  l0 = 6 for CSI-RS resource 5 and 6  l0 = 10 for CSI-RS resource 7 and 8  l0 = 4 for CSI-RS resource 9 and 10  l0 = 8 for CSI-RS resource 11 and 12 |  |
| } |  |  |  |

Table 5.2.2.2.21.4.3.1-6: CSI-ResourcePeriodicityAndOffset for CSI Tracking (Table 5.2.2.2.21.4.3.1-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots20 | 1 for CSI-RS resource #1, #2, #5, #6, #9, #10  2 for CSI-RS resource #3 #4, #7, #8, #11, #12 | For test 1-1:  periodicity:  20 slots.  offset:  1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4  1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8  1 for CSI-RS resource 9 and 10 2 for CSI-RS resource 11 and 12 |  |
| } |  |  |  |

Table 5.2.2.2.21.4.3.1-7: NZP-CSI-RS-ResourceSet for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-12 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-ResourceSet ::= SEQUENCE { |  |  |  |
| nzp\_CSI\_ResourceSetId | 0 for Resource set #1  1 for Resource set #2  2 for Resource set #3 | For test 1-1 |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 4 entries | For test 1-1 | Resource set #1 |
| NZP-CSI-RS-ResourceId[1] | 0 | entry 1  CSI-RS resource #1 |  |
| NZP-CSI-RS-ResourceId[2] | 1 | entry 2  CSI-RS resource #2 |  |
| NZP-CSI-RS-ResourceId[3] | 2 | entry 3  CSI-RS resource #3 |  |
| NZP-CSI-RS-ResourceId[4] | 3 | entry 4  CSI-RS resource #4 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 4 entries | For test 1-1 | Resource set #2 |
| NZP-CSI-RS-ResourceId[1] | 4 | entry 1  CSI-RS resource #5 |  |
| NZP-CSI-RS-ResourceId[2] | 5 | entry 2  CSI-RS resource #6 |  |
| NZP-CSI-RS-ResourceId[3] | 6 | entry 3  CSI-RS resource #7 |  |
| NZP-CSI-RS-ResourceId[4] | 7 | entry 4  CSI-RS resource #8 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 4 entries | For test 1-1 | Resource set #3 |
| NZP-CSI-RS-ResourceId[1] | 8 | entry 1  CSI-RS resource #9 |  |
| NZP-CSI-RS-ResourceId[2] | 9 | entry 2  CSI-RS resource #10 |  |
| NZP-CSI-RS-ResourceId[3] | 10 | entry 3  CSI-RS resource #11 |  |
| NZP-CSI-RS-ResourceId[4] | 11 | entry 4  CSI-RS resource #12 |  |
| } |  |  |  |
| trs-Info | true |  |  |
| } |  |  |  |

Table 5.2.2.2.21.4.3.1-8: NZP-CSI-RS-Resource for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-14 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| nzp-CSI-RS-ResourceId | 12 for CSI-RS resource #13  13 for CSI-RS resource #14  14 for CSI-RS resource #15 | for test 1-1 |  |
| qcl-InfoPeriodicCSI-RS | 0 for CSI-RS resource #13  1 for CSI-RS resource #14  2 for CSI-RS resource #15 | for test 1-1:  TCI-State #0 for CSI-RS resource #13  TCI-State #1 for CSI-RS resource #14  TCI-State #2 for CSI-RS resource #15 |  |
| } |  |  |  |

Table 5.2.2.2.21.4.3.1-9: CSI-RS-ResourceMapping for CSI Acquisition (Table 5.2.2.2.21.4.3.1-8)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 12 for CSI-RS resource #13  13 for CSI-RS resource #14  7 for CSI-RS resource #15 | for test 1-1  l0=12 for CSI-RS resource #13  l0=13 for CSI-RS resource #14  l0=7 for CSI-RS resource #15 |  |
| } |  |  |  |

Table 5.2.2.2.21.4.3.1-10: CSI-ResourcePeriodicityAndOffset for CSI Acquisition (Table 5.2.2.2.21.4.3.1-8)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-16 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots40 | 0 | For test 1-1  periodicity = 40 slots.  offset = 0 slots |  |
| } |  |  |  |

Table 5.2.2.2.21.4.3.1-11: NZP-CSI-RS-ResourceSet for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-18 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-ResourceSet ::= SEQUENCE { |  |  |  |
| nzp\_CSI\_ResourceSetId | 3 for Resource set #4  4 for Resource set #5  5 for Resource set #6 | For test 1-1 |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry | For test 1-1 | Resource set #4 |
| NZP-CSI-RS-ResourceId[1] | 12 | entry 1  CSI-RS resource #13 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry | For test 1-1 | Resource set #5 |
| NZP-CSI-RS-ResourceId[1] | 13 | entry 1  CSI-RS resource #14 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry | For test 1-1 | Resource set #5 |
| NZP-CSI-RS-ResourceId[1] | 14 | entry 1  CSI-RS resource #15 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.2.2.21.4.3.1-12: *TCI-State*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-190 | | | |
| Information Element | Value/remark | Comment | Condition |
| TCI-State ::= SEQUENCE { |  |  |  |
| tci-StateId | 0 for TCI state #0  1 for TCI state #1  2 for TCI state #2  3 for TCI state #3  4 for TCI state #4  5 for TCI state #5 | For test 1-1 |  |
| qcl-Type1 SEQUENCE { |  |  |  |
| bwp-Id | BWP-Id of active BWP |  | TCI state #0, TCI state #1, TCI state #2 |
|  | Not present |  | TCI state #3, TCI state #4, TCI state #5 |
| referenceSignal CHOICE { |  |  |  |
| csi-rs | 0 | CSI-RS resource #1 | TCI state #0 |
|  | 4 | CSI-RS resource #5 | TCI state #1 |
|  | 8 | CSI-RS resource #9 | TCI state #2 |
| ssb | 0 | SSB #0 | TCI state #3 |
|  | 1 | SSB #1 | TCI state #4 |
|  | 2 | SSB #2 | TCI state #5 |
| } |  |  |  |
| qcl-Type | typeA |  | TCI state #0, TCI state #1, TCI state #2 |
|  | typeC |  | TCI state #3, TCI state #4, TCI state #5 |
| } |  |  |  |
| } |  |  |  |

5.2.2.2.21.4.3.2 Message exceptions for NSA

Same as 5.2.2.2.21.4.3.1.

5.2.2.2.21.5 Test Requirement

Tables 5.2.2.2.21.3-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.21.5-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.21.5-1: Test Requirements for HST-SFN Scheme A

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | | |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.2-30.1 TDD | 40 / 30 | 16QAM, 0.48 | HST-SFN Scheme A | 2x2 | 70 | [13.5] |

##### 5.2.2.2.22 2Rx TDD FR1 PDSCH HST-SFN Scheme B performance - 2x2 MIMO for both SA and NSA

Editor's Note: This test cases is incomplete in following aspects:

- Minimum test time is FFS.

- SNR requirement is within square brackets.

5.2.2.2.22.1 Test Purpose

To verify the UE performance in the HST-SFN Scheme B scenario.

5.2.2.2.22.2 Test applicability

This test case applies to all types of NR UE release 17 and forward that support SFN scheme B for PDCCH scheduling SFN Scheme B PDSCH.

5.2.2.2.22.3 Minimum conformance requirements

The performance requirements are specified in Table 5.2.2.2.22.3-3, with the addition of test parameters in Table 5.2.2.2.22.3-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.22.3-1.

**Table 5.2.2.2.22.3-1: Tests purpose**

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify UE performance in the HST-SFN Scheme B scenario defined in B.3.6 | 1-1 |

**Table 5.2.2.2.22.3-2: Test parameters**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Value** |
| Duplex mode | | |  | TDD |
| Active DL BWP index | | |  | 1 |
| PDCCH configuration | TCI state | |  | Note 1 |
| PDSCH configuration | Mapping type | |  | Type A |
| k0 | |  | 0 |
| Starting symbol (S) | |  | 2 |
| Length (L) | |  | Specific to each Reference channel |
| PDSCH aggregation factor | |  | 1 |
| PRB bundling type | |  | Static |
| PRB bundling size | |  | 2 |
| Resource allocation type | |  | Type 0 |
| RBG size | |  | Config2 |
| VRB-to-PRB mapping type | |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size | |  | N/A |
| TCI state | |  | Note 1 |
| PDSCH DMRS configuration | DMRS Type | |  | Type 1 |
| Number of additional DMRS | |  | 2 |
| Maximum number of OFDM symbols for DL front loaded DMRS | |  | 1 |
| CSI-RS for tracking | Resource set #1 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 5 for CSI-RS resource 1 and 3  l0 = 9 for CSI-RS resource 2 and 4 |
| CSI-RS periodicity | Slots | 20 for CSI-RS resource 1,2,3,4. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4 |
| QCL info |  | TCI state #3 |
| Frequency Occupation |  | Start PRB 0 |
|  | Number of PRB = 52 |
| Resource set #2 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 6 for CSI-RS resource 5 and 6  l0 = 10 for CSI-RS resource 7 and 8 |
| CSI-RS periodicity | Slots | 20 for CSI-RS resource 5,6,7,8. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8 |
| QCL info |  | TCI state #4 |
| Frequency Occupation |  | Start PRB 0 |
|  | Number of PRB = 52 |
| Resource set #3 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 4 for CSI-RS resource 9 and 10  l0 = 8 for CSI-RS resource 11 and 12 |
| CSI-RS periodicity | Slots | 20 for CSI-RS resource 9,10,11,12. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 9 and 10 2 for CSI-RS resource 11 and 12 |
| QCL info |  | TCI state #5 |
| Frequency Occupation |  | Start PRB 0 |
|  | Number of PRB = 52 |
| NZP CSI-RS for CSI acquisition | Resource set #4 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 12 |
| CSI-RS periodicity | Slots | 40 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #0 |
| Resource set #5 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 13 |
| CSI-RS periodicity | Slots | 40 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #1 |
| Resource set #6 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 7 |
| CSI-RS periodicity | Slots | 40 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #2 |
| TCI state #0 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking Resource set #1' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #2 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 9 from 'CSI-RS for tracking Resource set #3' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #3 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #4 | Type 1 QCL information | SSB index |  | SSB #1 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #5 | Type 1 QCL information | SSB index |  | SSB #2 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| Number of HARQ Processes | | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |
| Note 1: SSB # (k mod 3), CSI-RS (for tracking) resource set # ((k mod 3) + 1) and CSI-RS (for CSI acquisition) resource set # ((k mod 3) + 4) are transmitted by kth RRH.  Codepoint#0 {TCI state #0, TCI State #1} is activated when UE receives PDCCH/PDSCH from RRH#3k and RRH#3k+1.  Codepoint#1 {TCI state #1, TCI State #2} is activated when UE receives PDCCH/PDSCH from RRH#3k+1 and RRH#3k+2.  Codepoint#2 {TCI state #2, TCI State #0} is activated when UE receives PDCCH/PDSCH from RRH#3k+2 and RRH#3k+3.  The second indicated TCI state in each codepoint is not used for quasi co-location parameters {Doppler shift, Doppler spread}. | | | | |

**Table 5.2.2.2.22.3-3: Minimum performance for HST-SFN Scheme B**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | | |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.2-30.1 TDD | 40/30 | 16QAM, 0.48 | HST-SFN-Scheme B | 2x2 | 70 | 11.8 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.2.2.22.

5.2.2.2.22.4 Test description

5.2.2.2.22.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.2.2.22.3-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.3.6.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.2.22.4.3.

5.2.2.2.22.4.2 Test procedure

1. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.2.22.5-1 as appropriate.

2. SS is configured to transmit SSB and CSI-RS continuously and schedule PDSCH and PDCCH transmission according to Note 1 in 5.2.2.2.22.3-2. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.2.2.22.5-1. The SS sends downlink MAC padding bits on the DL RMC.

Note: All TCI states are known to the UE through configuration inside RrcReconfiguration. There is no need to configure additional L1-RSRP measurements.

3. Send MAC CE command “Enhanced TCI States Indication for UE-specific PDCCH MAC CE” according to the timing described in Note 1 of table 5.2.2.2.22.5-1 to active TCI state codepoint 0, 1 or 2 for PDCCH periodically. PDSCH is automatically associated with TCI state codepoint 0, 1 or 2 as tci-PresentInDCI is not present. TCI states 3, 4 and 5 for SSBs are automatically activated through relation of QCL-Info in NZP CSI-RS.

4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.2.2.22.4.3 Message contents

Same as message contents in 5.2.2.2.21.4.3.

5.2.2.2.22.5 Test Requirement

Tables 5.2.2.2.22.3-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.22.5-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.2.2.22.5-1: Test Requirements for HST-SFN Scheme B

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | | |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.2-30.1 TDD | 40/30 | 16QAM, 0.48 | HST-SFN-Scheme B | 2x2 | 70 | 12.4 |

### 5.2.3 4RX requirements

#### 5.2.3.1 FDD

##### 5.2.3.1.1 4Rx FDD FR1 PDSCH mapping Type A performance

5.2.3.1.1.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.1.0-3, Table 5.2.3.1.1.0-4, Table 5.2.3.1.1.0-5, Table 5.2.3.1.1.0-6 and Table 5.2.3.1.1.0-7, with the addition of test parameters in Table 5.2.3.1.1.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.3.1.1.0-1.

Table 5.2.3.1.1.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions and with different channel models, MCSs and number of MIMO layers | 1-1, 1-2, 1-3, 1-5, 1-6, 1-7, 1-8, 2-1, 2-2, 3-1, 4-1 |
| Verify the PDSCH mapping Type A HARQ soft combining performance under 4 receive antenna conditions. | 1-4 |
| Verify the PDSCH mapping Type A performance requirements for Enhanced Receiver Type 1 under 4 receive antenna conditions. | 5-1 |

Table 5.2.3.1.1.0-2: Test parameters

| Parameter | | Unit | Value |
| --- | --- | --- | --- |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S) |  | 2 |
| Length (L) |  | 12 |
| PDSCH aggregation factor |  | 1 |
| PRB bundling type |  | Static |
| PRB bundling size |  | 4 for Test 1-1 WB for Test 3-1  2 for other tests |
| Resource allocation type |  | Test 1-2: Type 1 with start RB = 23, LRBs = 6  Other test: Type 0 |
| RBG size |  | Test 1-2: N/A  Other tests: Config2 |
| VRB-to-PRB mapping type |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
| Number of additional DMRS |  | 2 for Test 1-1, 1-5, 1-6, 1-7  1 for other tests |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CSI-RS for tracking | CSI-RS periodicity | Slots | Test 1-5, 1-6, 1-7: 10 for CSI-RS resource 1,2,3,4.  Other tests: Table 5.2-1. |
| CSI-RS offset | Slots | Test 1-5, 1-6, 1-7: 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4.  Other tests: Table 5.2-1. |
| Number of HARQ Processes | |  | 8 for Test 1-4, 2-1  4 for other tests |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 |

Table 5.2.3.1.1.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-1.1 FDD | 10 / 15 | QPSK, 0.30 | TDLB100-400 | 2x4, ULA Low | 70 | -3.5 |
| 1-2 | R.PDSCH.1-1.2 FDD | 10 / 15 | QPSK, 0.30 | TDLC300-100 | 2x4, ULA Low | 70 | -2.9 |
| 1-3 | R.PDSCH.1-4.1 FDD | 10 / 15 | 256QAM, 0.82 | TDLA30-10 | 2x4, ULA Low | 70 | 21.0 |
| 1-4 | R.PDSCH.1-2.1 FDD | 10 / 15 | 16QAM, 0.48 | TDLC300-100 | 2x4, ULA Low | 30 | -1.5 |
| 1-5 | R.PDSCH.1-8.1 FDD | 10 / 15 | 16QAM, 0.48 | HST-750 | 1x4 | 70 | 3.3 |
| 1-6 | R.PDSCH.1-8.2 FDD | 10 / 15 | 64QAM, 0.43 | HST-972 | 1x4 | 70 | [6.8] |
| 1-7 | R.PDSCH.1-8.1 FDD | 10 / 15 | 16QAM, 0.48 | TDLC300-600 | 2x4 | 70 | [5.8] |
| 1-8 | R.PDSCH.1-17.1 FDD | 10 / 15 | 1024QAM, 0.79 | TDLD30-5 | 2x4, ULA Low | 70 | 26.3 |

Table 5.2.3.1.1.0-4: Minimum performance for Rank 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 2-1 | R.PDSCH.1-3.1 FDD | 10 / 15 | 64QAM, 0.50 | TDLA30-10 | 2x4, ULA Low | 70 | 13.5 |
| 2-2 | R.PDSCH.2-1.1 FDD | 20 / 30 | 64QAM, 0.50 | TDLA30-10 | 2x4, ULA Low | 70 | 13.7 |

Table 5.2.3.1.1.0-5: Minimum performance for Rank 3

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 3-1 | R.PDSCH.1-2.3 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 4x4, ULA Low | 70 | 11.0 |

Table 5.2.3.1.1.0-6: Minimum performance for Rank 4

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 4-1 | R.PDSCH.1-2.4 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 4x4, ULA Low | 70 | 15.6 |

Table 5.2.3.1.1.0-7: Minimum performance for Rank 3 and Enhanced Receiver Type 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5-1 | R.PDSCH.1-2.3 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 4x4, ULA Medium A | 70 | 22.3 |

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2.3.1.1.

###### 5.2.3.1.1\_1 4Rx FDD FR1 PDSCH mapping Type A performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.1.1\_1.1 Test purpose

To verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 1 and Rank 2 scenarios.

5.2.3.1.1\_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports.

5.2.3.1.1\_1.3 Test description

5.2.3.1.1\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Tables 5.2-1 and 5.2.3.1.1.0-2 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, *Test Mode On* or (EN-DC, DC bearer *MCG* and *SCG, Connected without release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.1\_1.3.3.

5.2.3.1.1\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.1.1.0-3 and Table 5.2.3.1.1.0-4. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.1.1\_1.4-1 and 5.2.3.1.1\_1.4-2 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

4. Repeat steps from 1 to 4 for each subtest in Tables 5.2.3.1.1\_1.4-1 and 5.2.3.1.1\_1.4-2 as appropriate.

5.2.3.1.1\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.1.1\_1.3.3\_1 Message exceptions for SA

Table 5.2.3.1.1\_1.3.3\_1-1: *BWP*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| BWP ::= SEQUENCE { |  |  |  |
| locationAndBandwidth | 13750 | For Test 2-2  (20MHz BW, SCS 30kHz) |  |
| 14025 | For other tests  (10MHz BW, SCS 15kHz) |  |
| } |  |  |  |

Table 5.2.3.1.1\_1.3.3\_1-2: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| resourceAllocation | resourceAllocationType0 | resourceAllocationType0 for all tests except test 1-2 |  |
| resourceAllocationType1 | resourceAllocationType1 for test 1-2 |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | n4 | n4 for test 1-1 |  |
| wideband | wideband for test 3-1 |  |
| Not present | n2 for other tests |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.1.1\_1.3.3\_1-3: DMRS-DownlinkConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24 | | | |
| Information Element | Value/remark | Comment | Condition |
| DMRS-DownlinkConfig ::= SEQUENCE { |  |  |  |
| dmrs-AdditionalPosition | pos1 | pos1 for all tests except test 1-1, 1-5, 1-6, 1-7 |  |
| Not present | pos2 for test 1-1, 1-5, 1-6, 1-7 |  |
| } |  |  |  |

Table 5.2.3.1.1\_1.3.3\_1-4: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | Not present | n8 for test 1-4, 2.1 |  |
| n4 | n4 for other tests |  |
| } |  |  |  |

Table 5.2.3.1.1\_1.3.3\_1-5: CSI-ResourcePeriodicityAndOffset for CSI Tracking

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-43 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots10 | 1 (for CSI-RS resources 1 and 2)  2 (for CSI-RS resources 3 and 4) | Periodicity 10 slots and offset 1/2 for test 1-5, 1-6, 1-7 |  |
| } |  |  |  |

5.2.3.1.1\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.3.1.1\_1.3.3\_1

5.2.3.1.1\_1.4 Test requirement

Table 5.2.3.1.1.0-3 and Table 5.2.3.1.1.0-4 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.1\_1.4-1 and Table 5.2.3.1.1\_1.4-2 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.1\_1.4-1: Test Requirement for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-1.1 FDD | 10 / 15 | QPSK, 0.30 | TDLB100-400 | 2x4, ULA Low | 70 | -2.6 |
| 1-2 | R.PDSCH.1-1.2 FDD | 10 / 15 | QPSK, 0.30 | TDLC300-100 | 2x4, ULA Low | 70 | -2.0 |
| 1-3 | R.PDSCH.1-4.1 FDD | 10 / 15 | 256QAM, 0.82 | TDLA30-10 | 2x4, ULA Low | 70 | 22.0 |
| 1-4 | R.PDSCH.1-2.1 FDD | 10 / 15 | 16QAM, 0.48 | TDLC300-100 | 2x4, ULA Low | 30 | -0.6 |
| 1-5 | R.PDSCH.1-8.1 FDD | 10 / 15 | 16QAM, 0.48 | HST-750 | 1x4 | 70 | 4.2 |
| 1-6 | R.PDSCH.1-8.2 FDD | 10 / 15 | 64QAM, 0.43 | HST-972 | 1x4 | 70 | 7.7 |
| 1-7 | R.PDSCH.1-8.1 FDD | 10 / 15 | 16QAM, 0.48 | TDLC300-600 | 2x4 | 70 | 6.7 |

Table 5.2.3.1.1\_1.4-2: Test Requirement for Rank 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 2-1 | R.PDSCH.1-3.1 FDD | 10 / 15 | 64QAM, 0.50 | TDLA30-10 | 2x4, ULA Low | 70 | 14.5 |
| 2-2 | R.PDSCH.2-1.1 FDD | 20 / 30 | 64QAM, 0.50 | TDLA30-10 | 2x4, ULA Low | 70 | 14.7 |

###### 5.2.3.1.1\_2 4Rx FDD FR1 PDSCH mapping Type A performance - 4x4 MIMO with baseline receiver for both SA and NSA

5.2.3.1.1\_2.1 Test purpose

To verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 3 and Rank 4 scenarios.

5.2.3.1.1\_2.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports.

5.2.3.1.1\_2.3 Test description

Same test description as in clause 5.2.3.1.1\_1.3 with the following exception:

- Step 1 of test procedure to call for Tables 5.2.3.1.1.0-5 and 5.2.3.1.1.0-6 instead of Tables 5.2.3.1.1.0-3 and 5.2.3.1.1.0-4

Table 5.2.3.1.1\_2.4-1 instead of 5.2.3.1.1\_1.4-1

- Table 5.2.3.1.1\_2.4-2 instead of 5.2.3.1.1\_1.4-2

- Figure A.3.1.7.5 instead of A.3.1.7.4

5.2.3.1.1\_2.4 Test requirement

Table 5.2.3.1.1.0-5 and Table 5.2.3.1.1.0-6 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.1\_2.4-1 and Table 5.2.3.1.1\_2.4-2 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.1\_2.4-1: Test Requirement for Rank 3

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 3-1 | R.PDSCH.1-2.3 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 4x4, ULA Low | 70 | 12.0 |

Table 5.2.3.1.1\_2.4-2: Test Requirement for Rank 4

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 4-1 | R.PDSCH.1-2.4 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 4x4, ULA Low | 70 | 16.6 |

###### 5.2.3.1.1\_3 FFS

###### 5.2.3.1.1\_4 4Rx FDD FR1 PDSCH mapping Type A performance - 4x4 MIMO with enhanced receiver type 1 for both SA and NSA

5.2.3.1.1\_4.1 Test purpose

To verify the PDSCH mapping Type A enhanced performance under 4 receive antenna conditions for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default enhanced receiver type 1 configuration, for Rank 3 scenario.

5.2.3.1.1\_4.2 Test applicability

This test applies to all types of NR UE Rel-15 and forward supporting 4 Rx antenna ports and NR enhanced receiver type 1.

This test also applies to all types of EUTRA UE Rel-15 and forward supporting EN-DC, 4 Rx antenna ports and NR enhanced receiver type 1.

5.2.3.1.1\_4.3 Test description

Same test description as in clause 5.2.3.1.1\_1.3 with the following exception:

- Figure A.3.1.7.5 instead of A.3.1.7.4

Step 1 and 2 of Test procedure as in clause 5.2.3.1.1\_1.3.2 are replaced by:

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.1.1.0-7. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.1.1\_4.4-1 as appropriate.

5.2.3.1.1\_4.4 Test requirement

Table 5.2.3.1.1.0-7 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.1\_4.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.1\_4.4-1: Test Requirement for Rank 3 and Enhanced Receiver Type 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5-1 | R.PDSCH.1-2.3 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 4x4, ULA Medium A | 70 | 23.3 |

###### 5.2.3.1.1\_5 4Rx FDD FR1 PDSCH mapping Type A performance - 2x4 MIMO with baseline receiver for DL1024QAM for both SA and NSA

Editor's Note: Following aspects needs further investigation

- DL EVM of <= 2.5% for f > 4.2 GHz pending further analysis by the TE vendors

###### 5.2.3.1.1\_5.1 Test purpose

Verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions with DL1024QAM for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput for Rank 1 scenario.

5.2.3.1.1\_5.2 Test applicability

This test applies to all types of NR UE release 17 and forward supporting 4 Rx antenna ports and DL1024QAM.

This test also applies to all types of EUTRA UE release 17 and forward supporting EN-DC and 4 Rx antenna ports and DL1024QAM.

5.2.3.1.1\_5.3 Test description

5.2.3.1.1\_5.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Tables 5.2-1 and 5.2.3.1.1.0-2 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On*, *Test Mode On* or (EN-DC, DC bearer *MCG* and *SCG, Connected without release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.1\_5.3.3.

5.2.3.1.1\_5.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.1.1.0-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.1.1\_5.4-1 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.1.1\_5.3.3 Message contents

Message contents are according to 38.508-1 [6] subclauses 4.6.1 and 5.4.2.

5.2.3.1.1\_5.3.3\_1 Message exceptions for NR/5GC

Same as 5.2.3.1.1\_1.3.3\_1 with the following exceptions.

Table 5.2.3.1.1\_5.3.3\_1-1: PDSCH-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| mcs-Table-r17 | qam1024 |  | Test 1-8 |
| } |  |  |  |

5.2.3.1.1\_5.3.3\_2 Message exceptions for EN-DC

Same as 5.2.3.1.1\_5.3.3\_1.

5.2.3.1.1\_5.4 Test requirement

Table 5.2.3.1.1-5.4-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.1\_5.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.1\_5.4-1: Test Requirement for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-8 | R.PDSCH.1-17.1 FDD | 10 / 15 | 1024QAM, 0.79 | TDLD30-5 | 2x4, ULA Low | 70 | 27.2 |

##### 5.2.3.1.2 4Rx FDD FR1 PDSCH mapping Type A and CSI-RS overlapped with PDSCH performance

5.2.3.1.2.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.2.0-3, with the addition of test parameters in Table 5.2.3.1.2.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.2.0-1.

Table 5.2.3.1.2.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions and CSI-RS overlapped with PDSCH | 1-1 |

Table 5.2.3.1.2.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
|  | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 12 |
| PDSCH configuration | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
|  | DMRS Type |  | Type 1 |
| PDSCH DMRS configuration | Number of additional DMRS |  | 1 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| NZP CSI-RS for CSI acquisition | OFDM symbols in the PRB used for CSI-RS |  | l0 = 13 |
|  | CSI-RS periodicity | Slots | 5 |
| ZP CSI-RS for CSI acquisition | Subcarrier index in the PRB used for CSI-RS |  | (k0, k1, k2, k3)=(2, 4, 6, 8) |
|  | Number of CSI-RS ports (X) |  | 8 |
|  | CSI-RS periodicity | Slots | 5 |
| Number of HARQ Processes | |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 |

Table 5.2.3.1.2.0-3: Minimum performance for Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | | Reference value | |
|  |  | Fraction of maximum throughput (%) | | SNR (dB) |
| 1-1 | R.PDSCH.1-5.1 FDD | 10 / 15 | 16QAM, 0.48 | TDLC300-100 | 4x4, ULA Low | 70 | | 9.1 |

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2.3.1.2.

###### 5.2.3.1.2\_1 4Rx FDD FR1 PDSCH mapping Type A and CSI-RS overlapped with PDSCH performance - 4x4 MIMO with baseline receiver for both SA and NSA

5.2.3.1.2\_1.1 Test purpose

To verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration for CSI-RS overlapped with PDSCH scenario.

5.2.3.1.2\_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports.

5.2.3.1.2\_1.3 Test description

5.2.3.1.2\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.5 for TE diagram and clause A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Tables 5.2-1 and 5.2.3.1.2.0-2 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, C.3.1 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 5.2.3.1.2\_1.3.3.

5.2.3.1.2\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.1.2.0-2. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.1.2\_1.4-1 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-12 in Annex G clause G.1.5.

5.2.3.1.2\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 4.6.1 and 5.4.2.

5.2.3.1.2\_1.3.3\_1 Message exceptions for SA

Table 5.2.3.1.2\_1.3.3\_1-1: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | n4 |  |  |
| } |  |  |  |

Table 5.2.3.1.2\_1.3.3\_1-2: NZP CSI-RS-ResourceMapping for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| row4 | 001 | k0=0 |  |
| } |  |  |  |
| firstOFDMSymbolInTimeDomain | 13 | l0 = 13 |  |
| } |  |  |  |

Table 5.2.3.1.2\_1.3.3\_1-3: CSI-ResourcePeriodicityAndOffset for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-16 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots5 | 0 | Periodicity 5 slots and offset 0 |  |
| } |  |  |  |

Table 5.2.3.1.2\_1.3.3\_1-4: ZP CSI-RS-ResourceMapping for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause5.4.2.0-21 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 011110 | (k0, k1, k2, k3)=(2, 4, 6, 8) |  |
| } |  |  |  |
| nrofPorts | P8 | Eight Ports |  |
| firstOFDMSymbolInTimeDomain | 12 | l0 = 12 |  |
| cdm-Type | fd-CDM2 |  |  |
| density CHOICE { |  |  |  |
| one | NULL |  |  |
| } |  |  |  |
| freqBand | CSI-FrequencyOccupation |  |  |
| } |  |  |  |

5.2.3.1.2\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.3.1.2\_1.3.3\_1

5.2.3.1.2\_1.4 Test requirement

Table 5.2.3.1.2.0-3 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.2\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.2\_1.4-1: Test Requirement for Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | | Reference value | |
|  |  | Fraction of maximum throughput (%) | | SNR (dB) |
| 1-1 | R.PDSCH.1-5.1 FDD | 10 / 15 | 16QAM, 0.48 | TDLC300-100 | 4x4, ULA Low | 70 | | 10 |

##### 5.2.3.1.3 4Rx FDD FR1 PDSCH mapping Type B performance

5.2.3.1.3.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.3.0-3, with the addition of test parameters in Table 5.2.3.1.3.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.3.0-1.

Table 5.2.3.1.3.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| PDSCH mapping Type B performance under 4 receive antenna conditions | 1-1 |

Table 5.2.3.1.3.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
|  | Mapping type |  | Type B |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 5 |
|  | Length (L) |  | 7 |
| PDSCH configuration | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
|  | DMRS Type |  | Type 1 |
| PDSCH DMRS configuration | Number of additional DMRS |  | 1 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Number of HARQ Processes | |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 |

Table 5.2.3.1.3.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-1.3 FDD | 10 / 15 | QPSK, 0.30 | TDLA30-10 | 2x4, ULA Low | 70 | -3.8 |

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2.3.1.3.

###### 5.2.3.1.3\_1 4Rx FDD FR1 PDSCH mapping Type B performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.1.3\_1.1 Test purpose

To verify the PDSCH mapping Type B normal performance under 4 receive antenna conditions for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput with baseline receiver configuration.

5.2.3.1.3\_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports and PDSCH mapping type B.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports and PDSCH mapping type B.

5.2.3.1.3\_1.3 Test description

5.2.3.1.3\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Tables 5.2-1 and 5.2.3.1.3.0-2 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, C.3.1 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 5.2.3.1.3\_1.3.3.

5.2.3.1.3\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.1.3.0-2. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.1.3\_1.4-1 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.1.3\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 4.6.1 and 5.4.2.

5.2.3.1.3\_1.3.3\_1 Message exceptions for SA

Table 5.2.3.1.3\_1.3.3\_1-1: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | n4 |  |  |
| } |  |  |  |

Table 5.2.3.1.3\_1.3.3\_1-2: PDSCH-TimeDomainResourceAllocationList

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF { | 2 entry |  |  |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeB |  |  |
| startSymbolAndLength | 89 | Start symbol(S)=5, Length(L)=7 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[2] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | TypeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| } |  |  |  |

5.2.3.1.3\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.3.1.3\_1.3.3\_1

5.2.3.1.3\_1.4 Test requirement

Table 5.2.3.1.3.0-3 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.3\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.3\_1.4-1: Test Requirement for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-1.3 FDD | 10 / 15 | QPSK, 0.30 | TDLA30-10 | 2x4, ULA Low | 70 | -2.8 |

##### 5.2.3.1.4 4Rx FDD FR1 PDSCH Mapping Type A and LTE-NR coexistence performance

5.2.3.1.4.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.4.0-3, with the addition of test parameters in Table 5.2.3.1.4.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.3.1.4.0-1.

Table 5.2.3.1.4.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions with CRS rate matching configured | 1-1, 1-2 |

Table 5.2.3.1.4.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
| NR UL transmission with a 7.5 kHz shift to the LTE raster | |  | true |
| PDCCH configuration | Symbols with PDCCH |  | Symbol# 2 |
|  | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 3 |
|  | Length (L) |  | 9 for Test 1-1 11 for Test 1-2 |
| PDSCH configuration | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
| Position of the first DM-RS for downlink |  | 3 |
|  | Number of additional DMRS |  | 1 |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CRS for rate matching (Note 1) | LTE carrier centre subcarrier location |  | Same as NR carrier centre subcarrier location |
| LTE carrier BW | MHz | 10 |
|  | Number of antenna ports |  | 4 |
| v-shift |  | 0 |
| Number of HARQ Processes | |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 |
| Note 1: No MBSFN is configured on LTE carrier | | | |

Table 5.2.3.1.4.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-7.1 FDD | 10 / 15 | QPSK, 0.30 | TDLA30-10 | 4x4, ULA Low | 70 | -4.0 |
| 1-2 | R.PDSCH.1-7.2 FDD | 10 / 15 | QPSK, 0.30 | TDLA30-10 | 4x4, ULA Low | 70 | -4.0 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.4.

###### 5.2.3.1.4\_1 4Rx FDD FR1 PDSCH Mapping Type A and LTE-NR coexistence performance - 4x4 MIMO with baseline receiver for both SA and NSA

5.2.3.1.4\_1.1 Test purpose

Same as 5.2.2.1.4\_1.1.

5.2.3.1.4\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports and capability IE *rateMatchingLTE-CRS* but not supporting capability IE *additionalDMRS-DL-Alt*.

Test1-1 also applies to all types of EUTRA UE release 15 and forward supporting EN-DC supporting 4 Rx antenna ports and capability IE *rateMatchingLTE-CRS* but not supporting capability IE *additionalDMRS-DL-Alt*.

Test 1-2 applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports and capability IE *additionalDMRS-DL-Alt* and *rateMatchingLTE-CRS*.

Test 1-2 also applies to all types of EUTRA UE release 15 and forward supporting EN-DC supporting 4 Rx antenna ports and capability IE *additionalDMRS-DL-Alt* and *rateMatchingLTE-CRS*.

5.2.3.1.4\_1.3 Test description

5.2.3.1.4\_1.3.1 Initial conditions

Same as 5.2.2.1.4\_1.3.1 with the following exceptions:

- Use Figure A.3.1.7.4 for TE diagram

- Use Figure A.3.2.5 for UE diagram

- Instead of 5.2.2.1.4.x 🡪 refer 5.2.2.3.4.x

5.2.3.1.4\_1.3.2 Test procedure

Same as 5.2.2.1.4\_1.3.2 with the following exceptions:

- Instead of 5.2.2.1.4.x 🡪 refer 5.2.2.3.4.x

5.2.3.1.4\_1.3.3 Message contents

Same as 5.2.2.1.4\_1.3.3.

5.2.3.1.4\_1.3.4 Test requirement

Table 5.2.3.1.4.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.4\_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.4\_1.3.4-1: Test requirement for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-7.1 FDD | 10 / 15 | QPSK, 0.30 | TDLA30-10 | 4x4, ULA Low | 70 | -3.0 |
| 1-2 | R.PDSCH.1-7.2 FDD | 10 / 15 | QPSK, 0.30 | TDLA30-10 | 4x4, ULA Low | 70 | -3.0 |

##### 5.2.3.1.5 4Rx FDD FR1 PDSCH 0.001% BLER performance

5.2.3.1.5.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.5.0-3, with the addition of test parameters in Table 5.2.3.1.5.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.5.0-1.

Table 5.2.3.1.5.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH 0.001% BLER performance under 4 receive antenna conditions | 1-1 |

Table 5.2.3.1.5.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
|  | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 12 |
| PDSCH configuration | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 1 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Maximum number of HARQ transmission | |  | 1 |
| Number of HARQ Processes | |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 |

Table 5.2.3.1.5.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target BLER | SNR (dB) |
| 1-1 | R.PDSCH.1-1.4 FDD | 10 / 15 | QPSK, 0.59 | AWGN | 1x4, ULA Low | 0.001% | 0.7 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.5.

###### 5.2.3.1.5\_1 4Rx FDD FR1 PDSCH 0.001% BLER performance - 1x4 MIMO with baseline receiver for both SA and NSA

5.2.3.1.5\_1.1 Test purpose

To verify the PDSCH 0.001% BLER performance under 4 receive antenna conditions.

5.2.3.1.5\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *dl-64QAM-MCS-TableAlt* and capability IE *cqi-TableAlt*.

5.2.3.1.5\_1.3 Test description

5.2.3.1.5\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.3 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.3.1.5.0-2 and Table 5.2.3.1.5.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.5\_1.3.3.

5.2.3.1.5\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.1.5.0-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.1.5\_1.3.4-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.4. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.4.3-1 in Annex G.

5.2.3.1.5\_1.3.3 Message contents

5.2.3.1.5\_1.3.3\_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.3.1.5\_1.3.3\_1-1: PDSCH-TimeDomainResourceAllocationList

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF { | 2 entry |  | FR1 |
| mcs-Table | qam64LowSE |  |  |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  |  |  |
| k0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| } |  |  |  |

5.2.3.1.5\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.3.1.5\_1.3.3\_1.

5.2.3.1.5\_1.3.4 Test requirement

Table 5.2.3.1.5.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.5\_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.5\_1.3.4-1: Test requirement for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target BLER | SNR (dB) |
| 1-1 | R.PDSCH.1-1.4 FDD | 10 / 15 | QPSK, 0.59 | AWGN | 1x4, ULA Low | 0.001% | 1.8 |

##### 5.2.3.1.6 4Rx FDD FR1 PDSCH repetitions over multiple slots performance

5.2.3.1.6.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.6.0-3, with the addition of test parameters in Table 5.2.3.1.6.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.6.0-1.

Table 5.2.3.1.6.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH repetitions over multiple slots performance under 4 receive antenna conditions | 1-1 |

Table 5.2.3.1.6.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S) |  | 2 |
| Length (L) |  | 12 |
| PDSCH aggregation factor |  | 2 |
| PRB bundling type |  | Static |
| PRB bundling size |  | 2 |
| Resource allocation type |  | Type 0 |
| RBG size |  | Config2 |
| VRB-to-PRB mapping type |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
| Number of additional DMRS |  | 1 |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Number of HARQ Processes | |  | 4 |
| The number of slots between final repetition of PDSCH and corresponding HARQ-ACK information | |  | 2 |

Table 5.2.3.1.6.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target BLER | SNR (dB) |
| 1-1 | R.PDSCH.1-11.1 FDD | 10 / 15 | 16QAM, 0.54 | TDLA30-10 | 2x4, ULA Low | 1%(Note 1) | -2.3 |
| Note 1: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block. | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.6.

###### 5.2.3.1.6\_1 4Rx FDD FR1 PDSCH repetitions over multiple slots performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.1.6\_1.1 Test purpose

To Verify the PDSCH repetitions over multiple slots performance under 4 receive antenna conditions.

5.2.3.1.6\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE dl-64QAM-MCS-TableAlt and *pdsch-RepetitionMultiSlots-r16*.

Test 1-1 also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and capability IE dl-64QAM-MCS-TableAlt and pdsch-RepetitionMultiSlots-r16.

5.2.3.1.6\_1.3 Test description

5.2.3.1.6\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and section A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.3.1.6.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.6\_1.3.3.

5.2.3.1.6\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.1.6.0-3. The SS sends downlink MAC padding bits on the DL RMC. The UE may expect that the TB is repeated with same symbol allocation among each of the *pdsch-AggregationFactor* consecutive slots.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.1.6\_1.3.4-1.

3. Measure the BLER for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of correctly and incorrectly received transport bloks based on ACK/NACK feedback on the UL during each subtest and decide pass or fail according to clause G.1.5 and Table G.1.5-1a in Annex G clause G.1.5.

5.2.3.1.6\_1.3.3 Message contents

5.2.3.1.6\_1.3.3\_1 Message exceptions for SA

Same as 5.2.2.1.6\_1.3.3\_1.

5.2.3.1.6\_1.3.3\_2 Message exceptions for SA

Same as 5.2.2.1.6\_1.3.3\_1.

5.2.3.1s.6\_1.3.4 Test requirement

Table 5.2.3.1.6.0-3 defines the primary level settings.

The target BLER for the downlink reference measurement channels specified in Annex A.3.2.1 for each BLER test shall meet or exceed the specified value in Table 5.2.3.1.6\_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.6\_1.3.4-1: Test requirement for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target BLER | SNR (dB) |
| 1-1 | R.PDSCH.1-11.1 FDD | 10 / 15 | 16QAM, 0.54 | TDLA30-10 | 2x4, ULA Low | 1%(Note 1) | -1.4 |
| Note 1: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block. | | | | | | | |

##### 5.2.3.1.7 4Rx FDD FR1 PDSCH Mapping Type B and UE processing capability 2 performance

5.2.3.1.7.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.7.0-3, with the addition of test parameters in Table 5.2.3.1.7.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.7.0-1.

Table 5.2.3.1.7.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH mapping Type B performance and UE processing capability 2 under four receive antenna conditions | 1-1 |

Table 5.2.3.1.7.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type B |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 2 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 0 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Maximum number of HARQ transmission | |  | 1 |
| Number of HARQ Processes | |  | 2 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 0 |

Table 5.2.3.1.7.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-12.1 FDD | 10 / 15 | QPSK, 0.30 | TDLA30-10 | 2x4, ULA Low | 70 | -2.3 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.7.

###### 5.2.3.1.7\_1 4Rx FDD FR1 PDSCH Mapping Type B and UE processing capability 2 performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.1.7\_1.1 Test purpose

To verify PDSCH mapping Type B performance and UE processing capability 2 under four receive antenna conditions.

5.2.3.1.7\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *pdsch-ProcessingType2*.

5.2.3.1.7\_1.3 Test description

5.2.3.1.7\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and section A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.3.1.7.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.7\_1.3.3.

5.2.3.1.7\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.1.7.0-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.1.7\_1.4-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.1.7\_1.3.3 Message contents

5.2.3.1.7\_1.3.3\_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.3.1.7\_1.3.3\_1-1: PDSCH-TimeDomainResourceAllocationList

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF { | 2 entries |  | FR1 |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  |  |  |
| k0 | Not present |  |  |
| mappingType | typeB |  |  |
| startSymbolAndLength | 16 | Start symbol(S)=2, Length(L)=2 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.1.7\_1.3.3\_1-2: *PUCCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-112 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUCCH-Config ::= SEQUENCE { |  |  | FR1 |
| dl-DataToUL-ACK SEQUENCE (SIZE (1)) OF INTEGER { | 1 entry |  |  |
| INTEGER[1] | 0 | entry 1 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.1.7\_1.3.3\_1-3: Physical layer parameters for DCI format 1\_1

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1 | | | |
| Parameter | Value | Value in binary | Condition |
| PDSCH-to-HARQ\_feedback timing indicator | K1=0 as per dl-DataToUL-ACK in Table 5.2.3.1.7\_1.3.3\_1-3 | “000” |  |

Table 5.2.3.1.7\_1.3.3\_1-4: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| processingType2Enabled | true |  |  |
| } |  |  |  |

5.2.3.1.7\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.3.1.7\_1.3.3\_1.

5.2.3.1.7\_1.4 Test requirement

Table 5.2.3.1.7.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.7\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.7\_1.4-1: Test requirement for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-12.1 FDD | 10 / 15 | QPSK, 0.30 | TDLA30-10 | 2x4, ULA Low | 70 | -1.4 |

##### 5.2.3.1.8 4Rx FDD FR1 PDSCH pre-emption performance

5.2.3.1.8.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.8.0-3, with the addition of test parameters in Table 5.2.3.1.8.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.8.0-1.

Table 5.2.3.1.8.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH pre-emption performance under 4 receive antenna conditions | 1-1 |

Table 5.2.3.1.8.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
| PDCCH configuration (Note 4) | Symbols with PDCCH |  | 0, 1 |
|  | DCI format |  | 2\_1 |
|  | timeFrequencySet |  | 14x1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 12 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 1 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Pre-emption configuration (Note 2) | Starting symbol (S) |  | 3 |
|  | Length (L) |  | 2 |
|  | Pre-emption periodicity and offset (Note 3) | Slots | 10/1 |
| Number of HARQ Processes | |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 |
| Note 1: Void  Note 2: Interference modelled as random data on pre-empted REs.  Note 3: Pre-emption is scheduled with a fixed scheduling with 10% probability within 10ms periodicity.  Note 4: In addition to PDCCH configuration in Table 5.2-1. | | | |

Table 5.2.3.1.8.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH. 1-2.6 FDD | 10 / 15 | 16QAM  0.64 | TDLA30-10 | 2x4, ULA Low | 70 | 6.6 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.8.

###### 5.2.3.1.8\_1 4Rx FDD FR1 PDSCH pre-emption performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.1.8\_1.1 Test purpose

To Verify the PDSCH pre-emption performance under 4 receive antenna conditions.

5.2.3.1.8\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *pre-EmptIndication-DL-r16*.

5.2.3.1.8\_1.3 Test description

5.2.3.1.8\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and section A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.3.1.8.0-2 and Table 5.2.3.1.8.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.8\_1.3.3.

5.2.3.1.8\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.1.8.0-3. The SS sends downlink MAC padding bits on the DL RMC.

2. SS transmits PDCCH DCI format 2\_1 for int\_RNTI with 10% probability to transmit the DL Preemption indication according to Table 5.2.3.1.8.0-2. In the time and frequency set indicated by PDCCH DCI format 2\_1, SS stops transmission of PDSCH.

3. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.1.8\_1.3.4-1.

4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.1.8\_1.3.3 Message contents

5.2.3.1.8\_1.3.3\_1 Message exceptions for SA

Same as 5.2.2.1.8\_1.3.3\_1.

5.2.3.1.8\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.2.1.8\_1.3.3\_1.

5.2.3.1.8\_1.3.4 Test requirement

Table 5.2.3.1.8.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.8\_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.8\_1.3.4-1: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH. 1-2.6 FDD | 10 / 15 | 16QAM  0.64 | TDLA30-10 | 2x4, ULA Low | 70 | 7.6 |

##### 5.2.3.1.9 4Rx FDD FR1 HST-SFN performance

5.2.3.1.9.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.9.0-3, with the test parameters defined in Table 5.2.3.1.9.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.3.1.9.0-1.

Table 5.2.3.1.9.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH performance under 4 receive antenna conditions in the HST-SFN scenario defined in B.3.2 when highSpeedDemodFlag-r16 IE [20] is configured | 1-1 |

Table 5.2.3.1.9.0-2: Test Parameters for Testing

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S) |  | 2 |
| Length (L) |  | 12 |
| PDSCH aggregation factor |  | 1 |
| PRB bundling type |  | Static |
| PRB bundling size |  | 2 |
| Resource allocation type |  | Type 0 |
| RBG size |  | Config2 |
| VRB-to-PRB mapping type |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
| Number of additional DMRS |  | 2 |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CSI-RS for tracking | CSI-RS periodicity | Slots | 10 for CSI-RS resource 1,2,3,4. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4. |
| Number of HARQ Processes | |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 |

Table 5.2.3.1.9.0-3: Minimum performance for Rank 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-8.3 FDD | 10 / 15 | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 10.4 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.9.

###### 5.2.3.1.9\_1 4Rx FDD FR1 HST-SFN performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.1.9\_1.1 Test purpose

To verify the PDSCH performance under 4 receive antenna conditions in the HST-SFN scenario defined in B.3.2 when *highSpeedDemodFlag-r16* IE [20] is configured and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 2 scenarios.

5.2.3.1.9\_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting enhanced demodulation processing for HST-SFN joint transmission scheme.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and supporting enhanced demodulation processing for HST-SFN joint transmission scheme.

5.2.3.1.9\_1.3 Test description

5.2.3.1.9\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.3.1.9.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.9\_1.3.3.

5.2.3.1.9\_1.3.2 Testprocedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.3.1.9\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.1.9\_1.4-1 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

4. Repeat steps from 1 to 3 for each subtest in Tables 5.2.3.1.9\_1.4-1 as appropriate.

5.2.3.1.9\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.1.9\_1.3.3\_1 Message exceptions for SA

Table 5.2.3.1.9\_1.3.3\_1-1: PDSCH-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | Not present | n2 for test 1-1 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.1.9\_1.3.3\_1-2: DMRS-DownlinkConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24 | | | |
| Information Element | Value/remark | Comment | Condition |
| DMRS-DownlinkConfig ::= SEQUENCE { |  |  |  |
| dmrs-AdditionalPosition | pos2 | for test 1-1 |  |
| } |  |  |  |

Table 5.2.3.1.9\_1.3.3\_1-3: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | n4 | for test 1-1 |  |
| } |  |  |  |

Table 5.2.3.1.9\_1.3.3\_1-4: CSI-ResourcePeriodicityAndOffset for CSI Tracking

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots10 | 1 for CSI-RS resource #1 and #2  2 for CSI-RS resource #3 and #4 | For test 1-1:  offset = 1 for CSI-RS resource 1 and 2  offset =2 for CSI-RS resource 3 and 4. |  |
| } |  |  |  |

5.2.3.1.9\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.3.1.9\_1.3.3\_1

5.2.3.1.9\_1.4 Test requirement

Tables 5.2.3.1.9\_1.4-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.9\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.9\_1.4-1: Test Requirements for Rank 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-8.3 FDD | 10 / 15 | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11 |

##### 5.2.3.1.10 4Rx FDD FR1 HST DPS performance

5.2.3.1.10.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.10.0-3, with the test parameters defined in Table 5.2.3.1.10.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.3.1.10.0-1.

Table 5.2.3.1.10.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify UE performance in the HST-DPS scenario defined in B.3.3 | 1-1, 1-2 |

Table 5.2.3.1.10.0-2: Test Parameters for Testing

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Value |
| Duplex mode | | |  | FDD |
| Active DL BWP index | | |  | 1 |
| PDCCH configuration | TCI state | |  | Note 1 |
| PDSCH configuration | Mapping type | |  | Type A |
|  | k0 | |  | 0 |
|  | Starting symbol (S) | |  | 2 |
|  | Length (L) | |  | 12 |
|  | PDSCH aggregation factor | |  | 1 |
|  | PRB bundling type | |  | Static |
|  | PRB bundling size | |  | 2 |
|  | Resource allocation type | |  | Type 0 |
|  | RBG size | |  | Config2 |
|  | VRB-to-PRB mapping type | |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size | |  | N/A |
|  | TCI state | |  | Note 1 |
| PDSCH DMRS configuration | DMRS Type | |  | Type 1 |
|  | Number of additional DMRS | |  | 2 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS | |  | 1 |
| CSI-RS for tracking | Resource set #1 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 5 for CSI-RS resource 1 and 3  l0 = 9 for CSI-RS resource 2 and 4 |
|  |  | CSI-RS periodicity | Slots | 10 for CSI-RS resource 1,2,3,4. |
|  |  | CSI-RS offset | Slots | 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4 |
|  |  | QCL info |  | TCI state #2 |
|  | Resource set #2 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 6 for CSI-RS resource 5 and 6  l0 = 10 for CSI-RS resource 7 and 8 |
|  |  | CSI-RS periodicity | Slots | 10 for CSI-RS resource 5,6,7,8. |
|  |  | CSI-RS offset | Slots | 1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8 |
|  |  | QCL info |  | TCI state #3 |
| NZP CSI-RS for CSI acquisition | Resource set #3 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 12 |
|  |  | CSI-RS periodicity | Slots | 20 |
|  |  | CSI-RS offset | Slots | 0 |
|  |  | QCL info |  | TCI state #0 |
|  | Resource set #4 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 13 |
|  |  | CSI-RS periodicity | Slots | 20 |
|  |  | CSI-RS offset | Slots | 0 |
|  |  | QCL info |  | TCI state #1 |
| TCI state #0 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking Resource set #1' configuration |
|  |  | QCL Type |  | Type A |
|  | Type 2 QCL information | CSI-RS resource |  | N/A |
|  |  | QCL Type |  | N/A |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration |
|  |  | QCL Type |  | Type A |
|  | Type 2 QCL information | CSI-RS resource |  | N/A |
|  |  | QCL Type |  | N/A |
| TCI state #2 | Type 1 QCL information | SSB index |  | SSB #0 |
|  |  | QCL Type |  | Type C |
|  | Type 2 QCL information | SSB index |  | N/A |
|  |  | QCL Type |  | N/A |
| TCI state #3 | Type 1 QCL information | SSB index |  | SSB #1 |
|  |  | QCL Type |  | Type C |
|  | Type 2 QCL information | SSB index |  | N/A |
|  |  | QCL Type |  | N/A |
| Number of HARQ Processes | | |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | |  | 2 |
| Note 1: SSB # (k mod 2) , CSI-RS (for tracking) resource set # ((k mod 2) + 1) and CSI-RS (for CSI acquisition) resource set # ((k mod 2) + 3) are transmitted by kth RRH.  For Test 1-1, TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy . PDCCH and PDSCH associated with TCI # (k mod 2) is transmitted by kth RRH from slot#    to  slot#    PDCCH and PDSCH are DTXed in other slots in which throughput statistics are not considered.    For Test 1-2, TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy .  PDCCH and PDSCH associated with TCI # (k mod 2) is transmitted by kth RRH from:  slot#    to  slot#      PDCCH and PDSCH are DTXed in other slots in which throughput statistics are not considered.  Where k=0, 1, 2… is the RRH number, n = 2520 is half of the number of slots between two RRH, = 2  is the number of slots between PDSCH and corresponding HARQ-ACK information, = 3 is the  number of slots for MAC CE processing, = 6 is the number of slots to first TRS transmission  occasion after MAC CE command is decoded by the UE, = 2 is the number of slots for TRS  processing. | | | | |
|  |

Table 5.2.3.1.10.0-3: Minimum performance for HST-DPS

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Number of active PDSCH TCI states | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-8.4 FDD | 10 / 15 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 10.6 |
| 1-2 | R.PDSCH.1-8.4 FDD | 10 / 15 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 10.6 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.10.

###### 5.2.3.1.10\_1 4Rx FDD FR1 HST-DPS performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.1.10\_1.1 Test purpose

To verify UE performance in the HST-DPS scenario defined in B.3.3 and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 2 scenarios.

5.2.3.1.10\_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC.

5.2.3.1.10\_1.3 Test description

5.2.3.1.10\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.3.1.10.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.10\_1.3.3.

5.2.3.1.10\_1.3.2 Testprocedure

Test 1-1:

1. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.1.10\_1.4-1 as appropriate.

2. SS is configured to transmit SSB and CSI-RS continuously and schedule PDSCH and PDCCH transmission according to Note 1 in 5.2.2.1.10\_1.4-1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.2.1.10\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

Note: All TCI states are known to the UE through configuration inside RrcReconfiguration. There is no need to configure additional L1-RSRP measurements.

3. Send MAC CE command “TCI State Indication for UE-specific PDCCH” according to the timing described in Note 1 of table 5.2.2.1.10\_1.4-1 to switch from active TCI state 0 to 1 for PDCCH and vice versa periodically. PDSCH is automatically associated with TCI state 0 or 1 as tci-PresentInDCI is not present. TCI states 3 and 4 for SSBs are automatically activated through relation of QCL-Info in NZP CSI-RS.

4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

Test 1-2:

1. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.1.10\_1.4-1 as appropriate.

2. SS activates TCI state 0 and TCI 1 for PDSCH at the same time via MAC CE command “TCI States Activation/Deactivation for UE-specific PDSCH”.

3. SS is configured to transmit SSB and CSI-RS continuously and schedule PDSCH and PDCCH transmission according to Note 1 in 5.2.2.1.10\_1.4-1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.2.1.10\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

Note: All TCI states are known to the UE through configuration inside RrcReconfiguration. There is no need to configure additional L1-RSRP measurements.

4. Send MAC CE command “TCI State Indication for UE-specific PDCCH” according to the timing described in Note 1 of table 5.2.2.1.10\_1.4-1 to switch from active TCI state 0 to 1 for PDCCH and vice versa periodically. PDSCH is automatically associated with TCI state 0 or 1 as tci-PresentInDCI is not present. TCI states 3 and 4 for SSBs are automatically activated through relation of QCL-Info in NZP CSI-RS.

5. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.1.10\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.1.10\_1.3.3\_1 Message exceptions for SA

Table 5.2.3.1.10\_1.3.3\_1-1: PDSCH-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | Not present | n2 is used | test 1-1, 1-2 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.1.10\_1.3.3\_1-2: DMRS-DownlinkConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24 | | | |
| Information Element | Value/remark | Comment | Condition |
| DMRS-DownlinkConfig ::= SEQUENCE { |  |  |  |
| dmrs-AdditionalPosition | pos2 | for test 1-1, 1-2 |  |
| } |  |  |  |

Table 5.2.3.1.10\_1.3.3\_1-3: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | n4 | for test 1-1, 1-2 |  |
| } |  |  |  |

Table 5.2.3.1.10\_1.3.3\_1-4: NZP-CSI-RS-Resource for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| nzp-CSI-RS-ResourceId | i-1 for CSI-RS resource #i, i=1,2,3,4,5,6,7,8 | for test 1-1, 1-2 |  |
| qcl-InfoPeriodicCSI-RS | 2 for CSI-RS resource #1, #2, #3, #4  3 for CSI-RS resource #5, #6, #7, #8 | for test 1-1, 1-2:  TCI-StateId for TCI-State #2 for CSI-RS resource #1, #2, #3, #4  TCI-StateId for TCI-State #3 for CSI-RS resource #5, #6, #7, #8 |  |
| } |  |  |  |

Table 5.2.3.1.10\_1.3.3\_1-5: CSI-RS-ResourceMapping for TRS (Table 5.2.3.1.10\_1.3.3\_1-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 with condition TRS | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 5 for CSI-RS resource #1 and #3  9 for CSI-RS resource #2 and #4  6 for CSI-RS resource #5 and #6  10 for CSI-RS resource #7 and #8 | for test 1-1, 1-2:  l0 = 5 for CSI-RS resource 1 and 3  l0 = 9 for CSI-RS resource 2 and 4  l0 = 6 for CSI-RS resource 5 and 6  l0 = 10 for CSI-RS resource 7 and 8 |  |
| } |  |  |  |

Table 5.2.3.1.10\_1.3.3\_1-6: CSI-ResourcePeriodicityAndOffset for TRS (Table 5.2.3.1.10\_1.3.3\_1-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots10 | 1 for CSI-RS resource #1, #2, #5, #6  2 for CSI-RS resource #3 #4, #7, #8 | For test 1-1, 1-2:  periodicity:  10 slots.  offset:  1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4  1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8 |  |
| } |  |  |  |

Table 5.2.3.1.10\_1.3.3\_1-7: NZP-CSI-RS-ResourceSet for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-12 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-ResourceSet ::= SEQUENCE { |  |  |  |
| nzp\_CSI\_ResourceSetId | 0 for Resource set #1  1 for Resource set #2 | For test 1-1, 1-2 |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 4 entries | For test 1-1, 1-2 | Resource set #1 |
| NZP-CSI-RS-ResourceId[1] | 0 | entry 1  CSI-RS resource #1 |  |
| NZP-CSI-RS-ResourceId[2] | 1 | entry 2  CSI-RS resource #2 |  |
| NZP-CSI-RS-ResourceId[3] | 2 | entry 3  CSI-RS resource #3 |  |
| NZP-CSI-RS-ResourceId[4] | 3 | entry 4  CSI-RS resource #4 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 4 entries | For test 1-1, 1-2 | Resource set #2 |
| NZP-CSI-RS-ResourceId[1] | 4 | entry 1  CSI-RS resource #5 |  |
| NZP-CSI-RS-ResourceId[2] | 5 | entry 2  CSI-RS resource #6 |  |
| NZP-CSI-RS-ResourceId[3] | 6 | entry 3  CSI-RS resource #7 |  |
| NZP-CSI-RS-ResourceId[4] | 7 | entry 4  CSI-RS resource #8 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.1.10\_1.3.3\_1-8: NZP-CSI-RS-Resource for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-14 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| nzp-CSI-RS-ResourceId | 8 for CSI-RS resource #9  9 for CSI-RS resource #10 | for test 1-1, 1-2 |  |
| qcl-InfoPeriodicCSI-RS | 0 for CSI-RS resource #9  1 for CSI-RS resource #10 | for test 1-1, 1-2:  TCI-State #0 for CSI-RS resource #9  TCI-State #1 for CSI-RS resource #10 |  |
| } |  |  |  |

Table 5.2.3.1.10\_1.3.3\_1-9: CSI-RS-ResourceMapping for CSI Acquisition (Table 5.2.3.1.10\_1.3.3\_1-8)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 12 for CSI-RS resource #9  13 for CSI-RS resource #10 | for test 1-1, 1-2  l0=12 for CSI-RS resource #9  l0=13 for CSI-RS resource #10 |  |
| } |  |  |  |

Table 5.2.3.1.10\_1.3.3\_1-10: CSI-ResourcePeriodicityAndOffset for CSI Acquisition (Table 5.2.3.1.10\_1.3.3\_1-8)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-16 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots20 | 0 | For test 1-1, 1-2:  periodicity = 20 slots.  offset = 0 slots |  |
| } |  |  |  |

Table 5.2.3.1.10\_1.3.3\_1-11: NZP-CSI-RS-ResourceSet for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-18 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-ResourceSet ::= SEQUENCE { |  |  |  |
| nzp\_CSI\_ResourceSetId | 2 for Resource set #3  3 for Resource set #4 | For test 1-1, 1-2 |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry | For test 1-1, 1-2 | Resource set #3 |
| NZP-CSI-RS-ResourceId[1] | 8 | entry 1  CSI-RS resource #9 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry | For test 1-1, 1-2 | Resource set #4 |
| NZP-CSI-RS-ResourceId[1] | 9 | entry 1  CSI-RS resource #10 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.1.10\_1.3.3\_1-12: TCI-State

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-190 | | | |
| Information Element | Value/remark | Comment | Condition |
| TCI-State ::= SEQUENCE { |  |  |  |
| tci-StateId | 0 for TCI state #0  1 for TCI state #1  2 for TCI state #2  3 for TCI state #3 | For test 1-1, 1-2 |  |
| qcl-Type1 SEQUENCE { |  |  |  |
| bwp-Id | BWP-Id of active BWP |  | TCI state #0, TCI state #1 |
|  | Not present |  | TCI state #2, TCI state #3 |
| referenceSignal CHOICE { |  |  |  |
| csi-rs | 0 | CSI-RS resource #1 | TCI state #0 |
|  | 4 | CSI-RS resource #5 | TCI state #1 |
| ssb | 0 | SSB #0 | TCI state #2 |
|  | 1 | SSB #1 | TCI state #3 |
| } |  |  |  |
| qcl-Type | typeA |  | TCI state #0, TCI state #1 |
|  | typeC |  | TCI state #2, TCI state #3 |
| } |  |  |  |
| } |  |  |  |

5.2.3.1.10\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.3.1.10\_1.3.3\_1

5.2.3.1.10\_1.4 Test requirement

Tables 5.2.3.1.10\_1.4-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.10\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.10\_1.4-1: Test Requirements for HST-DPS

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Number of active PDSCH TCI states | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-8.4 FDD | 10 / 15 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 11.2 |
| 1-2 | R.PDSCH.1-8.4 FDD | 10 / 15 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 11.2 |

##### 5.2.3.1.11 4Rx FDD FR1 PDSCH Single-DCI based SDM scheme performance

5.2.3.1.11.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.11.0-3, with the addition of test parameters in Table 5.2.3.1.11.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.11.0-1.

Table 5.2.3.1.11.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH performance with Single-DCI based SDM scheme under 4 receive antenna conditions | 1-1,1-2 |

Table 5.2.3.1.11.0-2: Test parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | |
| TRxP #1(Note 1) | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | |  | TRxP #1 | |
| PDCCH configuration | | TCI state | |  | TCI State #1 | |
| CORESETPoolIndex | |  | 0 | |
| CSI-RS for tracking | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | |
| Density | |  | 3 | |
| CSI-RS periodicity | | Slots | 20 | |
| CSI-RS offset | | Slots | 10 for CSI-RS resources 1 and 2  11 for CSI-RS resources 3 and 4 | 10 for CSI-RS resources 5 and 6  11 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | |
| Duplex mode | | | |  | FDD | |
| Active DL BWP index | | | |  | 1 | |
| PDSCH configuration | Mapping type | | |  | Type A | |
| k0 | | |  | 0 | |
| Starting symbol (S) | | |  | 2 | |
| Length (L) | | |  | 12 | |
| PRB bundling type | | |  | Static | |
| PRB bundling size | | |  | 2 | |
| Resource allocation type | | |  | Type 1 | |
| RBG size | | |  | Config2 | |
| VRB-to-PRB mapping type | | |  | Non-interleaved | |
| VRB-to-PRB mapping interleaver bundle size | | |  | N/A | |
| PDSCH DMRS configuration | Antenna port indexes | | |  | 1000 | 1002 |
| TCI state | | |  | TCI State #1 | TCI State #2 |
| DMRS Type | | |  | Type 1 | |
| Number of additional DMRS | | |  | 1 | |
| Maximum number of OFDM symbols for DL front loaded DMRS | | |  | 1 | |
| TCI State #1 | Type 1 QCL information | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | N/A |
| QCL Type |  | Type A | N/A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| TCI State #2 | Type 1 QCL information | | CSI-RS resource |  | N/A | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | Type A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| Resource allocation | | | |  | Full-overlapping | |
| Timing offset of the second TRxP from the first TRxP | | | | us | -0.5 for test 1-1  2 for test 1-2 | |
| Frequency offset of the second TRxP from the first TRxP | | | | Hz | 200 for test 1-1  0 for test 1-2 | |
| Number of HARQ Processes | | | |  | 4 | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | | |  | 2 | |
| Precoding configuration | | | |  | SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity | |
| Note 1: PDSCH transmission is done from both TRxPs (PDSCH Layer 0 is transmitted from TRxP #1 and PDSCH layer 1 is transmitted from TRxP #2) | | | | | | |

Table 5.2.3.1.11.0-3: Minimum performance

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition(Note 1) | Correlation matrix and antenna configuration(Note 2) | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB)(Note 3) |
| 1-1 | R.PDSCH.1-3.2 FDD | 10 / 15 | 64QAM, 0.50 | TDLA30-10 | 2x4, ULA Low | 70 | 14.6 |
| 1-2 | R.PDSCH.1-3.2 FDD | 10 / 15 | 64QAM, 0.50 | TDLA30-10 | 2x4, ULA Low | 70 | 13.9 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 with scaling factor as 1/sqrt(2) for transmitted signal from each TRxP | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.11.

###### 5.2.3.1.11\_1 4Rx FDD FR1 PDSCH Single-DCI based SDM scheme performance - 2x4 MIMO for both SA and NSA

5.2.3.1.11\_1.1 Test purpose

To verify the PDSCH performance with Single-DCI based SDM scheme under 4 receive antenna conditions.

5.2.3.1.11\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *singleDCI-SDM-scheme-r16*.

5.2.3.1.11\_1.3 Test description

5.2.3.1.11\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.3.1.11.0-2 and Table 5.2.3.1.11.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.11\_1.3.3.

5.2.3.1.11\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.1.11\_1.3.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.1.11\_1.3.4-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

4. Repeat steps from 1 to 3 for each subtest in Table 5.2.3.1.11\_1.3.4-1 as appropriate.

5.2.3.1.11\_1.3.3 Message contents

5.2.3.1.11\_1.3.3\_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.3.1.11\_1.3.3\_1-1: Physical layer parameters for DCI format 1\_1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1 | | | | |
| Parameter | Value | Value in binary | Condition |
| PDSCH-to-HARQ\_feedback timing indicator | K1 = 2 | “010” |  |
| Antenna port(s) | DMRS port 0 and 2 | “1011” |  |
| Transmission configuration indication | TCI state 1 and 2 | “000” |  |

Table 5.2.3.1.11\_1.3.3\_1-2: *CellGroupConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| simultaneousTCI-UpdateList1-r16 SEQUENCE { |  |  |  |
| ServCellIndex [1] | ServCellIndex |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.1.11\_1.3.3\_1-3: *ControlResourceSet*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| tci-PresentInDCI | enabled |  |  |
| } |  |  |  |

Table 5.2.3.1.11\_1.3.3\_1-4: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-100 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| tci-StatesToAddModList SEQUENCE(SIZE (1.. maxNrofTCI-States)) OF TCI-State { | 2 entries |  |  |
| TCI-State[1] | *TCI-State* with condition TCI-state-0 |  |  |
| TCI-State[2] | *TCI-State* with condition TCI-state-1 |  |  |
| TCI-State[3] | *TCI-State* with condition TCI-state-2 |  |  |
| } |  |  |  |
| rbg-Size | config2 |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.1.11\_1.3.3\_1-5: *TCI-State*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-190 | | | |
| Information Element | Value/remark | Comment | Condition |
| TCI-State ::= SEQUENCE { |  |  |  |
| tci-StateId | 0 |  | TCI-state-0 |
|  | 1 |  | TCI-state-1 |
|  | 2 |  | TCI-state-2 |
| qcl-Type1 SEQUENCE { |  |  |  |
| cell | Not present |  |  |
| bwp-Id | Not present |  |  |
| referenceSignal CHOICE { |  |  |  |
| ssb | SSB-Index |  | TCI-state-0 |
| csi-rs | 1 |  | TCI-state-1 |
|  | 5 |  | TCI-state-2 |
| } |  |  |  |
| qcl-Type | typeA |  |  |
| } |  |  |  |
| qcl-Type2 | Not present |  |  |
| } |  |  |  |

Table 5.2.3.1.11\_1.3.3\_1-6: *NZP-CSI-RS-Resource*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-85 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| resourceMapping SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| row1 | 0000 | For CSI-RS resources 1, 2, 3, 4 |  |
|  | 0001 | For CSI-RS resources 5,6,7,8 |  |
| } |  |  |  |
| nrofPorts | p1 |  |  |
| firstOFDMSymbolInTimeDomain | 6 | For CSI-RS resources 1,3,5,7 |  |
|  | 10 | For CSI-RS resources 2,4,6,8 |  |
| cdm-Type | noCDM |  |  |
| density CHOICE { |  |  |  |
| three | NULL |  |  |
| } |  |  |  |
| } |  |  |  |
| periodicityAndOffset CHOICE { |  |  |  |
| slots20 | 10 | For CSI-RS resources 1,2,5,6 |  |
| slots20 | 11 | For CSI-RS resources 3,4,7,8 |  |
| } |  |  |  |
| qcl-InfoPeriodicCSI-RS | 0 |  |  |
| } |  |  |  |

5.2.3.1.11\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.3.1.11\_1.3.3\_1.

5.2.3.1.11\_1.3.4 Test requirement

Table 5.2.3.1.11.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.11\_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.11\_1.3.4-1: Test requirement

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition(Note 1) | Correlation matrix and antenna configuration(Note 2) | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB)(Note 3) |
| 1-1 | R.PDSCH.1-3.2 FDD | 10 / 15 | 64QAM, 0.50 | TDLA30-10 | 2x4, ULA Low | 70 | 15.6 |
| 1-2 | R.PDSCH.1-3.2 FDD | 10 / 15 | 64QAM, 0.50 | TDLA30-10 | 2x4, ULA Low | 70 | 14.9 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 with scaling factor as 1/sqrt(2) for transmitted signal from each TRxP | | | | | | | |

##### 5.2.3.1.12 4Rx FDD FR1 PDSCH Multi-DCI based transmission scheme performance

5.2.3.1.12.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.12.0-3, with the addition of test parameters in Table 5.2.3.1.12.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.12.0-1.

Table 5.2.3.1.12.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH performance when UE is configured two different values of CORESETPoolIndex in ControlResourceSet and when UE receives multiple PDCCHs scheduling PDSCHs | 1-1 |

Table 5.2.3.1.12.0-2: Test parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | |
| TRxP #1(Note 1) | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | |  | TRxP #1 | |
| PDCCH configuration | | TCI state | |  | TCI State #1 | TCI State #2 |
| CORESETPoolIndex | |  | 0,1 | |
|  | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | k0=1 for CSI-RS resources 5,6,7,8 |
|  | | First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
|  | | Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | 1 for CSI-RS resource 5,6,7,8 |
| CSI-RS for tracking | | CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | |
|  | | Density | |  | 3 | |
|  | | CSI-RS periodicity | | Slots | 20 | |
|  | | CSI-RS offset | | Slots | 10 for CSI-RS resources 1 and 2  11 for CSI-RS resources 3 and 4 | 10 for CSI-RS resources 5 and 6  11 for CSI-RS resources 7 and 8 |
|  | | QCL info | |  | TCI state #0 | |
| Duplex mode | | | |  | FDD | |
| Active DL BWP index | | | |  | 1 | |
|  | Mapping type | | |  | Type A | |
|  | k0 | | |  | 0 | |
|  | Starting symbol (S) | | |  | 2 | |
|  | Length (L) | | |  | 12 | |
| PDSCH configuration | PRB bundling type | | |  | Static | |
|  | PRB bundling size | | |  | 2 | |
|  | Resource allocation type | | |  | Type 1 | |
|  | RBG size | | |  | Config2 | |
|  | VRB-to-PRB mapping type | | |  | Non-interleaved | |
|  | VRB-to-PRB mapping interleaver bundle size | | |  | N/A | |
|  | Antenna port indexes | | |  | {1000,1001} | {1002,1003} |
|  | TCI state | | |  | TCI State #1 | TCI State #2 |
| PDSCH DMRS configuration | DMRS Type | | |  | Type 1 | |
|  | Number of additional DMRS | | |  | 1 | |
|  | Maximum number of OFDM symbols for DL front loaded DMRS | | |  | 1 | |
| TCI State #1 | Type 1 QCL information | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | N/A |
|  |  | | QCL Type |  | Type A | N/A |
|  | Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
|  |  | | QCL Type |  | N/A | N/A |
| TCI State #2 | Type 1 QCL information | | CSI-RS resource |  | N/A | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
|  |  | | QCL Type |  | N/A | Type A |
|  | Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
|  |  | | QCL Type |  | N/A | N/A |
| Resource allocation | | | |  | Non-overlapping | |
| Timing offset of the second TRxP from the first TRxP | | | | us | -0.5 | |
| Frequency offset of the second TRxP from the first TRxP | | | | Hz | 200 | |
| Number of HARQ Processes | | | |  | 4 | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | | |  | 2 | |
| Precoding configuration | | | |  | SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity | |
| Note 1: PDSCH transmission is done from both TRxPs. Transmission from TRxP #1 uses CORESETPoolIndex 0 and transmission from TRxP #2 uses CORESETPoolIndex 1 | | | | | | |

Table 5.2.3.1.12.0-3: Minimum performance

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition(Note 1) | Correlation matrix and antenna configuration(Note 2) | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB)(Note 3) |
|  | TRxP #1 | TRxP #2 |  |  |  |  |  |  |
| 1-1 | R.PDSCH.1-3.3 FDD | R.PDSCH.1-3.4 FDD | 10 / 15 | 64QAM, 0.50 | TDLA30-10 | 2x4, ULA Low | 70 | 14.6 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 | | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.12.

###### 5.2.3.1.12\_1 4Rx FDD FR1 PDSCH Multiple-DCI based transmission scheme performance - 2x4 MIMO for both SA and NSA

5.2.3.1.12\_1.1 Test purpose

To verify the PDSCH performance when UE is configured two different values of CORESETPoolIndex in ControlResourceSet and when UE receives multiple PDCCHs scheduling PDSCHs.

5.2.3.1.12\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *multiDCI-MultiTRP-r16*.

5.2.3.1.12\_1.3 Test description

5.2.3.1.12\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.9 for TE diagram and section A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.3.1.12.0-2 and Table 5.2.3.1.12.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.12\_1.3.3.

5.2.3.1.12\_1.3.2 Test procedure

1. SS transmits PDSCH in TRxP#1 via PDCCH DCI format 1\_1 for C\_RNTI in ControlResourceSetid1 (Table 5.2.3.1.12\_1.3.3\_1-2), and transmits PDSCH in TRxP#2 via PDCCH DCI format 1\_1 for C\_RNTI in ControlResourceSetid2 (Table 5.2.3.1.12\_1.3.3\_1-3), to transmit the DL RMC according to Table 5.2.3.1.12\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR for TRxP#1 and TRxP#2 according to Table 5.2.3.1.12\_1.4-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.1.12\_1.3.3 Message contents

5.2.3.1.12\_1.3.3\_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.3.1.12\_1.3.3\_1-1: *PDCCH-Config* (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4],Table 4.6.3-95 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-Config::= SEQUENCE { |  |  |  |
| controlResourceSetToAddModList SEQUENCE(SEQUENCE(SIZE (1..3)) OF ControlResourceSet { | 2 entries |  |  |
| ControlResourceSet[1] | ControlResourceSetid1 | entry 1 |  |
| ControlResourceSet[2] | ControlResourceSetid2 | entry 2 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.1.12\_1.3.3\_1-2: *ControlResourceSetId1* (Table 5.2.3.1.12\_1.3.3\_1-1: *PDCCH-Config*)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 1 |  |  |
| frequencyDomainResources | 11110000 00000000 00000000 00000000 00000000 00000 | CORESET to use the least significant 24 RBs of the BWP |  |
| tci-StatesPDCCH-ToAddList SEQUENCE(SIZE (1..maxNrofTCI-StatesPDCCH)) OF TCI-StateId { |  |  |  |
| TCI-StateId[1] | 1 |  |  |
| } |  |  |  |
| tci-PresentInDCI | enabled |  |  |
| coresetPoolIndex-r16 | 0 |  |  |
| } |  |  |  |

Table 5.2.3.1.12\_1.3.3\_1-3: *ControlResourceSetId2* (Table 5.2.3.1.12\_1.3.3\_1-1: *PDCCH-Config*)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 2 |  |  |
| frequencyDomainResources | 00001111 00000000 00000000 00000000 00000000 00000 | CORESET to use the RBs 24~47 of the BWP |  |
| tci-StatesPDCCH-ToAddList SEQUENCE(SIZE (1..maxNrofTCI-StatesPDCCH)) OF TCI-StateId { |  |  |  |
| TCI-StateId[1] | 2 |  |  |
| } |  |  |  |
| tci-PresentInDCI | enabled |  |  |
| coresetPoolIndex-r16 | 1 |  |  |
| } |  |  |  |

Table 5.2.3.1.12\_1.3.3\_1-4: Physical layer parameters for DCI format 1\_1 in ControlResourceSetid1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1 | | | | |
| Parameter | Value | Value in binary | Condition |
| Antenna port(s) | DMRS port 0 and 1 | “0111” |  |
| Transmission configuration indication | TCI State #1 | “000” |  |

Table 5.2.3.1.12\_1.3.3\_1-5: Physical layer parameters for DCI format 1\_1 in ControlResourceSetid2

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1 | | | |
| Parameter | Value | Value in binary | Condition |
| Antenna port(s) | DMRS port 2 and 3 | “1000” |  |
| Transmission configuration indication | TCI State #2 | “001” |  |

Table 5.2.3.1.12\_1.3.3\_1-6: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| tci-StatesToAddModList SEQUENCE(SIZE (1.. maxNrofTCI-States)) OF TCI-State { | 2 entries |  |  |
| TCI-State[1] SEQUENCE { |  | TCI-state-0 |  |
| tci-StateId | 0 |  |  |
| qcl-type1 SEQUENCE { |  |  |  |
| cell | Not present |  |  |
| bwp-Id | Not present |  |  |
| referenceSignal CHOICE { |  |  |  |
| ssb | SSB-Index |  |  |
| } |  |  |  |
| qcl-Type | typeC |  |  |
| } |  |  |  |
| } |  |  |  |
| TCI-State[2] |  | TCI-state-1 |  |
| tci-StateId | 1 |  |  |
| qcl-type1 SEQUENCE { |  |  |  |
| cell | Not present |  |  |
| bwp-Id | Not present |  |  |
| referenceSignal CHOICE { |  |  |  |
| csi-rs | 1 |  |  |
| } |  |  |  |
| qcl-Type | typeA |  |  |
| } |  |  |  |
| } |  |  |  |
| TCI-State[3] |  | TCI-state-2 |  |
| tci-StateId | 2 |  |  |
| qcl-type1 SEQUENCE { |  |  |  |
| cell | Not present |  |  |
| bwp-Id | Not present |  |  |
| referenceSignal CHOICE { |  |  |  |
| csi-rs | 5 |  |  |
| } |  |  |  |
| qcl-Type | typeA |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.1.12\_1.3.3\_1-7: *CSI-RS-ResourceMapping* for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| row1 | 0000 | For CSI-RS resources 1, 2, 3, 4 |  |
|  | 0001 | For CSI-RS resources 5,6,7,8 |  |
| } |  |  |  |
| nrofPorts | p1 |  |  |
| firstOFDMSymbolInTimeDomain | 6 | For CSI-RS resources 1,3,5,7 |  |
|  | 10 | For CSI-RS resources 2,4,6,8 |  |
| } |  |  |  |

Table 5.2.3.1.12\_1.3.3\_1-8: *CSI-ResourcePeriodicityAndOffset* for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots20 | 10 | For CSI-RS resources 1,2,5,6 |  |
| slots20 | 11 | For CSI-RS resources 3,4,7,8 |  |
| } |  |  |  |

5.2.3.1.12\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.3.1.12\_1.3.3\_1.

5.2.3.1.12\_1.4 Test requirement

Table 5.2.3.1.12.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.12\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.12\_1.4-1: Test requirement

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition(Note 1) | Correlation matrix and antenna configuration(Note 2) | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB)(Note 3) |
|  | TRxP #1 | TRxP #2 |  |  |  |  |  |  |
| 1-1 | R.PDSCH.1-3.3 FDD | R.PDSCH.1-3.4 FDD | 10 / 15 | 64QAM, 0.50 | TDLA30-10 | 2x4, ULA Low | 70 | 15.6 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 | | | | | | | | |

##### 5.2.3.1.13 4Rx FDD FR1 PDSCH Single-DCI based FDM scheme A performance

5.2.3.1.13.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.13.0-3, with the addition of test parameters in Table 5.2.3.1.13.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.13.0-1.

Table 5.2.3.1.13.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH performance under 4 receive antenna conditions when UE is configured with “FDMSchemeA” in “RepetitionScheme-r16” defined in clause 5.1 of TS 38.214 [12] | 1-1 |

Table 5.2.3.1.13.0-2: Test parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | |
| TRxP #1(Note 1) | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | |  | TRxP #1 | |
| PDCCH configuration | | TCI state | |  | TCI State #1 | |
| CORESETPoolIndex | |  | Not configured | |
| CSI-RS for tracking | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | |
| Density | |  | 3 | |
| CSI-RS periodicity | | Slots | 20 | |
| CSI-RS offset | | Slots | 10 for CSI-RS resources 1 and 2  11 for CSI-RS resources 3 and 4 | 10 for CSI-RS resources 5 and 6  11 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | |
| Duplex mode | | | |  | FDD | |
| Active DL BWP index | | | |  | 1 | |
| PDSCH configuration | Mapping type | | |  | Type A | |
| k0 | | |  | 0 | |
| Starting symbol (S) | | |  | 2 | |
| Length (L) | | |  | 12 | |
| PRB bundling type | | |  | Static | |
| PRB bundling size | | |  | Wideband | |
| Resource allocation type | | |  | Type 0 | |
| RBG size | | |  | Config2 | |
| VRB-to-PRB mapping type | | |  | Non-interleaved | |
| VRB-to-PRB mapping interleaver bundle size | | |  | N/A | |
| PDSCH DMRS configuration | Antenna port indexes | | |  | 1000,1001 | 1000,1001 |
| TCI state | | |  | TCI State #1 | TCI State #2 |
| DMRS Type | | |  | Type 1 | |
| Number of additional DMRS | | |  | 1 | |
| Maximum number of OFDM symbols for DL front loaded DMRS | | |  | 1 | |
| TCI State #1 | Type 1 QCL information | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | N/A |
| QCL Type |  | Type A | N/A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| TCI State #2 | Type 1 QCL information | | CSI-RS resource |  | N/A | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | Type A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| Timing offset of the second TRxP from the first TRxP | | | | us | -0.5 | |
| Frequency offset of the second TRxP from the first TRxP | | | | Hz | 200 | |
| Number of HARQ Processes | | | |  | 4 | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | | |  | 2 | |
| Precoding configuration | | | |  | SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity | |
| Note 1: PDSCH transmission is done from both TRxPs | | | | | | |

Table 5.2.3.1.13.0-3: Minimum performance for Rank 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition(Note 1) | Correlation matrix and antenna configuration (Note 2) | Reference value | |
| Fraction of  maximum  throughput  (%) | SNR (dB) (Note 3) |
| 1-1 | R.PDSCH.1-2.5 FDD | 10 / 15 | 16QAM, 0.54 | TDLA30-10 | 2x4, ULA Low | 70 | 10.9 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.13.

###### 5.2.3.1.13\_1 4Rx FDD FR1 PDSCH Single-DCI based FDM scheme A performance - 2x4 MIMO for both SA and NSA

5.2.3.1.13\_1.1 Test purpose

To verify the PDSCH performance under 4 receive antenna conditions when UE is configured with “FDMSchemeA” in “RepetitionScheme-r16”.

5.2.3.1.13\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *supportFDM-SchemeA-r16*.

5.2.3.1.13\_1.3 Test description

5.2.3.1.13\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.9 for TE diagram and section A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.3.1.13.0-2 and Table 5.2.3.1.13.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.13\_1.3.3.

5.2.3.1.13\_1.3.2 Test procedure

1. SS transmits PDSCH in TRxP#1 and TRxP#2 via PDCCH DCI format 1\_1 for C\_RNTI (Table 5.2.3.1.13\_1.3.3\_1-2), to transmit the DL RMC according to Table 5.2.3.1.13\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR for TRxP#1 and TRxP#2 according to Table 5.2.3.1.13\_1.4-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.1.13\_1.3.3 Message contents

5.2.3.1.13\_1.3.3\_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.3.1.13\_1.3.3\_1-1: *PDCCH-ControlResourceSet* (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4],Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| tci-PresentInDCI | enabled |  |  |
| } |  |  |  |

Table 5.2.3.1.13\_1.3.3\_1-2: Physical layer parameters for DCI format 1\_1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1 | | | | |
| Parameter | Value | Value in binary | Condition |
| Antenna port(s) | DMRS port 0 and 1 | “0111” |  |
| Transmission configuration indication | TCI codepoint 0, corresponding to TCI State #1 and #2 | “000” |  |

Table 5.2.3.1.13\_1.3.3\_1-3: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| tci-StatesToAddModList SEQUENCE(SIZE (1.. maxNrofTCI-States)) OF TCI-State { | 2 entries |  |  |
| TCI-State[1] SEQUENCE { |  | TCI-state-0 |  |
| tci-StateId | 0 |  |  |
| qcl-type1 SEQUENCE { |  |  |  |
| cell | Not present |  |  |
| bwp-Id | Not present |  |  |
| referenceSignal CHOICE { |  |  |  |
| ssb | SSB-Index |  |  |
| } |  |  |  |
| qcl-Type | typeC |  |  |
| } |  |  |  |
| } |  |  |  |
| TCI-State[2] |  | TCI-state-1 |  |
| tci-StateId | 1 |  |  |
| qcl-type1 SEQUENCE { |  |  |  |
| cell | Not present |  |  |
| bwp-Id | Not present |  |  |
| referenceSignal CHOICE { |  |  |  |
| csi-rs | 1 |  |  |
| } |  |  |  |
| qcl-Type | typeA |  |  |
| } |  |  |  |
| } |  |  |  |
| TCI-State[3] |  | TCI-state-2 |  |
| tci-StateId | 2 |  |  |
| qcl-type1 SEQUENCE { |  |  |  |
| cell | Not present |  |  |
| bwp-Id | Not present |  |  |
| referenceSignal CHOICE { |  |  |  |
| csi-rs | 5 |  |  |
| } |  |  |  |
| qcl-Type | typeA |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | wideband |  |  |
| } |  |  |  |
| } |  |  |  |
| repetitionSchemeConfig-r16 CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| fdm-TDM-r16 CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| repetitionScheme-r16 | fdmSchemeA |  |  |
| startingSymbolOffsetK-r16 | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.1.13\_1.3.3\_1-4: *CSI-RS-ResourceMapping* for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| row1 | 0000 | For CSI-RS resources 1, 2, 3, 4 |  |
|  | 0001 | For CSI-RS resources 5,6,7,8 |  |
| } |  |  |  |
| nrofPorts | p1 |  |  |
| firstOFDMSymbolInTimeDomain | 6 | For CSI-RS resources 1,3,5,7 |  |
|  | 10 | For CSI-RS resources 2,4,6,8 |  |
| } |  |  |  |

Table 5.2.3.1.13\_1.3.3\_1-5: *CSI-ResourcePeriodicityAndOffset* for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots20 | 10 | For CSI-RS resources 1,2,5,6 |  |
| slots20 | 11 | For CSI-RS resources 3,4,7,8 |  |
| } |  |  |  |

5.2.3.1.13\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.3.1.13\_1.3.3\_1.

5.2.3.1.13\_1.4 Test requirement

Table 5.2.3.1.13.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.13\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.13\_1.4-1: Test requirement for Rank 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition(Note 1) | Correlation matrix and antenna configuration (Note 2) | Reference value | |
| Fraction of  maximum  throughput  (%) | SNR (dB) (Note 3) |
| 1-1 | R.PDSCH.1-2.5 FDD | 10 / 15 | 16QAM, 0.54 | TDLA30-10 | 2x2, ULA Low | 70 | 11.9 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 | | | | | | | |

##### 5.2.3.1.14 4Rx FDD FR1 PDSCH Single-DCI based Inter-slot TDM scheme performance

5.2.3.1.14.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.14.0-3, with the addition of test parameters in Table 5.2.3.1.14.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.14.0-1.

Table 5.2.3.1.14.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH performance under 4 receive antenna conditions when UE is configured with repetitionNumber-r16 with multiple slot level PDSCH transmission occasions of the same TB with two TCI states defined in clause 5.1 of TS 38.214 [12] | 1-1 |

Table 5.2.3.1.14.0-2: Test parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | |
| TRxP #1(Note 1) | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | |  | TRxP #1 | |
| PDCCH configuration | | TCI state | |  | TCI State #1 | |
| CORESETPoolIndex | |  | Not configured | |
| CSI-RS for tracking | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | |
| Density | |  | 3 | |
| CSI-RS periodicity | | Slots | 20 | |
| CSI-RS offset | | Slots | 10 for CSI-RS resources 1 and 2  11 for CSI-RS resources 3 and 4 | 10 for CSI-RS resources 5 and 6  11 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | |
| Duplex mode | | | |  | FDD | |
| Active DL BWP index | | | |  | 1 | |
| PDSCH configuration | Mapping type | | |  | Type A | |
| k0 | | |  | 0 | |
| Starting symbol (S) | | |  | 2 | |
| Length (L) | | |  | 12 | |
| Repetition number | | |  | 2 | |
| PRB bundling type | | |  | Static | |
| PRB bundling size | | |  | 2 | |
| Resource allocation type | | |  | Type 0 | |
| RBG size | | |  | Config2 | |
| VRB-to-PRB mapping type | | |  | Non-interleaved | |
| VRB-to-PRB mapping interleaver bundle size | | |  | N/A | |
| PDSCH DMRS configuration | Antenna port indexes | | |  | 1000 | 1000 |
| TCI state | | |  | TCI State #1 | TCI State #2 |
| DMRS Type | | |  | Type 1 | |
| Number of additional DMRS | | |  | 1 | |
| Maximum number of OFDM symbols for DL front loaded DMRS | | |  | 1 | |
| TCI State #1 | Type 1 QCL information | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | N/A |
| QCL Type |  | Type A | N/A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| TCI State #2 | Type 1 QCL information | | CSI-RS resource |  | N/A | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | Type A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| Timing offset of the second TRxP from the first TRxP | | | | us | 2 | |
| Frequency offset of the second TRxP from the first TRxP | | | | Hz | 200 | |
| Number of HARQ Processes | | | |  | 4 | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | | |  | 2 | |
| Precoding configuration | | | |  | SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity | |
| Note 1: PDSCH transmission is done from both TRxPs | | | | | | |

Table 5.2.3.1.14.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition (Note 1) | Correlation matrix and antenna configuration Note 2) | Reference value | |
| BLER (%) | SNR (dB) (Note 4) |
| 1-1 | R.PDSCH.1-11.2 FDD | 10 / 15 | 16QAM, 0.54 | TDLA30-10 | 2x4, ULA Low | 1 (Note 3) | -0.4 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block.  Note 4: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.14.

###### 5.2.3.1.14\_1 4Rx FDD FR1 PDSCH Single-DCI based Inter-slot TDM scheme performance - 2x4 MIMO for both SA and NSA

5.2.3.1.14\_1.1 Test purpose

To verify the PDSCH performance under 4 receive antenna conditions when UE is configured with repetitionNumber-r16 with multiple slot level PDSCH transmission occasions of the same TB with two TCI states.

5.2.3.1.14\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *supportTDM-SchemeA-r16*.

5.2.3.1.14\_1.3 Test description

5.2.3.1.14\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.9 for TE diagram and section A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.3.1.14.0-2 and Table 5.2.3.1.14.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.14\_1.3.3.

5.2.3.1.14\_1.3.2 Test procedure

1. SS transmits PDSCH in TRxP#1 and TRxP#2 via PDCCH DCI format 1\_1 for C\_RNTI (Table 5.2.3.1.14\_1.3.3\_1-2), to transmit the DL RMC according to Table 5.2.3.1.14\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR for TRxP#1 and TRxP#2 according to Table 5.2.3.1.14\_1.4-1.

3. Measure the residual BLER for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of correctly and incorrectly received transport blocks based on ACK/NACK feedback on the UL during each subtest and decide pass or fail according to clause G.1.4 and Table G.1.5-1a in Annex G clause G.1.5.

5.2.3.1.14\_1.3.3 Message contents

5.2.3.1.14\_1.3.3\_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.3.1.14\_1.3.3\_1-1: *PDCCH-ControlResourceSet* (Preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4],Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| tci-PresentInDCI | enabled |  |  |
| } |  |  |  |

Table 5.2.3.1.14\_1.3.3\_1-2: Physical layer parameters for DCI format 1\_1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1 | | | | |
| Parameter | Value | Value in binary | Condition |
| Antenna port(s) | DMRS port 0 | “0000” |  |
| Transmission configuration indication | TCI codepoint 0, corresponding to TCI State #1 and #2 | “000” |  |

Table 5.2.3.1.14\_1.3.3\_1-3: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| tci-StatesToAddModList SEQUENCE(SIZE (1.. maxNrofTCI-States)) OF TCI-State { | 2 entries |  |  |
| TCI-State[1] SEQUENCE { |  | TCI-state-0 |  |
| tci-StateId | 0 |  |  |
| qcl-type1 SEQUENCE { |  |  |  |
| cell | Not present |  |  |
| bwp-Id | Not present |  |  |
| referenceSignal CHOICE { |  |  |  |
| ssb | SSB-Index |  |  |
| } |  |  |  |
| qcl-Type | typeC |  |  |
| } |  |  |  |
| } |  |  |  |
| TCI-State[2] |  | TCI-state-1 |  |
| tci-StateId | 1 |  |  |
| qcl-type1 SEQUENCE { |  |  |  |
| cell | Not present |  |  |
| bwp-Id | Not present |  |  |
| referenceSignal CHOICE { |  |  |  |
| csi-rs | 1 |  |  |
| } |  |  |  |
| qcl-Type | typeA |  |  |
| } |  |  |  |
| } |  |  |  |
| TCI-State[3] |  | TCI-state-2 |  |
| tci-StateId | 2 |  |  |
| qcl-type1 SEQUENCE { |  |  |  |
| cell | Not present |  |  |
| bwp-Id | Not present |  |  |
| referenceSignal CHOICE { |  |  |  |
| csi-rs | 5 |  |  |
| } |  |  |  |
| qcl-Type | typeA |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| pdsch-TimeDomainAllocationList | Not present |  |  |
| pdsch-TimeDomainAllocationList-r16 CHOICE { |  |  |  |
| setup SEQUENCE (SIZE(1..maxNrofDL-Allocations)) OF PDSCH-TimeDomainResourceAllocation-r16 { |  |  |  |
| PDSCH-TimeDomainResourceAllocation-r16[1] SEQUENCE { |  |  |  |
| k0-r16 | Not present |  |  |
| mappingType-r16 | typeA |  |  |
| startSymbolAndLength-r16 | 44 | Start symbol(S)=2, Length(L)=4 | For Slot i, if mod(i, 10) = 7 for i from {0,…,39} |
| repetitionNumber-r16 | 2 |  |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation-r16[2] SEQUENCE { |  |  |  |
| k0-r16 | Not present |  |  |
| mappingType-r16 | typeA |  |  |
| startSymbolAndLength-r16 | 53 | Start symbol(S)=2, Length(L)=12 | For Slot i, if mod(i, 10) = {0,1,2,3,4,5,}) for i from {1,…,39} |
| repetitionNumber-r16 | 2 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.1.14\_1.3.3\_1-4: *CSI-RS-ResourceMapping* for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| row1 | 0000 | For CSI-RS resources 1, 2, 3, 4 |  |
|  | 0001 | For CSI-RS resources 5,6,7,8 |  |
| } |  |  |  |
| nrofPorts | p1 |  |  |
| firstOFDMSymbolInTimeDomain | 6 | For CSI-RS resources 1,3,5,7 |  |
|  | 10 | For CSI-RS resources 2,4,6,8 |  |
| } |  |  |  |

Table 5.2.3.1.14\_1.3.3\_1-5: *CSI-ResourcePeriodicityAndOffset* for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots20 | 10 | For CSI-RS resources 1,2,5,6 |  |
| slots20 | 11 | For CSI-RS resources 3,4,7,8 |  |
| } |  |  |  |

5.2.3.1.14\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.3.1.14\_1.3.3\_1.

5.2.3.1.14\_1.4 Test requirement

Table 5.2.3.1.14.0-3 defines the primary level settings.

The residual BLER specified in Note 3 of Table 5.2.3.1.14\_1.4-1 test shall meet or be lower than the specified value in Table 5.2.3.1.14\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.14\_1.4-1: Test requirement for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition (Note 1) | Correlation matrix and antenna configuration (Note 2) | Reference value | |
| BLER (%) | SNR (dB) (Note 4) |
| 1-1 | R.PDSCH.1-11.2 FDD | 10 / 15 | 16QAM, 0.54 | TDLA30-10 | 2x4, ULA Low | 1 (Note 3) | 0.6 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block.  Note 4: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 | | | | | | | |

##### 5.2.3.1.15 4Rx FDD FR1 PDSCH with inter-cell interference

5.2.3.1.15.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.15.0-3, with the addition of test parameters in Table 5.2.3.1.15.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.15.0-1.

Table 5.2.3.1.15.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH performance in 4 receive antenna conditions, when the transmission from the serving cell is interfered by 1 or 2 interfering cells. | 1-1, 1-2 |

Table 5.2.3.1.15.0-2: Test parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | | |
|  | |  | Cell 1 | Cell 2 | Cell 3 |
|  | |  | Enabled | Enabled | Enabled for Test 1-1 Disabled for Test 1-2 |
| Duplex mode | |  | FDD | | |
| Active DL BWP index | |  | 1 | | |
| Physical cell ID | |  | 0 | 1 | 2 |
| Transmission rank | |  | 1 | Random rank with 70% and 30% probability for rank 1 and rank 2 | Random rank with 70% and 30% probability for rank 1 and rank 2 for Test 1-1  N/A for Test 1-2 |
| Time offset to Cell 1 | | us | N/A | 3 | -1 |
| Frequency offset to Cell 1 | | Hz | N/A | 300 | -100 |
| Interference Model | |  | N/A | As specified in B.6.2 | |
| INR (Note 2) | | dB | N/A | 7.77 for Test 1-1  7.58 for Test 1-2 | 2.29 for Test 1-1  N/A for Test 1-2 |
| SSB configuration | SSB position in burst |  | First SSB in Slot #0 | 1st SSB in Slot#0 for Test 1-1 2nd SSB in Slot #0 for Test 1-2 | 1st SSB in Slot#0 for Test 1-1 N/A for Test 1-2 |
| SSB periodicity | ms | 20 | 20 | 20 |
| PDSCH configuration | Mapping type |  | Type A | | |
|  | k0 |  | 0 | | |
|  | Starting symbol (S) |  | 2 | | |
|  | Length (L) |  | 12 | | |
|  | PDSCH aggregation factor |  | 1 | | |
|  | PRB bundling type |  | Static | | |
|  | PRB bundling size |  | 2 | | |
|  | Resource allocation type |  | Type 0 | | |
|  | RBG size |  | Config2 | | |
|  | VRB-to-PRB mapping type |  | Non-interleaved | | |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A | | |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 | | |
|  | Number of additional DMRS |  | 1 | | |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 | | |
| Number of HARQ Processes | |  | 4 | | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 | | |
| Note1: Cell 1 is the serving cell; Cells 2, 3 are interfering cells  Note 2: INR is defined in Annex B.6.1 | | | | | |

**Table 5.2.3.1.15.0-3: Minimum performance for PDSCH with rank 1 and with inter-cell interference**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-2.1 FDD | 10 / 15 | 16QAM, 0.48 | TDLC300-100 | 2x4, ULA Low | 70 | 10.1 |
| 1-2 | R.PDSCH.1-2.1 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 7.4 |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: Bandwidth/ Sub carrier spacing, Propagation Condition, Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.15.

###### 5.2.3.1.15\_1 4Rx FDD FR1 PDSCH with inter-cell interference performance - 2x4 MIMO for both SA and NSA

5.2.3.1.15\_1.1 Test purpose

Verify the PDSCH performance in 4 receive antenna conditions, when the transmission from the serving cell is interfered by 1 or 2 interfering cells.

5.2.3.1.15\_1.2 Test applicability

Test 1-1 and test 1-2 applies to all types of release 15 and release 16 NR UEs and E-UTRAN UEs supporting EN-DC and supporting MMSE-IRC processing for scenarios with inter-cell and intra-cell inter-user interference.

Test 1-1 and test 1-2 applies to all types of release 17 and forward NR UEs and E-UTRAN UEs supporting EN-DC.

5.2.3.1.15\_1.3 Test description

5.2.3.1.15\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [8].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.6.2 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the serving cell and interfering cells are set up according to Table 5.2-1 and Table 5.2.3.1.15.0-2 as appropriate.

3. Downlink signals for NR serving cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.15\_1.3.3.

5.2.3.1.15\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.1.15\_1.4-2. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR for the serving cell and interfering cells according to Table 5.2.3.1.15\_1.4-2.

3. Measure the average throughput on the serving cell for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Annex G.1.4.

4. Repeat steps from 1 to 3 for each subtest in Table 5.2.3.1.15\_1.4-2 as appropriate.

5.2.3.1.15\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.1.15\_1.3.3\_1 Message exceptions for SA

No message exceptions for SA

5.2.3.1.15\_1.3.3\_2 Message exceptions for NSA

No message exceptions for NSA

5.2.3.1.15\_1.4 Test requirement

Tables 5.2.3.1.15\_1.4-1 and 5.2.3.1.15\_1.4-2 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.15\_1.4-2 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.15\_1.4-1: Test parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | | |
|  | |  | Cell 1 | Cell 2 | Cell 3 |
|  | |  | Enabled | Enabled | Enabled for Test 1-1 Disabled for Test 1-2 |
| Duplex mode | |  | FDD | | |
| Active DL BWP index | |  | 1 | | |
| Physical cell ID | |  | 0 | 1 | 2 |
| Transmission rank | |  | 1 | Random rank with 70% and 30% probability for rank 1 and rank 2 | Random rank with 70% and 30% probability for rank 1 and rank 2 for Test 1-1  N/A for Test 1-2 |
| Time offset to Cell 1 | | us | N/A | 3 | -1 |
| Frequency offset to Cell 1 | | Hz | N/A | 300 | -100 |
| Interference Model | |  | N/A | As specified in B.6.2 | |
| INR (Note 2) | | dB | N/A | 7.77+0.8 for Test 1-1  7.58+0.8 for Test 1-2 | 2.29+0.8 for Test 1-1  N/A for Test 1-2 |
| SSB configuration | SSB position in burst |  | First SSB in Slot #0 | 1st SSB in Slot#0 for Test 1-1 2nd SSB in Slot #0 for Test 1-2 | 1st SSB in Slot#0 for Test 1-1 N/A for Test 1-2 |
| SSB periodicity | ms | 20 | 20 | 20 |
| PDSCH configuration | Mapping type |  | Type A | | |
|  | k0 |  | 0 | | |
|  | Starting symbol (S) |  | 2 | | |
|  | Length (L) |  | 12 | | |
|  | PDSCH aggregation factor |  | 1 | | |
|  | PRB bundling type |  | Static | | |
|  | PRB bundling size |  | 2 | | |
|  | Resource allocation type |  | Type 0 | | |
|  | RBG size |  | Config2 | | |
|  | VRB-to-PRB mapping type |  | Non-interleaved | | |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A | | |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 | | |
|  | Number of additional DMRS |  | 1 | | |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 | | |
| Number of HARQ Processes | |  | 4 | | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 | | |
| Note1: Cell 1 is the serving cell; Cells 2, 3 are interfering cells  Note 2: INR is defined in Annex B.6.1 | | | | | |

**Table 5.2.3.1.15\_1.4-2: Test Requirement for PDSCH with rank 1 and with inter-cell interference**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-2.1 FDD | 10 / 15 | 16QAM, 0.48 | TDLC300-100 | 2x4, ULA Low | 70 | 11.8 |
| 1-2 | R.PDSCH.1-2.1 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.2 |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: Bandwidth/ Sub carrier spacing, Propagation Condition, Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | |

##### 5.2.3.1.16 4Rx FDD FR1 for PDSCH with intra-cell inter-user interference

5.2.3.1.16.0 Minimum conformance requirements

The performance requirements are specified in Tables 5.2.3.1.16.0-3 and 5.2.3.1.16.0-4, with the addition of test parameters in Table 5.2.3.1.16.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.16.0-1.

Table 5.2.3.1.16.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH performance under 4 receive antenna conditions, when the PDSCH transmission of target UE is interfered by co-scheduled UE. | 1-1, 2-1 |

Table 5.2.3.1.16.0-2: Test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Target UE | Co-scheduled UE |
| Duplex mode | |  | FDD | |
| Active DL BWP index | |  | 1 | |
| PDSCH configuration | Mapping type |  | Type A | |
| k0 |  | 0 | |
| Starting symbol (S) |  | 2 | |
| Length (L) |  | 12 | |
| PDSCH aggregation factor |  | 1 | |
| PRB bundling type |  | Static | |
| PRB bundling size |  | 2 | |
| Resource allocation type |  | Type 0 | |
| RBG size |  | Config2 | |
| VRB-to-PRB mapping type |  | Non-interleaved | |
| VRB-to-PRB mapping interleaver bundle size |  | N/A | |
| PDSCH DMRS configuration (Note 1) | DMRS Type |  | Type 1 | |
| Number of additional DMRS |  | 1 | |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 | |
| Antenna ports indexes |  | {1000} for test 1-1  {1000, 1001} for test 2-1 | {1001} for test 1-1  {1002, 1003} for test 2-1 |
| Number of PDSCH DMRS CDM group(s) without data |  | 1 for test 1-1  2 for test 2-1 | 1 for test 1-1  2 for test 2-1 |
| PDSCH & PDSCH DMRS Precoding configuration | |  | Single Panel Type I, Randomized precoder selection for every PRB bundle and updated per slot, with equal probability of each applicable i1/i2 combination or codebook  Index, chosen from section 5.2.2.2.1 of TS 38.214 [12]. | Single Panel Type I, Randomized precoder selection for every PRB bundle and updated per slot, with equal probability of each applicable i1/i2 combination or codebook  Index, chosen from section 5.2.2.2.1 of TS 38.214 [12].  Any column of precoder matrix is not equal to any column of precoder matrix of Target UE for test 1-1  Select the precoder to ensure any column of precoder is orthogonal to any column of precoder for the target PDSCH for test 2-1 |
| MU-MIMO Beamforming Model | |  | As specified in B.4.2 | |
| Number of HARQ Processes | |  | 4 | N/A |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 | N/A |
| Note 1: DMRS scrambling ID is the same for both target and co-scheduled UEs. | | | | |

Table 5.2.3.1.16.0-3: Minimum performance for target UE with Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target UE | Co-scheduled UE | Fraction of  maximum  throughput  (%) | SNR (dB) |
| 1-1 | R.PDSCH.5-1.1 FDD | 10 / 15 | 16QAM, 0.48 | Random 16QAM symbols | TDLC300-100 | 2x4, ULA Low | 70 | 11.5 |

Table 5.2.3.1.16.0-4: Minimum performance for target UE with Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target UE | Co-scheduled UE | Fraction of  maximum  throughput  (%) | SNR (dB) |
| 2-1 | R.PDSCH.5-1.2 FDD | 10 / 15 | 16QAM, 0.48 | Random 16QAM symbols | TDLA30-10 | 4x4, ULA Low | 70 | 15.3 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.16.

###### 5.2.3.1.16\_1 4Rx FDD FR1 for PDSCH with intra cell inter user interference performance – 2x4 MIMO for both NSA and SA

5.2.3.1.16\_1.1 Test purpose

To verify the PDSCH performance under 4 receive antenna conditions, when the PDSCH transmission of target UE is interfered by co-scheduled UE.

5.2.3.1.16\_1.2 Test applicability

This test applies to all types of NR UEs and E-UTRAN UEs supporting EN-DC for release 15 and release 16 supporting MMSE-IRC processing for scenarios with inter-cell and intra-cell inter-user interference.

This test applies to all types of release 17 and forward NR UEs and E-UTRAN UEs supporting EN-DC.

5.2.3.1.16\_1.3 Test description

5.2.3.1.16\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.3.1.16.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.16\_1.3.3.

5.2.3.1.16\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.1.16\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.1.16\_1.4-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.1.16\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.1.16\_1.3.3\_1 Message exceptions for SA

No message exceptions for SA

5.2.3.1.16\_1.3.3\_1 Message exceptions for NSA

No message exceptions for NSA

5.2.3.1.16\_1.4 Test requirement

Table 5.2.3.1.16\_1.4-1: Test requirement for target UE with Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target UE | Co-scheduled UE | Fraction of  maximum  throughput  (%) | SNR (dB) |
| 1-1 | R.PDSCH.5-1.1 FDD | 10 / 15 | 16QAM, 0.48 | Random 16QAM symbols | TDLC300-100 | 2x4, ULA Low | 70 | 12.4 |

###### 5.2.3.1.16\_2 4Rx FDD FR1 for PDSCH with intra cell inter user interference performance – 4x4 MIMO for both NSA and SA

5.2.3.1.16\_2.1 Test purpose

To verify the PDSCH performance under 4 receive antenna conditions, when the PDSCH transmission of target UE is interfered by co-scheduled UE.

5.2.3.1.16\_2.2 Test applicability

This test applies to all types of NR UEs and E-UTRAN UEs supporting EN-DC for release 15 and release 16 supporting MMSE-IRC processing for scenarios with inter-cell and intra-cell inter-user interference.

This test applies to all types of release 17 and forward NR UEs and E-UTRAN UEs supporting EN-DC.

5.2.3.1.16\_2.3 Test description

5.2.3.1.16\_2.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.3.1.16.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.16\_2.3.3.

5.2.3.1.16\_2.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.1.16\_2.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.1.16\_2.4-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.1.16\_2.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.1.16\_2.3.3\_1 Message exceptions for SA

No message exceptions for SA

5.2.3.1.16\_2.3.3\_1 Message exceptions for NSA

No message exceptions for NSA

5.2.3.1.16\_2.4 Test requirement

Table 5.2.3.1.16\_2.4-1: Test requirement for target UE with Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target UE | Co-scheduled UE | Fraction of  maximum  throughput  (%) | SNR (dB) |
| 2-1 | R.PDSCH.5-1.2 FDD | 10 / 15 | 16QAM, 0.48 | Random 16QAM symbols | TDLA30-10 | 4x4, ULA Low | 70 | 16.3 |

##### 5.2.3.1.17 4Rx FDD FR1 for PDSCH CRS interference mitigation under NR-LTE coexistence scenario

5.2.3.1.17.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.17.0-4, with the addition of test parameters in Table 5.2.3.1.17.0-2 for the serving cell and Table 5.2.3.1.17.0-3 for the LTE interference cells and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.17.0-1.

Table 5.2.3.1.17.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH CRS interference mitigation performance under 4 receive antenna conditions with CRS rate matching configured for the serving cell. | 1-1 |

Table 5.2.3.1.17.0-2: Test parameters for the serving cell

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Value** |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
| NR UL transmission with a 7.5 kHz shift to the LTE raster | |  | true |
| PDCCH configuration | Symbols with PDCCH |  | Symbol# 2 | |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 3 |
|  | Length (L) |  | 9 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Position of the first DM-RS for downlink |  | 3 |
|  | Number of additional DMRS |  | 1 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CRS for rate matching (Note 1) | LTE carrier centre subcarrier location |  | Same as NR carrier centre subcarrier location |
|  | LTE carrier BW | MHz | 10 |
|  | Number of antenna ports |  | 2 |
|  | v-shift |  | 0 |
| Number of HARQ Processes | |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 |
| Note 1: No MBSFN is configured on LTE carrier.  Note 2: Network-based CRS interference mitigation is disabled on LTE carrier. | | | |

Table 5.2.3.1.17.0-3: Test parameters for the LTE interference cells

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1 | Cell 2 |
| Propagation conditions and MIMO configuration (Note 1) | |  | TDLA30-10 ULA Low | TDLA30-10 ULA Low |
| INR (Note 2) | | dB | 10.45 | 4.6 |
| Cell-specific reference signals | |  | Antenna ports 0,1 | Antenna ports 0,1 |
| Carrier centre subcarrier location | |  | Same as the serving carrier centre subcarrier location | Same as the serving carrier centre subcarrier location |
| BWChannel | | MHz | 10 | 10 |
| Cyclic Prefix | |  | Normal | Normal |
| Physical cell ID | |  | 1 | 2 |
| Number of control OFDM symbols | |  | 2 | 2 |
| PDSCH transmission mode | |  | 4 | 4 |
| Interference model | |  | As specified in clause B.7 | As specified in clause B.7 |
| Probability of occurrence of PDSCH data | | % | 20 | 20 |
| Probability of occurrence of transmission rank | Rank 1 | % | 80 | 80 |
| Rank 2 | % | 20 | 20 |
| Downlink power allocation |  | dB | -3 | -3 |
|  | dB | -3 | -3 |
| σ | dB | 0 | 0 |
| Precoding granularity | | PRB | 6 | 6 |
| Time offset to the serving cell | | us | 3 | -1 |
| Frequency offset to the serving cell | | Hz | 300 | -100 |
| MBSFN | |  | Not configured | Not configured |
| Network-based CRS interference mitigation | |  | Disabled | Disabled |
| Note 1: The channel for the LTE interference cells and the serving cell are independent.  Note 2: Defined in B.6.1. | | | | |

Table 5.2.3.1.17.0-4: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of  maximum  throughput  (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-7.3 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.0 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.17.

##### 5.2.3.1.17\_1 4Rx FDD FR1 for PDSCH CRS interference mitigation under NR-LTE coexistence scenario – 2x4 MIMO for both NSA and SA

Editor’s Note: This test case is incomplete in following aspects

- Message exceptions are FFS

- MU/TT analysis is pending

5.2.3.1.17\_1.1 Test purpose

To verify PDSCH CRS interference mitigation performance under 4 receive antenna conditions with CRS rate matching configured for the serving cell.

5.2.3.1.17\_1.2 Test applicability

This test applies to all types of NR UE release 17 and forward that support *CRS-IM-DSS-15kHzSCS-r17.*

5.2.3.1.17\_1.3 Test description

5.2.3.1.17\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Tables 5.2.3.1.17.0-2 and 5.2.3.1.17.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.17\_1.3.3.

5.2.3.1.17\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.1.17\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.1.17\_1.4-1 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

4. Repeat steps from 1 to 3 for each subtest in Table 5.2.3.1.17\_1.4-1 as appropriate.

5.2.3.1.17\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.1.17\_1.3.3\_1 Message exceptions for SA

FFS

5.2.3.1.17\_1.3.3\_1 Message exceptions for NSA

FFS

5.2.3.1.17\_1.4 Test requirement

Table 5.2.3.1.17\_1.4-1: Test requirement for Rank 1

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of  maximum  throughput  (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-7.3 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.0+TT |

##### 5.2.3.1.18 4Rx FDD FR1 for PDSCH with inter cell CRS interference

5.2.3.1.18.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.18.0-4 and Table 5.2.3.1.18.0-6, with the addition of test parameters in Table 5.2.3.1.18.0-2 and 5.2.3.1.18.0-3 and the downlink physical channel setup according to Annex C.3.1.

The requirements for UE capable of performing CRS-IM with the assistance of network signalling on LTE channel bandwidth are specified in Table 5.2.3.1.18.0-4.

The requirements for UE capable of performing CRS-IM without the assistance of network signalling on LTE channel bandwidth are specified in Table 5.2.3.1.18.0-6.

The test purposes are specified in Table 5.2.3.1.18.0-1.

Table 5.2.3.1.18.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH performance under 4 receive antenna conditions when PDSCH is interfered by inter cell CRS signal | 1-1 and 2-1 |

Table 5.2.3.1.18.0-2: Tests parameter for serving cell PDSCH

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 12 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 1 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Number of HARQ Processes | |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 2 |

Table 5.2.3.1.18.0-3: Tests parameter for interference cells

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Cell 1 | Cell 2 |
| Duplex mode | |  | FDD | FDD |
| INR | | dB | 10.45 | 4.6 |
| LTE Bandwidth (Note 5) | | MHz | 20 | 20 |
| Carrier centre subcarrier location (Note 6) | |  | Same as the NR serving carrier centre subcarrier location | Same as the NR serving carrier centre subcarrier location |
| Cyclic Prefix | |  | Normal | Normal |
| Physical cell ID | |  | 1 | 2 |
| CRS pattern | Number of antenna ports |  | 4 | 4 |
| v-shift |  | 1 | 2 |
| Downlink power allocation |  | dB | -6 | -6 |
|  | dB | -6 | -6 |
| σ | dB | 0 | 0 |
| PDSCH transmission mode | |  | TM4 | TM4 |
| PDSCH loading level | | % | 20% probability of occurrence of LTE data transmission in time domain, and full bandwidth allocation in frequency domain for test 1-1. | 20% probability of occurrence of LTE data transmission in time domain, and full bandwidth allocation in frequency domain for test 1-1. |
| Transmission rank | | % | 80% and 20% probability for rank 1 and rank 2 respectively | 80% and 20% probability for rank 1 and rank 2 respectively |
| Interference model | |  | As specified in clause B.7 | As specified in clause B.7 |
| Time offset to the serving cell | | us | 3 | -1 |
| Frequency offset to the serving cell | | Hz | 300 | -100 |
| Propagation conditions and MIMO configuration (Note 1) | |  | TDLA30-10 ULA Low | TDLA30-10 ULA Low |
| Precoding granularity | | PRB | 8 | 8 |
| Note 1: The channel for the LTE interference cells and the serving cell are independent.  Note 2: No MBSFN is configured on LTE carrier.  Note 3: Network-based CRS interference mitigation is disabled on LTE carrier.  Note 4: The start of transmission of LTE frame is delayed by 2 LTE subframes with respect to the start of transmission of NR frame  Note 5: This parameter is informed to UE via network assistance signalling for Test 1-1 in Table 5.2.3.1.18.0-4.  Note 6: Single entry is included in IE *LTE-NeighCellsCRS-AssistInfoList-r17* that applies for both cells for cases with network signalling assistance | | | | |

Table 5.2.3.1.18.0-4: Minimum performance for Rank 1 with the assistance of network signalling on LTE channel bandwidth

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation  condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-18.1 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 4x4, ULA Low | 70 | 8.0 |

Table 5.2.3.1.18.0-5: Measurement Gap configurations

|  |  |  |
| --- | --- | --- |
| Parameter | Unit | Value |
| Measurement Gap Length | ms | 6 |
| Measurement Gap Repetition Period | ms | 40 |
| Gap offset | ms | 7 |
| Measurement gap timing advance | ms | 0 |

Table 5.2.3.1.18.0-6: Minimum performance for Rank 1 without the assistance of network signalling on LTE channel bandwidth

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation  condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 2-1 | R.PDSCH.1-17.2 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 4x4, ULA Low | 70 | 8.0 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.18.

##### 5.2.3.1.18\_1 4Rx FDD FR1 for PDSCH with inter cell CRS interference scenario – 4x4 MIMO for both NSA and SA

Editor’s Note: This test case is incomplete in following aspects

- Message exceptions are FFS

- MU/TT analysis is pending

5.2.3.1.18\_1.1 Test purpose

To verify PDSCH performance under 4 receive antenna conditions when PDSCH is interfered by inter cell CRS signal.

5.2.3.1.18\_1.2 Test applicability

Test 2-1 applies to all types of NR UE release 17 and forward that support *CRS-IM-nonDSS-15kHzSCS-r17.*

Test 1-1 applies to all types of NR UE release 17 and forward that support *CRS-IM-nonDSS-NWA-15kHzSCS-r17.*

5.2.3.1.18\_1.3 Test description

5.2.3.1.18\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Tables 5.2.3.1.18.0-2 and 5.2.3.1.18.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.18\_1.3.3.

6. For UE capable of performing CRS-IM without the assistance of network signalling on LTE channel bandwidth, ensure the network configures an inter-RAT LTE measurement object of the interfering cells to the tested UE. Inter-RAT measurement is configured at the beginning of the test and applied throughout the test with gap pattern configurations according to Table 5.2.3.1.18.0-5. PDSCH is not scheduled, and throughput is not counted during 4.64s after the beginning of test. PDSCH is not scheduled in the measurement gaps.

5.2.3.1.18\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.3.1.18\_1.4-1 and 5.2.3.1.18\_1.4-2 as appropriate. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.1.18\_1.4-1 and 5.2.3.1.18\_1.4-2 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

4. Repeat steps from 1 to 3 for each subtest in Tables 5.2.3.1.18\_1.4-1 and 5.2.3.1.18\_1.4-2 as appropriate.

5.2.3.1.18\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.1.18\_1.3.3\_1 Message exceptions for SA

FFS

5.2.3.1.18\_1.3.3\_1 Message exceptions for NSA

FFS

5.2.3.1.18\_1.4 Test requirement

Table 5.2.3.1.18\_1.4-1: Test requirement for Rank 1 with the assistance of network signalling on LTE channel bandwidth

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation  condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-18.1 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 4x4, ULA Low | 70 | 8.0+TT |

Table 5.2.3.1.18\_1.4-2: Test requirement for Rank 1 without the assistance of network signalling on LTE channel bandwidth

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation  condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 2-1 | R.PDSCH.1-17.2 FDD | 10 / 15 | 16QAM, 0.48 | TDLA30-10 | 4x4, ULA Low | 70 | 8.0+TT |

##### 5.2.3.1.19 4Rx FDD FR1 PDSCH HST-SFN Scheme A performance - 2x4 MIMO for both SA and NSA

Editor's Note: This test cases is incomplete in following aspects:

- Minimum test time is FFS.

5.2.3.1.19.1 Test Purpose

To verify the UE performance in the HST-SFN Scheme A scenario.

5.2.3.1.19.2 Test applicability

This test case applies to all types of NR UE release 17 and forward that support SFN scheme A for PDCCH scheduling SFN Scheme A PDSCH.

5.2.3.1.19.3 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.19.3-3, with the addition of test parameters in Table 5.2.3.1.19.3-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.19.3-1.

**Table 5.2.3.1.19.3-1: Tests purpose**

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify UE performance in the HST-SFN Scheme A scenario defined in B.3.5 | 1-1 |

**Table 5.2.3.1.19.3-2: Test parameters**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Value** |
| Duplex mode | | |  | FDD |
| Active DL BWP index | | |  | 1 |
| PDCCH configuration | TCI state | |  | Note 1 |
| PDSCH configuration | Mapping type | |  | Type A |
| k0 | |  | 0 |
| Starting symbol (S) | |  | 2 |
| Length (L) | |  | 12 |
| PDSCH aggregation factor | |  | 1 |
| PRB bundling type | |  | Static |
| PRB bundling size | |  | 2 |
| Resource allocation type | |  | Type 0 |
| RBG size | |  | Config2 |
| VRB-to-PRB mapping type | |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size | |  | N/A |
| TCI state | |  | Note 1 |
| PDSCH DMRS configuration | DMRS Type | |  | Type 1 |
| Number of additional DMRS | |  | 2 |
| Maximum number of OFDM symbols for DL front loaded DMRS | |  | 1 |
| CSI-RS for tracking | Resource set #1 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 5 for CSI-RS resource 1 and 3  l0 = 9 for CSI-RS resource 2 and 4 |
| CSI-RS periodicity | Slots | 10 for CSI-RS resource 1,2,3,4. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4 |
| QCL info |  | TCI state #3 |
| Resource set #2 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 6 for CSI-RS resource 5 and 6  l0 = 10 for CSI-RS resource 7 and 8 |
| CSI-RS periodicity | Slots | 10 for CSI-RS resource 5,6,7,8. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8 |
| QCL info |  | TCI state #4 |
| Resource set #3 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 4 for CSI-RS resource 9 and 10  l0 = 8 for CSI-RS resource 11 and 12 |
| CSI-RS periodicity | Slots | 10 for CSI-RS resource 9,10,11,12. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 9 and 10 2 for CSI-RS resource 11 and 12 |
| QCL info |  | TCI state #5 |
| NZP CSI-RS for CSI acquisition | Resource set #4 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 12 |
| CSI-RS periodicity | Slots | 20 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #0 |
| Resource set #5 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 13 |
| CSI-RS periodicity | Slots | 20 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #1 |
| Resource set #6 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 7 |
| CSI-RS periodicity | Slots | 20 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #2 |
| TCI state #0 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking Resource set #1' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #2 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 9 from 'CSI-RS for tracking Resource set #3' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #3 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #4 | Type 1 QCL information | SSB index |  | SSB #1 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #5 | Type 1 QCL information | SSB index |  | SSB #2 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| Number of HARQ Processes | | |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | |  | 2 |
| Note 1: SSB # (k mod 3), CSI-RS (for tracking) resource set # ((k mod 3) + 1) and CSI-RS (for CSI acquisition) resource set # ((k mod 3) + 4) are transmitted by kth RRH.  Codepoint #0 is activated when UE receives PDCCH/PDSCH from RRH#3k and RRH#3k+1 with TCI States TCI state #0, TCI State #1.  Codepoint #1 is activated when UE receives PDCCH/PDSCH from RRH#3k+1 and RRH#3k+2 with TCI States TCI state #1, TCI State #2.  Codepoint #2 is activated when UE receives PDCCH/PDSCH from RRH#3k+2 and RRH#3k+3 with TCI States TCI state #2, TCI State #0. | | | | |

**Table 5.2.3.1.19.3-3: Minimum performance for HST-SFN Scheme A**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | | |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.1-8.5 FDD | 10 / 15 | 16QAM, 0.48 | HST-SFN Scheme A | 2x4 | 70 | 9.1 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.19.

5.2.3.1.19.4 Test description

5.2.3.1.19.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.3.1.19.3-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.3.5.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.19.4.3.

5.2.3.1.19.4.2 Test procedure

1. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.1.19.5-1 as appropriate.

2. SS is configured to transmit SSB and CSI-RS continuously and schedule PDSCH and PDCCH transmission according to Note 1 in 5.2.3.1.19.3-2. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.3.1.19.5-1. The SS sends downlink MAC padding bits on the DL RMC.

Note: All TCI states are known to the UE through configuration inside RrcReconfiguration. There is no need to configure additional L1-RSRP measurements.

3. Send MAC CE command “Enhanced TCI States Indication for UE-specific PDCCH MAC CE” according to the timing described in Note 1 of Table 5.2.3.1.19.3-2to active TCI state codepoint 0, 1 or 2 for PDCCH periodically. PDSCH is automatically associated with TCI state codepoint 0, 1 or 2 as tci-PresentInDCI is not present. TCI states 3, 4 and 5 for SSBs are automatically activated through relation of QCL-Info in NZP CSI-RS.

4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.1.19.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.1.19.4.3.1 Message exceptions for SA

Table 5.2.3.1.19.4.3.1-1: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | Not present | n2 is used | Test 1-1 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.1.19.4.3.1-2: DMRS-DownlinkConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24 | | | |
| Information Element | Value/remark | Comment | Condition |
| DMRS-DownlinkConfig ::= SEQUENCE { |  |  |  |
| dmrs-AdditionalPosition | pos2 |  | Test 1-1 |
| } |  |  |  |

Table 5.2.3.1.19.4.3.1-3: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | n4 |  | Test 1-1 |
| } |  |  |  |

Table 5.2.3.1.19.4.3.1-4: NZP-CSI-RS-Resource for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| nzp-CSI-RS-ResourceId | i-1 for CSI-RS resource #i, i=1,2,3,4,5,6,7,8,9,10,11,12 | for test 1-1 |  |
| qcl-InfoPeriodicCSI-RS | 3 for CSI-RS resource #1, #2, #3, #4  4 for CSI-RS resource #5, #6, #7, #8  5 for CSI-RS resource #9, #10, #11, #12 | for test 1-1:  TCI-StateId for TCI-State #3 for CSI-RS resource #1, #2, #3, #4  TCI-StateId for TCI-State #4 for CSI-RS resource #5, #6, #7, #8  TCI-StateId for TCI-State #5 for CSI-RS resource #9, #10, #11, #12 |  |
| } |  |  |  |

Table 5.2.3.1.19.4.3.1-5: CSI-RS-ResourceMapping for TRS (Table 5.2.3.1.19.4.3.1-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 with condition TRS | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 5 for CSI-RS resource #1 and #3  9 for CSI-RS resource #2 and #4  6 for CSI-RS resource #5 and #6  10 for CSI-RS resource #7 and #8  4 for CSI-RS resource #9 and #10  8 for CSI-RS resource #11 and #12 | for test 1-1:  l0 = 5 for CSI-RS resource 1 and 3  l0 = 9 for CSI-RS resource 2 and 4  l0 = 6 for CSI-RS resource 5 and 6  l0 = 10 for CSI-RS resource 7 and 8  l0 = 4 for CSI-RS resource 9 and 10  l0 = 8 for CSI-RS resource 11 and 12 |  |
| } |  |  |  |

Table 5.2.3.1.19.4.3.1-6: CSI-ResourcePeriodicityAndOffset for CSI Tracking (Table 5.2.3.1.19.4.3.1-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots10 | 1 for CSI-RS resource #1, #2, #5, #6, #9, #10  2 for CSI-RS resource #3 #4, #7, #8, #11, #12 | For test 1-1:  periodicity:  10 slots.  offset:  1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4  1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8  1 for CSI-RS resource 9 and 10 2 for CSI-RS resource 11 and 12 |  |
| } |  |  |  |

Table 5.2.3.1.19.4.3.1-7: NZP-CSI-RS-ResourceSet for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-12 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-ResourceSet ::= SEQUENCE { |  |  |  |
| nzp\_CSI\_ResourceSetId | 0 for Resource set #1  1 for Resource set #2  2 for Resource set #3 | For test 1-1 |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 4 entries | For test 1-1 | Resource set #1 |
| NZP-CSI-RS-ResourceId[1] | 0 | entry 1  CSI-RS resource #1 |  |
| NZP-CSI-RS-ResourceId[2] | 1 | entry 2  CSI-RS resource #2 |  |
| NZP-CSI-RS-ResourceId[3] | 2 | entry 3  CSI-RS resource #3 |  |
| NZP-CSI-RS-ResourceId[4] | 3 | entry 4  CSI-RS resource #4 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 4 entries | For test 1-1 | Resource set #2 |
| NZP-CSI-RS-ResourceId[1] | 4 | entry 1  CSI-RS resource #5 |  |
| NZP-CSI-RS-ResourceId[2] | 5 | entry 2  CSI-RS resource #6 |  |
| NZP-CSI-RS-ResourceId[3] | 6 | entry 3  CSI-RS resource #7 |  |
| NZP-CSI-RS-ResourceId[4] | 7 | entry 4  CSI-RS resource #8 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 4 entries | For test 1-1 | Resource set #3 |
| NZP-CSI-RS-ResourceId[1] | 8 | entry 1  CSI-RS resource #9 |  |
| NZP-CSI-RS-ResourceId[2] | 9 | entry 2  CSI-RS resource #10 |  |
| NZP-CSI-RS-ResourceId[3] | 10 | entry 3  CSI-RS resource #11 |  |
| NZP-CSI-RS-ResourceId[4] | 11 | entry 4  CSI-RS resource #12 |  |
| } |  |  |  |
| trs-Info | true |  |  |
| } |  |  |  |

Table 5.2.3.1.19.4.3.1-8: NZP-CSI-RS-Resource for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-14 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| nzp-CSI-RS-ResourceId | 12 for CSI-RS resource #13  13 for CSI-RS resource #14  14 for CSI-RS resource #15 | for test 1-1 |  |
| qcl-InfoPeriodicCSI-RS | 0 for CSI-RS resource #13  1 for CSI-RS resource #14  2 for CSI-RS resource #15 | for test 1-1:  TCI-State #0 for CSI-RS resource #13  TCI-State #1 for CSI-RS resource #14  TCI-State #2 for CSI-RS resource #15 |  |
| } |  |  |  |

Table 5.2.3.1.19.4.3.1-9: CSI-RS-ResourceMapping for CSI Acquisition (Table 5.2.3.1.19.4.3.1-8)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 12 for CSI-RS resource #13  13 for CSI-RS resource #14  7 for CSI-RS resource #15 | for test 1-1  l0=12 for CSI-RS resource #13  l0=13 for CSI-RS resource #14  l0=7 for CSI-RS resource #15 |  |
| } |  |  |  |

Table 5.2.3.1.19.4.3.1-10: CSI-ResourcePeriodicityAndOffset for CSI Acquisition (Table 5.2.3.1.19.4.3.1-8)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-16 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots20 | 0 | For test 1-1  periodicity = 20 slots.  offset = 0 slots |  |
| } |  |  |  |

Table 5.2.3.1.19.4.3.1-11: NZP-CSI-RS-ResourceSet for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-18 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-ResourceSet ::= SEQUENCE { |  |  |  |
| nzp\_CSI\_ResourceSetId | 3 for Resource set #4  4 for Resource set #5  5 for Resource set #6 | For test 1-1 |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry | For test 1-1 | Resource set #4 |
| NZP-CSI-RS-ResourceId[1] | 12 | entry 1  CSI-RS resource #13 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry | For test 1-1 | Resource set #5 |
| NZP-CSI-RS-ResourceId[1] | 13 | entry 1  CSI-RS resource #14 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry | For test 1-1 | Resource set #5 |
| NZP-CSI-RS-ResourceId[1] | 14 | entry 1  CSI-RS resource #15 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.1.19.4.3.1-12: *TCI-State*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-190 | | | |
| Information Element | Value/remark | Comment | Condition |
| TCI-State ::= SEQUENCE { |  |  |  |
| tci-StateId | 0 for TCI state #0  1 for TCI state #1  2 for TCI state #2  3 for TCI state #3  4 for TCI state #4  5 for TCI state #5 | For test 1-1 |  |
| qcl-Type1 SEQUENCE { |  |  |  |
| bwp-Id | BWP-Id of active BWP |  | TCI state #0, TCI state #1, TCI state #2 |
|  | Not present |  | TCI state #3, TCI state #4, TCI state #5 |
| referenceSignal CHOICE { |  |  |  |
| csi-rs | 0 | CSI-RS resource #1 | TCI state #0 |
|  | 4 | CSI-RS resource #5 | TCI state #1 |
|  | 8 | CSI-RS resource #9 | TCI state #2 |
| ssb | 0 | SSB #0 | TCI state #3 |
|  | 1 | SSB #1 | TCI state #4 |
|  | 2 | SSB #2 | TCI state #5 |
| } |  |  |  |
| qcl-Type | typeA |  | TCI state #0, TCI state #1, TCI state #2 |
|  | typeC |  | TCI state #3, TCI state #4, TCI state #5 |
| } |  |  |  |
| } |  |  |  |

5.2.3.1.19.4.3.2 Message exceptions for NSA

Same as 5.2.3.1.19.4.3.1.

5.2.3.1.19.5 Test Requirement

Tables 5.2.3.1.19.3-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.19.5-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.19.5-1: Test Requirements for HST-SFN Scheme A

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | | |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.1-8.5 FDD | 10 / 15 | 16QAM, 0.48 | HST-SFN Scheme A | 2x4 | 70 | 9.7 |

##### 5.2.3.1.20 4Rx FDD FR1 PDSCH HST-SFN Scheme B performance - 2x4 MIMO for both SA and NSA

Editor's Note: This test cases is incomplete in following aspects:

- Minimum test time is FFS.

5.2.3.1.20.1 Test Purpose

To verify the UE performance in the HST-SFN Scheme B scenario.

5.2.3.1.20.2 Test applicability

This test case applies to all types of NR UE release 17 and forward that support SFN scheme B for PDCCH scheduling SFN Scheme B PDSCH.

5.2.3.1.20.3 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.1.20.3-3, with the addition of test parameters in Table 5.2.3.1.20.3-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.20.3-1.

**Table 5.2.3.1.20.3-1: Tests purpose**

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify UE performance in the HST-SFN Scheme B scenario defined in B.3.6 | 1-1 |

**Table 5.2.3.1.20.3-2: Test parameters**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Value** |
| Duplex mode | | |  | FDD |
| Active DL BWP index | | |  | 1 |
| PDCCH configuration | TCI state | |  | Note 1 |
| PDSCH configuration | Mapping type | |  | Type A |
| k0 | |  | 0 |
| Starting symbol (S) | |  | 2 |
| Length (L) | |  | 12 |
| PDSCH aggregation factor | |  | 1 |
| PRB bundling type | |  | Static |
| PRB bundling size | |  | 2 |
| Resource allocation type | |  | Type 0 |
| RBG size | |  | Config2 |
| VRB-to-PRB mapping type | |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size | |  | N/A |
| TCI state | |  | Note 1 |
| PDSCH DMRS configuration | DMRS Type | |  | Type 1 |
| Number of additional DMRS | |  | 2 |
| Maximum number of OFDM symbols for DL front loaded DMRS | |  | 1 |
| CSI-RS for tracking | Resource set #1 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 5 for CSI-RS resource 1 and 3  l0 = 9 for CSI-RS resource 2 and 4 |
| CSI-RS periodicity | Slots | 10 for CSI-RS resource 1,2,3,4. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4 |
| QCL info |  | TCI state #3 |
| Resource set #2 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 6 for CSI-RS resource 5 and 6  l0 = 10 for CSI-RS resource 7 and 8 |
| CSI-RS periodicity | Slots | 10 for CSI-RS resource 5,6,7,8. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8 |
| QCL info |  | TCI state #4 |
| Resource set #3 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 4 for CSI-RS resource 9 and 10  l0 = 8 for CSI-RS resource 11 and 12 |
| CSI-RS periodicity | Slots | 10 for CSI-RS resource 9,10,11,12. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 9 and 10 2 for CSI-RS resource 11 and 12 |
| QCL info |  | TCI state #5 |
| NZP CSI-RS for CSI acquisition | Resource set #4 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 12 |
| CSI-RS periodicity | Slots | 20 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #0 |
| Resource set #5 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 13 |
| CSI-RS periodicity | Slots | 20 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #1 |
| Resource set #6 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 7 |
| CSI-RS periodicity | Slots | 20 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #2 |
| TCI state #0 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking Resource set #1' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #2 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 9 from 'CSI-RS for tracking Resource set #3' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #3 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #4 | Type 1 QCL information | SSB index |  | SSB #1 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #5 | Type 1 QCL information | SSB index |  | SSB #2 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| Number of HARQ Processes | | |  | 4 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | |  | 2 |
| Note 1: SSB # (k mod 3), CSI-RS (for tracking) resource set # ((k mod 3) + 1) and CSI-RS (for CSI acquisition) resource set # ((k mod 3) + 4) are transmitted by kth RRH. Codepoint#0 {TCI state #0, TCI State #1} is activated when UE receives PDCCH/PDSCH from RRH#3k and RRH#3k+1. Codepoint#1 {TCI state #1, TCI State #2} is activated when UE receives PDCCH/PDSCH from RRH#3k+1 and RRH#3k+2. Codepoint#2 {TCI state #2, TCI State #0} is activated when UE receives PDCCH/PDSCH from RRH#3k+2 and RRH#3k+3. The second indicated TCI state in each codepoint is not used for quasi co-location parameters {Doppler shift, Doppler spread}. | | | | |

**Table 5.2.3.1.20.3-3: Minimum performance for HST-SFN Scheme B**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | | |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.1-8.5 FDD | 10/15 | 16QAM, 0.48 | HST-SFN-Scheme B | 2x4 | 70 | 8.4 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.1.20.

5.2.3.1.20.4 Test description

5.2.3.1.20.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.3.1.20.3-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.3.6.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.1.20.4.3.

5.2.3.1.20.4.2 Test procedure

1. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.1.20.5-1 as appropriate.

2. SS is configured to transmit SSB and CSI-RS continuously and schedule PDSCH and PDCCH transmission according to Note 1 in 5.2.3.1.20.3-2. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.3.1.20.5-1. The SS sends downlink MAC padding bits on the DL RMC.

Note: All TCI states are known to the UE through configuration inside RrcReconfiguration. There is no need to configure additional L1-RSRP measurements.

3. Send MAC CE command “Enhanced TCI States Indication for UE-specific PDCCH MAC CE” according to the timing described in Note 1 of Table 5.2.3.1.20.3-2 to active TCI state codepoint 0, 1 or 2 for PDCCH periodically. PDSCH is automatically associated with TCI state codepoint 0, 1 or 2 as tci-PresentInDCI is not present. TCI states 3, 4 and 5 for SSBs are automatically activated through relation of QCL-Info in NZP CSI-RS.

4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.1.20.4.3 Message contents

Same message contents as in 5.2.3.1.19.4.3.

5.2.3.1.20.5 Test Requirement

Table 5.2.3.1.20.3-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.1.20.5-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.1.20.5-1: Test Requirements for HST-SFN Scheme B

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | | |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.1-8.5 FDD | 10/15 | 16QAM, 0.48 | HST-SFN-Scheme B | 2x4 | 70 | 9.0 |

#### 5.2.3.2 TDD

##### 5.2.3.2.1 4Rx TDD FR1 PDSCH mapping Type A performance

5.2.3.2.1.0 Minimum conformance requirements for PDSCH Mapping Type A

The performance requirements are specified in Table 5.2.3.2.1.0-3, Table 5.2.3.2.1.0-4, Table 5.2.3.2.1.0-5 and Table 5.2.3.2.1.0-6, with the test parameters defined in Table 5.2.3.2.1.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2.3.2.1.0-1.

Table 5.2.3.2.1.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH mapping Type A normal performance under4 receive antenna conditions and with different channel models, MCSs and number of MIMO layers | 1-1, 1-2, 1-3, 1-5, 1-6, 1-7, 1-8, 1-9, 1-10, 1-11, 1-12, 2-1, 2-2, 3-1, 4-1 |
| Verify the PDSCH mapping Type A HARQ soft combining performance under 4 receive antenna conditions. | 1-4 |
| Verify the PDSCH mapping Type A performance requirements for Enhanced Receiver Type 1 under 4 receive antenna conditions. | 5-1 |

Table 5.2.3.2.1.0-2: Test Parameters for Testing

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Value | |
| Duplex mode | | |  | | TDD | |
| Active DL BWP index | | |  | | 1 | |
| PDSCH configuration | Mapping type | |  | | Type A | |
|  | k0 | |  | | | 0 |
|  | Starting symbol (S) | |  | | | 2 |
|  | | Length (L) | |  | | Specific to each Reference channel | |
| PDSCH aggregation factor | |  | | 1 | |
| PRB bundling type | |  | | Static | |
| PRB bundling size | |  | | 4 for Tests 1-1, 1-8, 1-9  WB for Test 3-1  2 for other tests | |
| Resource allocation type | |  | | Test 1-2: Type 1 with start RB = 50, LRBs = 6  Other tests: Type 0 | |
| RBG size | |  | | Test 1-2: N/A  Other tests: Config2 | |
| VRB-to-PRB mapping type | |  | | Non-interleaved | |
| VRB-to-PRB mapping interleaver bundle size | |  | | N/A | |
| PDSCH DMRS configuration | DMRS Type | |  | | Type 1 | |
|  | | Number of additional DMRS | |  | | 2 for Tests 1-1, 1-7, 1-8, 1-9, 1-10, 1-11 1 for other tests | |
| Maximum number of OFDM symbols for DL front loaded DMRS | |  | | 1 | |
| CSI-RS for tracking | First OFDM symbol in the PRB used for CSI-RS | |  | | Tests 1-8, 1-9:  l0 = 4 for CSI-RS resource 1 and 3  l0 = 8 for CSI-RS resource 2 and 4  Other tests; Table 5.2-1. | |
|  | | CSI-RS periodicity | | Slots | | Test 1-7, 1-10, 1-11: 20 for CSI-RS resource 1,2,3,4.  Other tests: Table 5.2-1. | |
| CSI-RS offset | | Slots | | Test 1-7, 1-10, 1-11: 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4.  Other tests: Table 5.2-1. | |
| Frequency Occupation | |  | | Test 1-7, 1-10, 1-11: Start PRB 0 Number of PRB = 52  Other tests: Table 5.2-1. | |
| Number of HARQ Processes | | |  | | 16 for Test 1-4  10 for Test 1-9  8 for other tests | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | |  | | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 | |

Table 5.2.3.2.1.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-1.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-1A | TDLB100-400 | 2x4, ULA Low | 70 | -4.1 |
| 1-2 | R.PDSCH.2-1.2 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-1 | TDLC300-100 | 2x4, ULA Low | 70 | -2.7 |
| 1-3 | R.PDSCH.2-4.1 TDD | 40 / 30 | 256QAM, 0.82 | FR1.30-1 | TDLA30-10 | 2x4, ULA Low | 70 | 21.6 |
| 1-4 | R.PDSCH.2-2.1 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLC300-100 | 2x4, ULA Low | 30 | -1.2 |
| 1-5 | R.PDSCH.2-5.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-2 | TDLA30-10 | 2x4, ULA Low | 70 | -3.8 |
| 1-6 | R.PDSCH.2-6.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-3 | TDLA30-10 | 2x4, ULA Low | 70 | -3.6 |
| 1-7 | R.PDSCH.2-10.1 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | HST-1000 | 1x4 | 70 | 3.4 |
| 1-8 | R.PDSCH.2-11.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-5 | TDLB100-400 | 2x4, ULA Low | 70 | -4.0 |
| 1-9 | R.PDSCH.2-12.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-6 | TDLB100-400 | 2x4, ULA Low | 70 | -4.0 |
| 1-10 | R.PDSCH.2-10.2 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLC300-1200 | 2x4 | 70 | 5.8 |
| 1-11 | R.PDSCH.2-10.3 TDD | 40 / 30 | 64QAM, 0.43 | FR1.30-1 | HST-1667 | 1x4 | 70 | 6.8 |
| 1-12 | R.PDSCH.2-25.1 TDD | 40 / 30 | 1024QAM, 0.79 | FR1.30-1 | TDLD30-5 | 2x4, ULA Low | 70 | 26.3 |

Table 5.2.3.2.1.0-4: Minimum performance for Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 2-1 | R.PDSCH.2-3.1 TDD | 40 / 30 | 64QAM, 0.50 | FR1.30-1 | TDLA30-10 | 2x4, ULA Low | 70 | 13.6 |
| 2-2 | R.PDSCH.2-9.1 TDD | 20 / 30 | 64QAM, 0.50 | FR1.30-4 | TDLA30-10 | 2x4, ULA Low | 70 | 13.7 |

Table 5.2.3.2.1.0-5: Minimum performance for Rank 3

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 3-1 | R.PDSCH.2-2.3 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLA30-10 | 4x4, ULA Low | 70 | 11.1 |

Table 5.2.3.2.1.0-6: Minimum performance for Rank 4

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 4-1 | R.PDSCH.2-2.4 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLA30-10 | 4x4, ULA Low | 70 | 15.4 |

Table 5.2.3.2.1.0-7: Minimum performance for Rank 3 and EnhancedReceiver Type 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5-1 | R.PDSCH.2-2.3 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLA30-10 | 4x4, ULA Medium A | 70 | 22.9 |

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2.3.2.1.

###### 5.2.3.2.1\_1 4Rx TDD FR1 PDSCH mapping Type A performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.2.1\_1.1 Test purpose

To verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 1 and Rank 2 scenarios.

5.2.3.2.1\_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward, supporting 4Rx antenna ports.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4Rx antenna ports.

5.2.3.2.1\_1.3 Test description

5.2.3.2.1\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.3.2.1.0-2 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [] clause 4.5. Message contents are defined in clause 5.2.3.2.1\_1.4.3.

5.2.3.2.1\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.2.1.0-3 and Table 5.2.3.2.1.0-4. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.2.1\_1.3.4-1 and 5.2.3.2.1\_1.3.4-2 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

4. Repeat steps from 1 to 3 for each subtest in Tables 5.2.3.2.1\_1.3.4-1 and 5.2.3.2.1\_1.3.4-2 as appropriate.

5.2.3.2.1\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.2.1\_1.3.3\_1 Message exceptions for SA

Table 5.2.3.2.1\_1.3.3\_1-1: *BWP*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| BWP ::= SEQUENCE { |  |  |  |
| locationAndBandwidth | 13750 | For Test 2-2  (20MHz BW, SCS 30kHz) |  |
| 28875 | For other tests  (40MHz BW, SCS 30kHz) |  |
| } |  |  |  |

Table 5.2.3.2.1\_1.3.3\_1-2: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | n4 | n4 for tests 1-1, 1-8, 1-9 |  |
| wideband | wideband for test 3-1 |  |
| Not present | n2 for other tests |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.2.1\_1.3.3\_1-3: DMRS-DownlinkConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24 | | | |
| Information Element | Value/remark | Comment | Condition |
| DMRS-DownlinkConfig ::= SEQUENCE { |  |  |  |
| dmrs-AdditionalPosition | pos1 | pos1 for all tests except tests 1-1, 1-7, 1-8, 1-9 |  |
| Not present | pos2 for tests 1-1, 1-7, 1-8, 1-9, 1-10, 1-11 |  |
| } |  |  |  |

Table 5.2.3.2.1\_1.3.3\_1-4: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | Not present | n8 for other tests |  |
| n16 | n16 for test 1-4 |  |
|  | n10 | n10 for test 1-9 |  |
| } |  |  |  |

Table 5.2.3.2.1\_1.3.3\_1-5: CSI-ResourcePeriodicityAndOffset for CSI Tracking

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-43 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots20 | 1 (for CSI-RS resources 1 and 2)  2 (for CSI-RS resources 3 and 4) | Periodicity 20 slots and offset 1/2 for test 1-7, 1-10, 1-11 |  |
|  |  |  |  |
| } |  |  |  |

Table 5.2.3.2.1\_1.3.3\_1-5A: CSI-RS-ResourceMapping for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 4 | For Tests 1-8, 1-9:  l0 = 4 for CSI-RS resource 1 and 3 | TRS |
|  | 8 | For Tests 1-8, 1-9:  l0 = 8 for CSI-RS resource 2 and 4 | TRS |
| } |  |  |  |

Table 5.2.3.2.1\_1.3.3\_1-6: CSI-FrequencyOccupation for CSI Tracking

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-11 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-FrequencyOccupation ::= SEQUENCE { |  |  |  |
| nrofRBs | 52 | 52 for tests 1-7, 1-10, 1-11, 2-2 | TRS |
| 108 | 108 for other tests | TRS |
| } |  |  |  |

Table 5.2.3.2.1\_1.3.3\_1-7: RACH-ConfigGeneric

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-130 | | | |
| Information Element | Value/remark | Comment | Condition |
| RACH-ConfigGeneric ::= SEQUENCE { |  |  |  |
| prach-ConfigurationIndex | 163 | Only for test 2-2 |  |
| } |  |  |  |

Table 5.2.3.2.1\_1.3.3\_1-8: SchedulingRequestResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-157 | | | |
| Information Element | Value/remark | Comment | Condition |
| SchedulingRequestResourceConfig ::= SEQUENCE { |  |  |  |
| periodicityAndOffset CHOICE { |  |  |  |
| sl20 | 7 | For test 1-9 |  |
| sl20 | 5 | For test 2-2 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.2.1\_1.3.3\_1-9: Physical layer parameters for DCI format 1\_1

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-1 | | | |
| Parameter | Value | Value in binary | Condition |
| PUCCH resource indicator | *PUCCH-ResourceId[1]* = 6 in pucch-ResourceSetID[1] or  *PUCCH-ResourceId[1]* = 14 in pucch-ResourceSetID[2] as defined in Table 4.6.3-112 (Mapping as per Table 9.2.3-2 in TS 38.213) | ‘110’B | Slot S1 for test 1-9 |

Table 5.2.3.2.1\_1.3.3\_1-10: PDSCH-TimeDomainResourceAllocationList

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-27 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF { | 3 entry |  | Test 1-5, Test 1-6 |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 44 | Start symbol(S)=2, Length(L)=4 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[2] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[3] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF { | 2 entry |  | Test 1-8 |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[2] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 81 | Start symbol(S)=2, Length(L)=10 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF { | 5 entry |  | Test 1-9 |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[2] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 100 | Start symbol(S)=2, Length(L)=8 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[3] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 81 | Start symbol(S)=2, Length(L)=10 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[4] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[5] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| } |  |  |  |

5.2.3.2.1\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.3.2.1\_1.3.3\_1

5.2.3.2.1\_1.4 Test requirement

Table 5.2.3.2.1.0-2 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A clause A.3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.1\_1.4-1 and Table 5.2.3.2.1\_1.4-2 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.1\_1.4-1: Test Requirements for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-1.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-1A | TDLB100-400 | 2x4, ULA Low | 70 | -3.1 |
| 1-2 | R.PDSCH.2-1.2 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-1 | TDLC300-100 | 2x4, ULA Low | 70 | -1.7 |
| 1-3 | R.PDSCH.2-4.1 TDD | 40 / 30 | 256QAM, 0.82 | FR1.30-1 | TDLA30-10 | 2x4, ULA Low | 70 | 22.5 |
| 1-4 | R.PDSCH.2-2.1 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLC300-100 | 2x4, ULA Low | 30 | -0.3 |
| 1-5 | R.PDSCH.2-5.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-2 | TDLA30-10 | 2x4, ULA Low | 70 | -2.8 |
| 1-6 | R.PDSCH.2-6.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-3 | TDLA30-10 | 2x4, ULA Low | 70 | -2.6 |
| 1-7 | R.PDSCH.2-10.1 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | HST-1000 | 1x4 | 70 | 4.3 |
| 1-8 | R.PDSCH.2-11.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-5 | TDLB100-400 | 2x4, ULA Low | 70 | -3.1 |
| 1-9 | R.PDSCH.2-12.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-6 | TDLB100-400 | 2x4, ULA Low | 70 | -3.1 |
| 1-10 | R.PDSCH.2-10.2 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLC300-1200 | 2x4 | 70 | 6.7 |
| 1-11 | R.PDSCH.2-10.3 TDD | 40 / 30 | 64QAM, 0.43 | FR1.30-1 | HST-1667 | 1x4 | 70 | 7.7 |

Table 5.2.3.2.1\_1.4-2: Test Requirements for Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 2-1 | R.PDSCH.2-3.1 TDD | 40 / 30 | 64QAM, 0.50 | FR1.30-1 | TDLA30-10 | 2x4, ULA Low | 70 | 14.6 |
| 2-2 | R.PDSCH.2-9.1 TDD | 20 / 30 | 64QAM, 0.50 | FR1.30-4 | TDLA30-10 | 2x4, ULA Low | 70 | 14.7 |

###### 5.2.3.2.1\_2 4Rx TDD FR1 PDSCH mapping Type A performance - 4x4 MIMO with baseline receiver for both SA and NSA

5.2.3.2.1\_2.1 Test purpose

To verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 3 and Rank 4 scenarios.

5.2.3.2.1\_2.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports.

5.2.3.2.1\_2.3 Test description

Same test description as in clause 5.2.3.2.1\_1.3 with the following exception:

- Figure A.3.1.7.5 instead of A.3.1.7.4

- Step 1 of Test procedure as in clause 5.2.3.2.1\_1.3.2 to call for Tables 5.2.3.2.1.0-5 and 5.2.3.2.1.0-6 instead of Table 5.2.3.2.1.0-3 and 5.2.3.2.1.0-4.

- Step 2 and 4 of Test procedure as in clause 5.2.3.2.1\_1.3.2 to call for Tables 5.2.3.2.1\_2.3.4-1 and 5.2.3.2.1\_2.4-2 instead of Tables 5.2.3.2.1\_1.4-1 and 5.2.3.2.1\_1.4-2.

5.2.3.2.1\_2.3.1 Void

5.2.3.2.1\_2.3.2 Void

5.2.3.2.1\_2.3.3 Void

5.2.3.2.1\_2.4 Test requirement

Table 5.2.3.2.1.0-5 and Table 5.2.3.2.1.0-6 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A A.3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.1\_2.4-1 andTable 5.2.3.2.1\_2.4-2 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.1\_2.4-1: Test Requirements for Rank 3

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 3-1 | R.PDSCH.2-2.3 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLA30-10 | 4x4, ULA Low | 70 | 12.1 |

Table 5.2.3.2.1\_2.4-2: Test Requirements for Rank 4

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 4-1 | R.PDSCH.2-2.4 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLA30-10 | 4x4, ULA Low | 70 | 16.4 |

###### 5.2.3.2.1\_3 4Rx TDD FR1 PDSCH mapping Type A performance - 2x4 MIMO with enhanced receiver type 1 for both SA and NSA

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###### 5.2.3.2.1\_4 4Rx TDD FR1 PDSCH mapping Type A performance - 4x4 MIMO with enhanced receiver type 1 for both SA and NSA

5.2.3.2.1\_4.1 Test purpose

To verify the PDSCH mapping Type A enhanced performance under 4 receive antenna conditions for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default enhanced receiver type 1 configuration, for Rank 3 scenario.

5.2.3.2.1\_4.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports and NR enhanced receiver type 1.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC, 4 Rx antenna ports and NR enhanced receiver type1.

5.2.3.2.1\_4.3 Test description

Same test description as in clause 5.2.3.2.1\_2.3 with the following exception:

- Step 1 of Test procedure as in clause 5.2.3.2.1\_1.3.2 to call for Table 5.2.3.2.1.0-7 instead of Table 5.2.3.2.1.0-3 and 5.2.3.2.1.0-4.

- Step 2 and 4 of Test procedure as in clause 5.2.3.2.1\_1.3.2 to call for Table 5.2.3.2.1\_4.4-1 instead of Tables 5.2.3.2.1\_1.4-1 and 5.2.3.2.1\_1.4-2.

5.2.3.2.1\_4.3.1 Void

5.2.3.2.1\_4.3.2 Void

5.2.3.2.1\_4.3.3 Void

5.2.3.2.1\_4.4 Test requirement

Table 5.2.3.2.1.0-7 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A A.3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.1\_4.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.1\_4.4-1: Test Requirements for Rank 3 and Enhanced Receiver Type 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5-1 | R.PDSCH.2-2.3 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLA30-10 | 4x4, ULA Medium A | 70 | 23.9 |

###### 5.2.3.2.1\_5 4Rx TDD FR1 PDSCH mapping Type A performance - 2x4 MIMO with baseline receiver for DL1024QAM for both SA and NSA

Editor's Note: Following aspects needs further investigation.

- DL EVM of <= 2.5% for f > 4.2 GHz pending further analysis by the TE vendors

###### 5.2.3.2.1\_5.1 Test purpose

Verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions with DL1024QAM for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput for Rank 1 scenario.

5.2.3.2.1\_5.2 Test applicability

This test applies to all types of UE release 17 and forward supporting NR/5GC and DL1024QAM.

This test also applies to all types of UE release 17 and forward supporting EN-DC and DL1024QAM.

5.2.3.2.1\_5.3 Test description

5.2.3.2.1\_5.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.3.2.1.0-2 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [] clause 4.5. Message contents are defined in clause 5.2.3.2.1\_5.3.3.

5.2.3.2.1\_5.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.2.1\_5.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.2.1\_5.4-1 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.2.1\_5.3.3 Message contents

Message contents are according to 38.508-1 [6] subclauses 4.6.1 and 5.4.2.

5.2.3.2.1\_5.3.3\_1 Message exceptions for NR/5GC

Same as 5.2.3.2.1\_1.3.3\_1 with the following exceptions.

Table 5.2.3.2.1\_5.3.3\_1-1: PDSCH-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| mcs-Table-r17 | qam1024 |  | Test 1-12 |
| } |  |  |  |

5.2.3.2.1\_5.3.3\_2 Message exceptions for EN-DC

Same as 5.2.3.2.1\_5.3.3\_1.

5.2.3.2.1\_5.4 Test requirement

Table 5.2.3.2.1\_5.4-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A clause A.3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.1\_5.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.1\_5.4-1: Test Requirements for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-12 | R.PDSCH.2-25.1 TDD | 40 / 30 | 1024QAM, 0.79 | FR1.30-1 | TDLD30-5 | 2x4, ULA Low | 70 | 27.2 |

##### 5.2.3.2.2 4Rx TDD FR1 PDSCH mapping Type A and CSI-RS overlapped with PDSCH performance

5.2.3.2.2.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.2.0-3, with the addition of test parameters in Table 5.2.3.2.2.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.2.0-1.

Table 5.2.3.2.2.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions and CSI-RS overlapped with PDSCH | 1-1 |

Table 5.2.3.2.2.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S) |  | 2 |
| Length (L) |  | 12 |
| PDSCH aggregation factor |  | 1 |
| PRB bundling type |  | Static |
| PRB bundling size |  | 2 |
| Resource allocation type |  | Type 0 |
| RBG size |  | Config2 |
| VRB-to-PRB mapping type |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
| Number of additional DMRS |  | 1 |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| NZP CSI-RS for CSI acquisition | OFDM symbols in the PRB used for CSI-RS |  | l0 = 13 |
| CSI-RS periodicity | Slots | 5 |
| ZP CSI-RS for CSI acquisition | Subcarrier index in the PRB used for CSI-RS |  | (k0, k1, k2, k3)=(2, 4, 6, 8) |
| Number of CSI-RS ports (X) |  | 8 |
| CSI-RS periodicity | Slots | 5 |
| Number of HARQ Processes | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |

Table 5.2.3.2.2.0-3: Minimum performance for Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-7.1 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLC300-100 | 2x4, ULA Low | 70 | 9.0 |

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2.3.2.2.

###### 5.2.3.2.2\_1 4Rx TDD FR1 PDSCH mapping Type A and CSI-RS overlapped with PDSCH performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.2.2\_1.1 Test purpose

To verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration for CSI-RS overlapped with PDSCH scenario.

5.2.3.2.2\_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports.

5.2.3.2.2\_1.3 Test description

5.2.3.2.2\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Tables 5.2-1 and 5.2.3.2.2.0-2 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, C.3.1 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 5.2.3.2.2\_1.3.3.

5.2.3.2.2\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.2.2.0-2. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.2.2\_1.4-1 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-12 in Annex G clause G.1.5.

5.2.3.2.2\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 4.6.1 and 5.4.2.

5.2.3.2.2\_1.3.3\_1 Message exceptions for SA

Table 5.2.3.2.2\_1.3.3\_1-1: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | Not present |  |  |
| } |  |  |  |

Table 5.2.3.2.2\_1.3.3\_1-2: NZP CSI-RS-ResourceMapping for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 13 | l0 = 13 |  |
| } |  |  |  |

Table 5.2.3.2.2\_1.3.3\_1-3: CSI-ResourcePeriodicityAndOffset for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-16 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots5 | 0 | Periodicity 5 slots and offset 0 |  |
| } |  |  |  |

Table 5.2.3.2.2\_1.3.3\_1-4: ZP CSI-RS-ResourceMapping for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause5.4.2.0-21 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 011110 | (k0, k1, k2, k3)=(2, 4, 6, 8) |  |
| } |  |  |  |
| nrofPorts | P8 | Eight Ports |  |
| freqBand | CSI-FrequencyOccupation |  |  |
| } |  |  |  |

Table 5.2.3.2.2\_1.3.3\_1-4A: ZP CSI-ResourcePeriodicityAndOffset for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-16 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots5 | 0 | Periodicity 5 slots and offset 0 |  |
| } |  |  |  |

5.2.3.2.2\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.3.2.2\_1.3.3\_1

5.2.3.2.2\_1.4 Test requirement

Table 5.2.3.2.2.0-3 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.2 for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.2\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.2\_1.4-1: Test Requirement for Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-7.1 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLC300-100 | 2x4, ULA Low | 70 | 9.9 |

##### 5.2.3.2.3 4Rx TDD FR1 PDSCH mapping Type B performance

5.2.3.2.3.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.3.0-3, with the addition of test parameters in Table 5.2.3.2.3.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.3.0-1.

Table 5.2.3.2.3.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| PDSCH mapping Type B performance under 4 receive antenna conditions | 1-1 |

Table 5.2.3.2.3.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type B |
| k0 |  | 0 |
| Starting symbol (S) |  | 5 |
| Length (L) |  | 7 |
| PDSCH aggregation factor |  | 1 |
| PRB bundling type |  | Static |
| PRB bundling size |  | 2 |
| Resource allocation type |  | Type 0 |
| RBG size |  | Config2 |
| VRB-to-PRB mapping type |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
| Number of additional DMRS |  | 1 |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Number of HARQ Processes | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |

Table 5.2.3.2.3.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation  condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH,2-1.3 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-1 | TDLA30-10 | 2x4, ULA Low | 70 | -3.9 |

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2.3.2.3.

###### 5.2.3.2.3\_1 4Rx TDD FR1 PDSCH mapping Type B performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.2.3\_1.1 Test purpose

To verify the PDSCH mapping Type B normal performance under 4 receive antenna conditions for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput with baseline receiver configuration.

5.2.3.2.3\_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports and PDSCH mapping type B.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports and PDSCH mapping type B.

5.2.3.2.3\_1.3 Test description

5.2.3.2.3\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Tables 5.2-1 and 5.2.3.2.3.0-2 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, C.3.1 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 5.2.3.2.3\_1.3.3.

5.2.3.2.3\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.2.3.0-2. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.2.3\_1.4-1 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.2.3\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 4.6.1 and 5.4.2.

5.2.3.2.3\_1.3.3\_1 Message exceptions for SA

Table 5.2.3.2.3\_1.3.3\_1-1: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | Not present |  |  |
| } |  |  |  |

Table 5.2.3.2.3\_1.3.3\_1-2: PDSCH-TimeDomainResourceAllocationList

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF { | 2 entry |  |  |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeB |  |  |
| startSymbolAndLength | 89 | Start symbol(S)=5, Length(L)=7 |  |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[2] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| } |  |  |  |

5.2.3.2.3\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.3.2.3\_1.3.3\_1

5.2.3.2.3\_1.4 Test requirement

Table 5.2.3.2.3.0-3 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.2 for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.3\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.3\_1.4-1: Test Requirement for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation  condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH,2-1.3 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-1 | TDLA30-10 | 2x4, ULA Low | 70 | -2.9 |

##### 5.2.3.2.4 4Rx TDD FR1 PDSCH mapping Type A performance

5.2.3.2.4.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.4.0-3, with the addition of test parameters in Table 5.2.3.2.4.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.4.0-1.

Table 5.2.3.2.4.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions with CRS rate matching configured | 1-1, 1-2 |

Table 5.2.3.2.4.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| NR UL transmission with a 7.5 kHz shift to the LTE raster | |  | true |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S) |  | 3 |
| Length (L) |  | 9 for Test 1-1 11 for Test 1-2 |
| PDSCH aggregation factor |  | 1 |
| PRB bundling type |  | Static |
| PRB bundling size |  | 2 |
| Resource allocation type |  | Type 0 |
| RBG size |  | Config2 |
| VRB-to-PRB mapping type |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
| Position of the first DM-RS for downlink |  | 3 |
| Number of additional DMRS |  | 1 |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CRS for rate matching (Note 1) | LTE carrier centre subcarrier location |  | Same as NR carrier centre subcarrier location |
| LTE carrier BW | MHz | 10 |
| Number of antenna ports |  | 4 |
| v-shift |  | 0 |
| Number of HARQ Processes | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |
| Note 1: No MBSFN is configured on LTE carrier | | | |

Table 5.2.3.2.4.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-1.1 TDD | 10 / 15 | QPSK, 0.30 | FR1.15-1 | TDLA30-10 | 4x4, ULA Low | 70 | -3.6 |
| 1-2 | R.PDSCH.1-1.2 TDD | 10 / 15 | QPSK, 0.30 | FR1.15-1 | TDLA30-10 | 4x4, ULA Low | 70 | -3.5 |

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2.3.2.4.

###### 5.2.3.2.4\_1 4Rx TDD FR1 PDSCH Mapping Type A and LTE-NR coexistence performance - 4x4 MIMO with baseline receiver for both SA and NSA

5.2.3.2.4\_1.1 Test purpose

To verify the PDSCH mapping Type A coexistence performance under 4 receive antenna conditions for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput with baseline receiver configuration.

5.2.3.2.4\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports and capability IE *rateMatchingLTE-CRS* but not supporting capability IE *additionalDMRS-DL-Alt*.

Test 1-1 also applies to all types of E-UTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports and capability IE *rateMatchingLTE-CRS* but not supporting capability IE *additionalDMRS-DL-Alt*.

Test 1-2 applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports and capability IE *additionalDMRS-DL-Alt* and *rateMatchingLTE-CRS*.

Test 1-2 also applies to all types of E-UTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports and and capability IE *additionalDMRS-DL-Alt* and *rateMatchingLTE-CRS*.

5.2.3.2.4\_1.3 Test description

5.2.3.2.4\_1.3.1 Initial conditions

Same as 5.2.2.2.4\_1.3.1 with the following exceptions:

- Use Figure A.3.1.7.5 for TE diagram

- Use Figure A.3.2.5 for UE diagram

- Instead of 5.2.2.2.4.x 🡪 refer 5.2.3.2.4.x

5.2.3.2.4\_1.3.2 Test procedure

Same as 5.2.2.2.4\_1.3.2 with the following exceptions:

- Instead of 5.2.2.2.4.x 🡪 refer 5.2.3.2.4.x

5.2.3.2.4\_1.3.3 Message contents

Same as 5.2.2.2.4\_1.3.3

5.2.3.2.4\_1.4 Test requirement

Table 5.2.3.2.4.0-3 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.2 for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.4\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.4\_1.4-1: Test Requirement for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-1.1 TDD | 10 / 15 | QPSK, 0.30 | FR1.15-1 | TDLA30-10 | 4x4, ULA Low | 70 | -2.6 |
| 1-2 | R.PDSCH.1-1.2 TDD | 10 / 15 | QPSK, 0.30 | FR1.15-1 | TDLA30-10 | 4x4, ULA Low | 70 | -2.5 |

##### 5.2.3.2.5 4Rx TDD FR1 PDSCH 0.001% BLER performance

5.2.3.2.5.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.5.0-3, with the addition of test parameters in Table 5.2.3.2.5.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.5.0-1.

Table 5.2.3.2.5.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH 0.001% BLER performance under 4 receive antenna conditions | 1-1 |

Table 5.2.3.2.5.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 12 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 1 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Maximum number of HARQ transmission | |  | 1 |
| Number of HARQ Processes | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Defined in Annex A.1.2 for TDD pattern FR1.30-1 |

Table 5.2.3.2.5.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target BLER | SNR (dB) |
| 1-1 | R.PDSCH.2-1.4 TDD | 40 / 30 | QPSK, 0.59 | FR1.30-1 | AWGN | 1x4, ULA Low | 0.001% | 0.7 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.2.5.

###### 5.2.3.2.5\_1 4Rx TDD FR1 PDSCH 0.001% BLER performance - 1x4 MIMO with baseline receiver for both SA and NSA

5.2.3.2.5\_1.1 Test purpose

To verify the PDSCH 0.001% BLER performance under 4 receive antenna conditions.

5.2.3.2.5\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *dl-64QAM-MCS-TableAlt* and capability IE *cqi-TableAlt*.

5.2.3.2.5\_1.3 Test description

5.2.3.2.5\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.3 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.3.2.5.0-2 and Table 5.2.3.2.5.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.2.5\_1.3.3.

5.2.3.2.5\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.2.5.0-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.2.5\_1.3.4-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.4. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.4.3-1 in Annex G.

5.2.3.2.5\_1.3.3 Message contents

5.2.3.2.5\_1.3.3\_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.3.2.5\_1.3.3\_1-1: PDSCH-TimeDomainResourceAllocationList

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF { | 2 entry |  | FR1 |
| mcs-Table | qam64LowSE |  |  |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  |  |  |
| k0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 |  |
| } |  |  |  |
| } |  |  |  |

5.2.3.2.5\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.3.2.5\_1.3.3\_1.

5.2.3.2.5\_1.3.4 Test requirement

Table 5.2.3.2.5.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.5\_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.5\_1.3.4-1: Test requirement for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target BLER | SNR (dB) |
| 1-1 | R.PDSCH.2-1.4 TDD | 40 / 30 | QPSK, 0.59 | FR1.30-1 | AWGN | 1x4, ULA Low | 0.001% | 1.8 |

##### 5.2.3.2.6 4Rx TDD FR1 PDSCH repetitions over multiple slots performance

5.2.3.2.6.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.6.0-3, with the addition of test parameters in Table 5.2.3.2.6.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.6.0-1.

Table 5.2.3.2.6.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH repetitions over multiple slots performance under 4 receive antenna conditions | 1-1 |

Table 5.2.3.2.6.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S) |  | 2 |
| Length (L) |  | 12 |
| PDSCH aggregation factor |  | 2 |
| PRB bundling type |  | Static |
| PRB bundling size |  | 2 |
| Resource allocation type |  | Type 0 |
| RBG size |  | Config2 |
| VRB-to-PRB mapping type |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
| Number of additional DMRS |  | 1 |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Number of HARQ Processes | |  | 4 |
| The number of slots between final repetition of PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 (Note 1) |
| Note 1: ACK/NACK feedback is generated for PDSCH on slot i, where mod(i,10) = {2, 4, 6}. | | | |

Table 5.2.3.2.6.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target BLER | SNR (dB) |
| 1-1 | R.PDSCH.2-16.1 TDD | 40 / 30 | 16QAM, 0.54 | FR1.30-1 | TDLA30-10 | 2x4, ULA Low | 1%(Note 1) | -2.6 |
| Note 1: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block. | | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.2.6.

###### 5.2.3.2.6\_1 4Rx TDD FR1 PDSCH repetitions over multiple slots performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.2.6\_1.1 Test purpose

To Verify the PDSCH repetitions over multiple slots performance under 4 receive antenna conditions.

5.2.3.2.6\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE dl-64QAM-MCS-TableAlt and *pdsch-RepetitionMultiSlots-r16*.

Test 1-1 also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and capability IE dl-64QAM-MCS-TableAlt and pdsch-RepetitionMultiSlots-r16.

5.2.3.2.6\_1.3 Test description

5.2.3.2.6\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-2 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and section A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.2.3.2.6.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.2.6\_1.3.3.

5.2.3.2.6\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.2.6.0-3. The SS sends downlink MAC padding bits on the DL RMC. The UE may expect that the TB is repeated with same symbol allocation among each of the *pdsch-AggregationFactor* consecutive slots.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.2.6\_1.3.4-1.

3. Measure the BLER for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of correctly and incorrectly received transport bloks based on ACK/NACK feedback on the UL during each subtest and decide pass or fail according to clause G.1.5 and Table G.1.5-1a in Annex G clause G.1.5.

5.2.3.2.6\_1.3.3 Message contents

5.2.3.2.6\_1.3.3\_1 Message exceptions for SA

Same as 5.2.2.1.6\_1.3.3\_1.

5.2.2.2.6\_1.3.3\_2 Message exceptions for SA

Same as 5.2.2.1.6\_1.3.3\_1.

5.2.3.2.6\_1.3.4 Test requirement

Table 5.2.3.2.6.0-3 defines the primary level settings.

The target BLER percentage for the downlink reference measurement channels specified in Annex A.3.2.2 for each BLER test shall meet or exceed the specified value in Table 5.2.2.2.6\_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.6\_1.3.4-1: Test requirement for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target BLER | SNR (dB) |
| 1-1 | R.PDSCH.2-16.1 TDD | 40 / 30 | 16QAM, 0.54 | FR1.30-1 | TDLA30-10 | 2x4, ULA Low | 1%(Note 1) | -1.7 |
| Note 1: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block. | | | | | | | | |

##### 5.2.3.2.7 4Rx TDD FR1 PDSCH Mapping Type B and UE processing capability 2 performance

5.2.3.2.7.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.7.0-3, with the addition of test parameters in Table 5.2.3.2.7.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.7.0-1.

Table 5.2.3.2.7.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH mapping Type B performance and UE processing capability 2 under four receive antenna conditions | 1-1 |

Table 5.2.3.2.7.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type B |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 2 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 0 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Maximum number of HARQ transmission | |  | 1 |
| Number of HARQ Processes | |  | 2 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | 0 |

Table 5.2.3.2.7.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation  condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-17.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-2 | TDLA30-10 | 2x4, ULA Low | 70 | -2.5 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.2.7.

###### 5.2.3.2.7\_1 4Rx TDD FR1 PDSCH Mapping Type B and UE processing capability 2 performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.2.7\_1.1 Test purpose

To verify PDSCH mapping Type B performance and UE processing capability 2 under four receive antenna conditions.

5.2.3.2.7\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *pdsch-ProcessingType2*.

5.2.3.2.7\_1.3 Test description

5.2.3.2.7\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and section A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.3.2.7.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.2.7\_1.3.3.

5.2.3.2.7\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.2.7.0-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.2.7\_1.4-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.2.7\_1.3.3 Message contents

5.2.3.2.7\_1.3.3\_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.3.2.7\_1.3.3\_1-1: PDSCH-TimeDomainResourceAllocationList

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF { | 2 entry |  | FR1 |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  |  |  |
| k0 | Not present |  |  |
| mappingType | typeB |  |  |
| startSymbolAndLength | 16 | Start symbol(S)=2, Length(L)=2 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.2.7\_1.3.3\_1-2: *PUCCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-112 | | | |
| Information Element | Value/remark | Comment | Condition |
| PUCCH-Config ::= SEQUENCE { |  |  | FR1 |
| dl-DataToUL-ACK SEQUENCE (SIZE (1)) OF INTEGER { | 1 entry |  |  |
| INTEGER[1] | 0 | entry 1 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.2.7\_1.3.3\_1-3: Physical layer parameters for DCI format 1\_1

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1 | | | |
| Parameter | Value | Value in binary | Condition |
| PDSCH-to-HARQ\_feedback timing indicator | K1=0 as per dl-DataToUL-ACK in Table 5.2.3.2.7\_1.3.3\_1-3 | “000” |  |

Table 5.2.3.2.7\_1.3.3\_1-4: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| processingType2Enabled | true |  |  |
| } |  |  |  |

5.2.3.2.7\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.3.2.7\_1.3.3\_1.

5.2.3.2.7\_1.4 Test requirement

Table 5.2.3.2.7.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.7\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.7\_1.4-1: Test requirement for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation  condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-17.1 TDD | 40 / 30 | QPSK, 0.30 | FR1.30-2 | TDLA30-10 | 2x4, ULA Low | 70 | -1.5 |

##### 5.2.3.2.8 4Rx TDD FR1 PDSCH pre-emption performance

5.2.3.2.8.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.8.0-3, with the addition of test parameters in Table 5.2.3.2.8.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.8.0-1.

Table 5.2.3.2.8.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH pre-emption performance under 4 receive antenna conditions | 1-1 |

Table 5.2.3.2.8.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| PDCCH configuration (Note 4) | Symbols with PDCCH |  | 0, 1 |
| DCI format |  | 2\_1 |
| timeFrequencySet |  | 14x1 |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S) |  | 2 |
| Length (L) |  | 12 |
| PDSCH aggregation factor |  | 1 |
| PRB bundling type |  | Static |
| PRB bundling size |  | 2 |
| Resource allocation type |  | Type 0 |
| RBG size |  | Config2 |
| VRB-to-PRB mapping type |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
| Number of additional DMRS |  | 1 |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Pre-emption configuration (Note 2) | Starting symbol (S) |  | 3 |
| Length (L) |  | 2 |
| Pre-emption periodicity and offset | Slots | 40/(1,12,23,34) (Note 3) |
| Number of HARQ Processes | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | FR1.30-1 |
| Note 1: Void  Note 2: Interference modelled as random data on pre-empted REs.  Note 3: Pre-emption is scheduled with 10% probability within 20ms periodicity.  Note 4: In addition to PDCCH configuration in Table 5.2-1. | | | |

Table 5.2.3.2.8.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH. 2-2.6 TDD | 40 / 30 | 16QAM  0.64 | FR1.30-1 | TDLA30-10 | 2x4, ULA Low | 70 | 8.7 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.2.8.

###### 5.2.3.2.8\_1 4Rx TDD FR1 PDSCH pre-emption performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.2.8\_1.1 Test purpose

To Verify the PDSCH pre-emption performance under 4 receive antenna conditions.

5.2.3.2.8\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *pre-EmptIndication-DL-r16*.

5.2.3.2.8\_1.3 Test description

5.2.3.2.8\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and section A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.3.2.8.0-2 and Table 5.2.3.2.8.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.2.8\_1.3.3.

5.2.3.2.8\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.2.8.0-3. The SS sends downlink MAC padding bits on the DL RMC.

2. SS transmits PDCCH DCI format 2\_1 for int\_RNTI with 10% probability to transmit the DL Preemption indication according to Table 5.2.3.2.8.0-2. In the time and frequency set indicated by PDCCH DCI format 2\_1, SS stops transmission of PDSCH.

3. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.2.8\_1.3.4-1.

4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.2.8\_1.3.3 Message contents

5.2.3.2.8\_1.3.3\_1 Message exceptions for SA

Same as 5.2.2.1.8\_1.3.3\_1

5.2.3.2.8\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.2.1.8\_1.3.3\_1

5.2.3.2.8\_1.3.4 Test requirement

Table 5.2.3.2.8.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.8\_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.8\_1.3.4-1: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH. 2-2.6 TDD | 40 / 30 | 16QAM  0.64 | FR1.30-1 | TDLA30-10 | 2x4, ULA Low | 70 | 9.7 |

##### 5.2.3.2.9 4Rx TDD FR1 HST-SFN performance

5.2.3.2.9.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.9.0-3, with the addition of test parameters in Table 5.2.3.2.9.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.9.0-1.

Table 5.2.3.2.9.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH performance under 4 receive antenna conditions in the HST-SFN scenario defined in B.3.2 when *highSpeedDemodFlag-r16* [17] is configured. | 1-1 |

Table 5.2.3.2.9.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S) |  | 2 |
| Length (L) |  | 12 |
| PDSCH aggregation factor |  | 1 |
| PRB bundling type |  | Static |
| PRB bundling size |  | 2 |
| Resource allocation type |  | Type 0 |
| RBG size |  | Config2 |
| VRB-to-PRB mapping type |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
| Number of additional DMRS |  | 2 |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CSI-RS for tracking | CSI-RS periodicity | Slots | 20 for CSI-RS resource 1,2,3,4. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 1 and 22 for CSI-RS resource 3 and 4. |
| Frequency Occupation |  | Start PRB 0 Number of PRB = 52 |
| Number of HARQ Processes | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |

Table 5.2.3.2.9.0-3: Minimum performance for Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-10.4 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | HST-SFN | 2x4 | 70 | 11.7 |

The normative reference for this requirement is TS 38.101-4 [5] clause 5.2.3.2.9.

###### 5.2.3.2.9\_1 4Rx TDD FR1 HST-SFN performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.2.9\_1.1 Test purpose

To verify the PDSCH performance under 4 receive antenna conditions in the HST-SFN scenario defined in B.3.2 when *highSpeedDemodFlag-r16* IE [20] is configured and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 2 scenarios.

5.2.3.2.9\_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting enhanced demodulation processing for HST-SFN joint transmission scheme.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC supporting enhanced demodulation processing for HST-SFN joint transmission scheme.

5.2.3.2.9\_1.3 Test description

5.2.3.2.9\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.3.2.9.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.2.9\_1.3.3.

5.2.3.2.9\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.3.2.9\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.2.9\_1.4-1 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

4. Repeat steps from 1 to 3 for each subtest in Tables 5.2.3.2.9\_1.4-1 as appropriate.

5.2.3.2.9\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.2.9\_1.3.3\_1 Message exceptions for SA

Table 5.2.3.2.9\_1.3.3\_1-1: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | Not present | n2 for test 1-1 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.2.9\_1.3.3\_1-2: DMRS-DownlinkConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24 | | | |
| Information Element | Value/remark | Comment | Condition |
| DMRS-DownlinkConfig ::= SEQUENCE { |  |  |  |
| dmrs-AdditionalPosition | pos2 | for test 1-1 |  |
| } |  |  |  |

Table 5.2.3.2.9\_1.3.3\_1-3: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | n8 | for test 1-1 |  |
| } |  |  |  |

Table 5.2.3.2.9\_1.3.3\_1-4: CSI-ResourcePeriodicityAndOffset for CSI Tracking

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots20 | 1 for CSI-RS resource #1 and #2  2 for CSI-RS resource #3 and #4 | For test 1-1:  offset = 1 for CSI-RS resource 1 and 2  offset =2 for CSI-RS resource 3 and 4. |  |
| } |  |  |  |

5.2.3.2.9\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.3.2.9\_1.3.3\_1

5.2.3.2.9\_1.4 Test requirement

Tables 5.2.3.2.9\_1.4-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.9\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.9\_1.4-1: Test Requirements for Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-10.4 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-1 | HST-SFN | 2x4 | 70 | 12.3 |

##### 5.2.3.2.10 4Rx TDD FR1 HST DPS performance

5.2.3.2.10.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.10.0-3, with the addition of test parameters in Table 5.2.3.2.10.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.10.0-1.

Table 5.2.3.2.10.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify UE performance in the HST-DPS scenario defined in B.3.3 | 1-1, 1-2 |

Table 5.2.3.2.10.0-2: Test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Value |
| Duplex mode | | |  | TDD |
| Active DL BWP index | | |  | 1 |
| PDCCH configuration | TCI state | |  | Note 1 |
| PDSCH configuration | Mapping type | |  | Type A |
| k0 | |  | 0 |
| Starting symbol (S) | |  | 2 |
| Length (L) | |  | Specific to each Reference channel |
| PDSCH aggregation factor | |  | 1 |
| PRB bundling type | |  | Static |
| PRB bundling size | |  | 2 |
| Resource allocation type | |  | Type 0 |
| RBG size | |  | Config2 |
| VRB-to-PRB mapping type | |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size | |  | N/A |
| TCI state | |  | Note 1 |
| PDSCH DMRS configuration | DMRS Type | |  | Type 1 |
| Number of additional DMRS | |  | 2 |
| Maximum number of OFDM symbols for DL front loaded DMRS | |  | 1 |
| CSI-RS for tracking | Resource set #1 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 5 for CSI-RS resource 1 and 3 |
| l0 = 9 for CSI-RS resource 2 and 4 |
| CSI-RS periodicity | Slots | 20 for CSI-RS resource 1,2,3,4 |
| CSI-RS offset | Slots | 1 for CSI-RS resource 1 and 2 |
| 2 for CSI-RS resource 3 and 4 |
| QCL info |  | TCI state #2 |
| Frequency Occupation |  | Start PRB 0 |
| Number of PRB = 52 |
| Resource set #2 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 6 for CSI-RS resource 5 and 6 |
| l0 = 10 for CSI-RS resource 7 and 8 |
| CSI-RS periodicity | Slots | 20 for CSI-RS resource 5,6,7,8. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 5 and 6 |
| 2 for CSI-RS resource 7 and 8 |
| QCL info |  | TCI state #3 |
| Frequency Occupation |  | Start PRB 0 |
| Number of PRB = 52 |
| NZP CSI-RS for CSI acquisition | Resource set #3 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 12 |
| CSI-RS periodicity | Slots | 40 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #0 |
| Resource set #4 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 13 |
| CSI-RS periodicity | Slots | 40 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #1 |
| TCI state #0 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking Resource set #1' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #2 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #3 | Type 1 QCL information | SSB index |  | SSB #1 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| Number of HARQ Processes | | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |
| Note 1: SSB # (k mod 2) , CSI-RS (for tracking) resource set # ((k mod 2) + 1) and CSI-RS (for CSI acquisition) resource set # ((k mod 2) + 3) are transmitted by kth RRH.  For Test 1-1, TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy.  PDCCH and PDSCH associated with TCI # (k mod 2) is transmitted by kth RRH from.  slot#    to  slot#  ,    PDCCH and PDSCH are DTXed in other slots in which throughput statistics are not considered.    For Test 1-2, TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that  Satisfy. PDCCH and PDSCH associated with TCI # (k mod 2) is transmitted by kth RRH from  slot#    to  slot#    PDCCH and PDSCH are DTXed in other slots in which throughput statistics are not considered.  Where k=0, 1, 2… is the RRH number, n = 5040 is half of the number of slots between two RRH, = 8  Is the number of slots between PDSCH and corresponding HARQ-ACK information, = 6 is the  number of slots for MAC CE processing, = 7 is the number of slots to first TRS transmission  occasion after MAC CE command is decoded by the UE, = 4 is the number of slots for TRS  processing. | | | | |

Table 5.2.3.2.10.0-3: Minimum performance for HST-DPS

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Number of active PDSCH TCI states | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-10.5 TDD | 40 / 30 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 10.2 |
| 1-2 | R.PDSCH.2-10.5 TDD | 40 / 30 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 10.2 |

###### 5.2.3.2.10\_1 4Rx TDD FR1 HST DPS performance - 2x4 MIMO with baseline receiver for both SA and NSA

5.2.3.2.10\_1.1 Test purpose

To verify UE performance in the HST-DPS scenario defined in B.3.3 and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput and as well verify the HARQ soft combining with default baseline receiver configuration, for Rank 2 scenarios.

5.2.3.2.10\_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC.

5.2.3.2.10\_1.3 Test description

5.2.3.2.10\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.3.2.10.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.2.10\_1.3.3.

5.2.3.2.10\_1.3.2 Testprocedure

Test 1-1:

1. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.1.10\_1.4-1 as appropriate.

2. SS is configured to transmit SSB and CSI-RS continuously and schedule PDSCH and PDCCH transmission according to Note 1 in 5.2.2.1.10\_1.4-1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.2.1.10\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

Note: All TCI states are known to the UE through configuration inside RrcReconfiguration. There is no need to configure additional L1-RSRP measurements.

3. Send MAC CE command “TCI State Indication for UE-specific PDCCH” according to the timing described in Note 1 of table 5.2.2.1.10\_1.4-1 to switch from active TCI state 0 to 1 for PDCCH and vice versa periodically. PDSCH is automatically associated with TCI state 0 or 1 as tci-PresentInDCI is not present. TCI states 3 and 4 for SSBs are automatically activated through relation of QCL-Info in NZP CSI-RS.

4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

Test 1-2:

1. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.1.10\_1.4-1 as appropriate.

2. SS activates TCI state 0 and TCI 1 for PDSCH at the same time via MAC CE command “TCI States Activation/Deactivation for UE-specific PDSCH”.

3. SS is configured to transmit SSB and CSI-RS continuously and schedule PDSCH and PDCCH transmission according to Note 1 in 5.2.2.1.10\_1.4-1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.2.1.10\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

Note: All TCI states are known to the UE through configuration inside RrcReconfiguration. There is no need to configure additional L1-RSRP measurements.

4. Send MAC CE command “TCI State Indication for UE-specific PDCCH” according to the timing described in Note 1 of table 5.2.2.1.10\_1.4-1 to switch from active TCI state 0 to 1 for PDCCH and vice versa periodically. PDSCH is automatically associated with TCI state 0 or 1 as tci-PresentInDCI is not present. TCI states 3 and 4 for SSBs are automatically activated through relation of QCL-Info in NZP CSI-RS.

5. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.2.10\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.2.10\_1.3.3\_1 Message exceptions for SA

Table 5.2.3.2.10\_1.3.3\_1-1: DMRS-DownlinkConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24 | | | |
| Information Element | Value/remark | Comment | Condition |
| DMRS-DownlinkConfig ::= SEQUENCE { |  |  |  |
| dmrs-AdditionalPosition | pos2 | for test 1-1, 1-2 |  |
| } |  |  |  |

Table 5.2.3.2.10\_1.3.3\_1-2: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | n8 | for test 1-1, 1-2 |  |
| } |  |  |  |

Table 5.2.3.2.10\_1.3.3\_1-3: NZP-CSI-RS-Resource for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| nzp-CSI-RS-ResourceId | i-1 for CSI-RS resource #i, i=1,2,3,4,5,6,7,8 | for test 1-1, 1-2 |  |
| qcl-InfoPeriodicCSI-RS | 2 for CSI-RS resource #1, #2, #3, #4  3 for CSI-RS resource #5, #6, #7, #8 | for test 1-1, 1-2:  TCI-StateId for TCI-State #2 for CSI-RS resource #1, #2, #3, #4  TCI-StateId for TCI-State #3 for CSI-RS resource #5, #6, #7, #8 |  |
| } |  |  |  |

Table 5.2.3.2.10\_1.3.3\_1-4: CSI-RS-ResourceMapping for TRS (Table 5.2.3.2.10\_1.3.3\_1-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 with condition TRS | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 5 for CSI-RS resource #1 and #3  9 for CSI-RS resource #2 and #4  6 for CSI-RS resource #5 and #6  10 for CSI-RS resource #7 and #8 | for test 1-1, 1-2:  l0 = 5 for CSI-RS resource 1 and 3  l0 = 9 for CSI-RS resource 2 and 4  l0 = 6 for CSI-RS resource 5 and 6  l0 = 10 for CSI-RS resource 7 and 8 |  |
| } |  |  |  |

Table 5.2.3.2.10\_1.3.3\_1-5: CSI-ResourcePeriodicityAndOffset for TRS (Table 5.2.3.2.10\_1.3.3\_1-3)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots20 | 1 for CSI-RS resource #1, #2, #5, #6  2 for CSI-RS resource #3 #4, #7, #8 | For test 1-1, 1-2:  periodicity:  10 slots.  offset:  1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4  1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8 |  |
| } |  |  |  |

Table 5.2.3.2.10\_1.3.3\_1-6: NZP-CSI-RS-ResourceSet for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-12 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-ResourceSet ::= SEQUENCE { |  |  |  |
| nzp\_CSI\_ResourceSetId | 0 for Resource set #1  1 for Resource set #2 | For test 1-1, 1-2 |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 4 entries | For test 1-1, 1-2 | Resource set #1 |
| NZP-CSI-RS-ResourceId[1] | 0 | entry 1  CSI-RS resource #1 |  |
| NZP-CSI-RS-ResourceId[2] | 1 | entry 2  CSI-RS resource #2 |  |
| NZP-CSI-RS-ResourceId[3] | 2 | entry 3  CSI-RS resource #3 |  |
| NZP-CSI-RS-ResourceId[4] | 3 | entry 4  CSI-RS resource #4 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 4 entries | For test 1-1, 1-2 | Resource set #2 |
| NZP-CSI-RS-ResourceId[1] | 4 | entry 1  CSI-RS resource #5 |  |
| NZP-CSI-RS-ResourceId[2] | 5 | entry 2  CSI-RS resource #6 |  |
| NZP-CSI-RS-ResourceId[3] | 6 | entry 3  CSI-RS resource #7 |  |
| NZP-CSI-RS-ResourceId[4] | 7 | entry 4  CSI-RS resource #8 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.2.10\_1.3.3\_1-7: NZP-CSI-RS-Resource for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-14 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| nzp-CSI-RS-ResourceId | 8 for CSI-RS resource #9  9 for CSI-RS resource #10 | for test 1-1, 1-2 |  |
| qcl-InfoPeriodicCSI-RS | 0 for CSI-RS resource #9  1 for CSI-RS resource #10 | for test 1-1, 1-2:  TCI-State #0 for CSI-RS resource #9  TCI-State #1 for CSI-RS resource #10 |  |
| } |  |  |  |

Table 5.2.3.2.10\_1.3.3\_1-8: CSI-RS-ResourceMapping for CSI Acquisition (Table 5.2.3.2.10\_1.3.3\_1-7)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 12 for CSI-RS resource #9  13 for CSI-RS resource #10 | for test 1-1, 1-2  l0=12 for CSI-RS resource #9  l0=13 for CSI-RS resource #10 |  |
| } |  |  |  |

Table 5.2.3.2.10\_1.3.3\_1-9: CSI-ResourcePeriodicityAndOffset for CSI Acquisition (Table 5.2.3.2.10\_1.3.3\_1-7)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-16 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots40 | 0 | For test 1-1, 1-2:  periodicity = 40 slots.  offset = 0 slots |  |
| } |  |  |  |

Table 5.2.3.2.10\_1.3.3\_1-10: NZP-CSI-RS-ResourceSet for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-18 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-ResourceSet ::= SEQUENCE { |  |  |  |
| nzp\_CSI\_ResourceSetId | 2 for Resource set #3  3 for Resource set #4 | For test 1-1, 1-2 |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry | For test 1-1, 1-2 | Resource set #3 |
| NZP-CSI-RS-ResourceId[1] | 8 | entry 1  CSI-RS resource #9 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry | For test 1-1, 1-2 | Resource set #4 |
| NZP-CSI-RS-ResourceId[1] | 9 | entry 1  CSI-RS resource #10 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.2.10\_1.3.3\_1-11: TCI-State

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-190 | | | |
| Information Element | Value/remark | Comment | Condition |
| TCI-State ::= SEQUENCE { |  |  |  |
| tci-StateId | 0 for TCI state #0  1 for TCI state #1  2 for TCI state #2  3 for TCI state #3 | For test 1-1, 1-2 |  |
| qcl-Type1 SEQUENCE { |  |  |  |
| bwp-Id | BWP-Id of active BWP |  | TCI state #0, TCI state #1 |
|  | Not present |  | TCI state #2, TCI state #3 |
| referenceSignal CHOICE { |  |  |  |
| csi-rs | 0 | CSI-RS resource #1 | TCI state #0 |
|  | 4 | CSI-RS resource #5 | TCI state #1 |
| ssb | 0 | SSB #0 | TCI state #2 |
|  | 1 | SSB #1 | TCI state #3 |
| } |  |  |  |
| qcl-Type | typeA |  | TCI state #0, TCI state #1 |
|  | typeC |  | TCI state #2, TCI state #3 |
| } |  |  |  |
| } |  |  |  |

5.2.3.2.10\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.3.2.10\_1.3.3\_1

5.2.3.2.10\_1.4 Test requirement

Tables 5.2.3.2.10\_1.4-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.10\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.10\_1.4-1: Test Requirements for HST-DPS

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Number of active PDSCH TCI states | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-10.5 TDD | 40 / 30 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 10.8 |
| 1-2 | R.PDSCH.2-10.5 TDD | 40 / 30 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 10.8 |

##### 5.2.3.2.11 4Rx TDD FR1 PDSCH Single-DCI based SDM scheme performance

5.2.3.2.11.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.11.0-3, with the addition of test parameters in Table 5.2.3.2.11.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.11.0-1.

Table 5.2.3.2.11.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH performance with Single-DCI based SDM scheme under 4 receive antenna conditions | 1-1,1-2 |

Table 5.2.3.2.11.0-2: Test parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | |
| TRxP #1(Note 1) | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | |  | TRxP #1 | |
| PDCCH configuration | | TCI state | |  | TCI State #1 | |
| CORESETPoolIndex | |  | 0 | |
| CSI-RS for tracking | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | |
| Density | |  | 3 | |
| CSI-RS periodicity | | Slots | 40 | |
| CSI-RS offset | | Slots | 20 for CSI-RS resources 1 and 2  21 for CSI-RS resources 3 and 4 | 20 for CSI-RS resources 5 and 6  21 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | |
| Duplex mode | | | |  | TDD | |
| Active DL BWP index | | | |  | 1 | |
| PDSCH configuration | Mapping type | | |  | Type A | |
| k0 | | |  | 0 | |
| Starting symbol (S) | | |  | 2 | |
| Length (L) | | |  | 12 | |
| PRB bundling type | | |  | Static | |
| PRB bundling size | | |  | 2 | |
| Resource allocation type | | |  | Type 1 | |
| RBG size | | |  | Config2 | |
| VRB-to-PRB mapping type | | |  | Non-interleaved | |
| VRB-to-PRB mapping interleaver bundle size | | |  | N/A | |
| PDSCH DMRS configuration | Antenna port indexes | | |  | 1000 | 1002 |
| TCI state | | |  | TCI State #1 | TCI State #2 |
| DMRS Type | | |  | Type 1 | |
| Number of additional DMRS | | |  | 1 | |
| Maximum number of OFDM symbols for DL front loaded DMRS | | |  | 1 | |
| TCI State #1 | Type 1 QCL information | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | N/A |
| QCL Type |  | Type A | N/A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| TCI State #2 | Type 1 QCL information | | CSI-RS resource |  | N/A | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | Type A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| Resource allocation | | | |  | Full-overlapping | |
| Timing offset of the second TRxP from the first TRxP | | | | us | -0.25 for test 1-1  1 for test 1-2 | |
| Frequency offset of the second TRxP from the first TRxP | | | | Hz | 300 for test 1-1  0 for test 1-2 | |
| Number of HARQ Processes | | | |  | 8 | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 | |
| Precoding configuration | | | |  | SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity | |
| Note 1: PDSCH transmission is done from both TRxPs (PDSCH Layer 0 is transmitted from TRxP #1 and PDSCH layer 1 is transmitted from TRxP #2) | | | | | | |

Table 5.2.3.2.11.0-3: Minimum performance

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition(Note 1) | Correlation matrix and antenna configuration(Note 2) | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB)(Note 3) |
| 1-1 | R.PDSCH.2-3.2 TDD | 40 / 30 | 64QAM, 0.50 | FR1.30-1 | TDLA30-10 | 2x4, ULA Low | 70 | 14.5 |
| 1-2 | R.PDSCH.2-3.2 TDD | 40 / 30 | 64QAM, 0.50 | FR1.30-1 | TDLA30-10 | 2x4, ULA Low | 70 | 13.9 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 with scaling factor as 1/sqrt(2) for transmitted signal from each TRxP | | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.2.11.

###### 5.2.3.2.11\_1 4Rx TDD FR1 PDSCH Single-DCI based SDM scheme performance - 2x4 MIMO for both SA and NSA

5.2.3.2.11\_1.1 Test purpose

To verify the PDSCH performance with Single-DCI based SDM scheme under 4 receive antenna conditions.

5.2.3.2.11\_1.2 Test applicability

Test applies to all types of NR UE release 16 and forward supporting capability IE *singleDCI-SDM-scheme-r16*.

5.2.3.2.11\_1.3 Test description

5.2.3.2.11\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2.3.2.11.0-2 and Table 5.2.3.2.11.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.2.11\_1.3.3.

5.2.3.2.11\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.2.11\_1.3.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.2.11\_1.3.4-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

4. Repeat steps from 1 to 3 for each subtest in Table 5.2.3.2.11\_1.3.4-1 as appropriate.

5.2.3.2.11\_1.3.3 Message contents

5.2.3.2.11\_1.3.3\_1 Message exceptions for SA

As defined in clause 5.4.2 of TS 38.508-1 [6] with the following exceptions:

Table 5.2.3.2.11\_1.3.3\_1-1: Physical layer parameters for DCI format 1\_1

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.3.6.1.2.2-1 | | | |
| Parameter | Value | Value in binary | Condition |
| Antenna port(s) | DMRS port 0 and 2 | “1011” |  |
| Transmission configuration indication | TCI state 1 and 2 | “000” |  |

Table 5.2.3.2.11\_1.3.3\_1-2: *CellGroupConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-19 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| simultaneousTCI-UpdateList1-r16 SEQUENCE { |  |  |  |
| ServCellIndex [1] | ServCellIndex |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.2.11\_1.3.3\_1-3: *ControlResourceSet*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| tci-PresentInDCI | enabled |  |  |
| } |  |  |  |

Table 5.2.3.2.11\_1.3.3\_1-4: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-100 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| tci-StatesToAddModList SEQUENCE(SIZE (1.. maxNrofTCI-States)) OF TCI-State { | 2 entries |  |  |
| TCI-State[1] | *TCI-State* with condition TCI-state-0 |  |  |
| TCI-State[2] | *TCI-State* with condition TCI-state-1 |  |  |
| TCI-State[3] | *TCI-State* with condition TCI-state-2 |  |  |
| } |  |  |  |
| rbg-Size | config2 |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | Not present |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.2.11\_1.3.3\_1-5: *TCI-State*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-190 | | | |
| Information Element | Value/remark | Comment | Condition |
| TCI-State ::= SEQUENCE { |  |  |  |
| tci-StateId | 0 |  | TCI-state-0 |
|  | 1 |  | TCI-state-1 |
|  | 2 |  | TCI-state-2 |
| qcl-Type1 SEQUENCE { |  |  |  |
| cell | Not present |  |  |
| bwp-Id | Not present |  |  |
| referenceSignal CHOICE { |  |  |  |
| ssb | SSB-Index |  | TCI-state-0 |
| csi-rs | 1 |  | TCI-state-1 |
|  | 5 |  | TCI-state-2 |
| } |  |  |  |
| qcl-Type | typeA |  |  |
| } |  |  |  |
| qcl-Type2 | Not present |  |  |
| } |  |  |  |

Table 5.2.3.2.11\_1.3.3\_1-6: *NZP-CSI-RS-Resource*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-85 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| resourceMapping SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| row1 | 0000 | For CSI-RS resources 1, 2, 3, 4 |  |
|  | 0001 | For CSI-RS resources 5,6,7,8 |  |
| } |  |  |  |
| nrofPorts | p1 |  |  |
| firstOFDMSymbolInTimeDomain | 6 | For CSI-RS resources 1,3,5,7 |  |
|  | 10 | For CSI-RS resources 2,4,6,8 |  |
| cdm-Type | noCDM |  |  |
| density CHOICE { |  |  |  |
| three | NULL |  |  |
| } |  |  |  |
| } |  |  |  |
| periodicityAndOffset CHOICE { |  |  |  |
| slots40 | 20 | For CSI-RS resources 1,2,5,6 |  |
| slots40 | 21 | For CSI-RS resources 3,4,7,8 |  |
| } |  |  |  |
| qcl-InfoPeriodicCSI-RS | 0 |  |  |
| } |  |  |  |

5.2.3.2.11\_1.3.3\_2 Message exceptions for NSA

Same as 5.2.3.2.11\_1.3.3\_1.

5.2.3.2.11\_1.3.4 Test requirement

Table 5.2.3.2.11.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.11\_1.3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.11\_1.3.4-1: Test requirement

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition(Note 1) | Correlation matrix and antenna configuration(Note 2) | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB)(Note 3) |
| 1-1 | R.PDSCH.2-3.2 TDD | 40 / 30 | 64QAM, 0.50 | FR1.30-1 | TDLA30-10 | 2x4, ULA Low | 70 | 15.5 |
| 1-27 | R.PDSCH.2-3.2 TDD | 40 / 30 | 64QAM, 0.50 | FR1.30-1 | TDLA30-10 | 2x4, ULA Low | 70 | 14.9 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 with scaling factor as 1/sqrt(2) for transmitted signal from each TRxP | | | | | | | | |

##### 5.2.3.2.12 4Rx TDD FR1 PDSCH Multi-DCI based transmission scheme performance

5.2.3.2.12.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.12.0-3, with the addition of test parameters in Table 5.2.3.2.12.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.12.0-1.

Table 5.2.3.2.12.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH performance when UE is configured two different values of CORESETPoolIndex in ControlResourceSet and when UE receives multiple PDCCHs scheduling PDSCHs | 1-1 |

Table 5.2.3.2.12.0-2: Test parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | |
| TRxP #1(Note 1) | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | |  | TRxP #1 | |
| PDCCH configuration | | TCI state | |  | TCI State #1 | TCI State #2 |
| CORESETPoolIndex | |  | 0,1 | |
| CSI-RS for tracking | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | |
| Density | |  | 3 | |
| CSI-RS periodicity | | Slots | 40 | |
| CSI-RS offset | | Slots | 20 for CSI-RS resources 1 and 2  21 for CSI-RS resources 3 and 4 | 20 for CSI-RS resources 5 and 6  21 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | |
| Duplex mode | | | |  | TDD | |
| Active DL BWP index | | | |  | 1 | |
| PDSCH configuration | Mapping type | | |  | Type A | |
| k0 | | |  | 0 | |
| Starting symbol (S) | | |  | 2 | |
| Length (L) | | |  | 12 | |
| PRB bundling type | | |  | Static | |
| PRB bundling size | | |  | 2 | |
| Resource allocation type | | |  | Type 1 | |
| RBG size | | |  | Config2 | |
| VRB-to-PRB mapping type | | |  | Non-interleaved | |
| VRB-to-PRB mapping interleaver bundle size | | |  | N/A | |
| PDSCH DMRS configuration | Antenna port indexes | | |  | {1000,1001} | {1002,1003} |
| TCI state | | |  | TCI State #1 | TCI State #2 |
| DMRS Type | | |  | Type 1 | |
| Number of additional DMRS | | |  | 1 | |
| Maximum number of OFDM symbols for DL front loaded DMRS | | |  | 1 | |
| TCI State #1 | Type 1 QCL information | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | N/A |
| QCL Type |  | Type A | N/A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| TCI State #2 | Type 1 QCL information | | CSI-RS resource |  | N/A | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | Type A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| Resource allocation | | | |  | Non-overlapping | |
| Timing offset of the second TRxP from the first TRxP | | | | us | -0.25 | |
| Frequency offset of the second TRxP from the first TRxP | | | | Hz | 300 | |
| Number of HARQ Processes | | | |  | 8 | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 | |
| Precoding configuration | | | |  | SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity | |
| Note 1: PDSCH transmission is done from both TRxPs. Transmission from TRxP #1 uses CORESETPoolIndex 0 and transmission from TRxP #2 uses CORESETPoolIndex 1 | | | | | | |

Table 5.2.3.2.12.0-3: Minimum performance

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition(Note 1) | Correlation matrix and antenna configuration(Note 2) | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB)(Note 3) |
|  | TRxP #1 | TRxP #2 |  |  |  |  |  |  |  |
| 1-1 | R.PDSCH.2-3.3 TDD | R.PDSCH.2-3.4 TDD | 40 / 30 | 64QAM, 0.50 | FR1.30-1 | TDLA30-10 | 2x4, ULA Low | 70 | 14.6 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 | | | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.2.12.

###### 5.2.3.2.12\_1 4Rx TDD FR1 PDSCH Multiple-DCI based transmission scheme performance - 2x4 MIMO for both SA and NSA

5.2.3.2.12\_1.1 Test purpose

To verify the PDSCH performance when UE is configured two different values of CORESETPoolIndex in ControlResourceSet and when UE receives multiple PDCCHs scheduling PDSCHs.

5.2.3.2.12\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *multiDCI-MultiTRP-r16*.

5.2.3.2.12\_1.3 Test description

Same test description as in clause 5.2.3.1.12\_1.3 with the following exception:

- Table 5.2.3.2.12\_1.4-1 instead of 5.2.3.1.12\_1.4-1

- Table 5.2.3.2.12\_1.3-1 instead of Table 5.2.3.1.12\_1.3.3\_1-8

Table 5.2.3.2.12\_1.3-1: *CSI-ResourcePeriodicityAndOffset* for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots40 | 20 | For CSI-RS resources 1,2,5,6 |  |
| Slots40 | 21 | For CSI-RS resources 3,4,7,8 |  |
| } |  |  |  |

5.2.3.2.12\_1.4 Test requirement

Table 5.2.3.2.12.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.12\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.12\_1.4-1: Test requirement

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition(Note 1) | Correlation matrix and antenna configuration(Note 2) | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB)(Note 3) |
|  | TRxP #1 | TRxP #2 |  |  |  |  |  |  |  |
| 1-1 | R.PDSCH.2-3.3 TDD | R.PDSCH.2-3.4 TDD | 40 / 30 | 64QAM, 0.50 | FR1.30-1 | TDLA30-10 | 2x4, ULA Low | 70 | 15.6 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 | | | | | | | | | |

##### 5.2.3.2.13 4Rx TDD FR1 PDSCH Single-DCI based FDM scheme A performance

5.2.3.2.13.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.13.0-3, with the addition of test parameters in Table 5.2.3.2.13.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.13.0-1.

Table 5.2.3.2.13.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH performance under 4 receive antenna conditions when UE is configured with “FDMSchemeA” in “RepetitionScheme-r16” defined in clause 5.1 of TS 38.214 [12] | 1-1 |

Table 5.2.3.2.13.0-2: Test parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | |
| TRxP #1(Note 1) | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | |  | TRxP #1 | |
| PDCCH configuration | | TCI state | |  | TCI State #1 | |
| CORESETPoolIndex | |  | Not configured | |
| CSI-RS for tracking | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | |
| Density | |  | 3 | |
| CSI-RS periodicity | | Slots | 40 | |
| CSI-RS offset | | Slots | 20 for CSI-RS resources 1 and 2  21 for CSI-RS resources 3 and 4 | 20 for CSI-RS resources 5 and 6  21 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | |
| Duplex mode | | | |  | TDD | |
| Active DL BWP index | | | |  | 1 | |
| PDSCH configuration | Mapping type | | |  | Type A | |
| k0 | | |  | 0 | |
| Starting symbol (S) | | |  | 2 | |
| Length (L) | | |  | 12 | |
| PRB bundling type | | |  | Static | |
| PRB bundling size | | |  | Wideband | |
| Resource allocation type | | |  | Type 0 | |
| RBG size | | |  | Config2 | |
| VRB-to-PRB mapping type | | |  | Non-interleaved | |
| VRB-to-PRB mapping interleaver bundle size | | |  | N/A | |
| PDSCH DMRS configuration | Antenna port indexes | | |  | 1000,1001 | 1000,1001 |
| TCI state | | |  | TCI State #1 | TCI State #2 |
| DMRS Type | | |  | Type 1 | |
| Number of additional DMRS | | |  | 1 | |
| Maximum number of OFDM symbols for DL front loaded DMRS | | |  | 1 | |
| TCI State #1 | Type 1 QCL information | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | N/A |
| QCL Type |  | Type A | N/A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| TCI State #2 | Type 1 QCL information | | CSI-RS resource |  | N/A | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | Type A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| Timing offset of the second TRxP from the first TRxP | | | | us | -0.25 | |
| Frequency offset of the second TRxP from the first TRxP | | | | Hz | 300 | |
| Number of HARQ Processes | | | |  | 8 | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | | |  | Specific to each TDD UL-DL pattern  and as defined in Annex A.1.2 | |
| Precoding configuration | | | |  | SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity | |
| Note 1: PDSCH transmission is done from both TRxPs | | | | | | |

Table 5.2.3.2.13.0-3: Minimum performance for Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition (Note 1) | Correlation matrix and antenna configuration (Note 2) | Reference value | |
| Fraction of  maximum  throughput  (%) | SNR (dB) (Note 3) |
| 1-1 | R.PDSCH.2-2.5 TDD | 40 / 30 | 16QAM, 0.54 | FR1.30-1 | TDLA30-10 | 2x4, ULA Low | 70 | 10.5 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 | | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.2.13.

###### 5.2.3.2.13\_1 4Rx TDD FR1 PDSCH Single-DCI based FDM scheme A performance - 2x4 MIMO for both SA and NSA

5.2.3.2.13\_1.1 Test purpose

To verify the PDSCH performance under 4 receive antenna conditions when UE is configured with “FDMSchemeA” in “RepetitionScheme-r16”.

5.2.3.2.13\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *supportFDM-SchemeA-r16*.

5.2.3.2.13\_1.3 Test description

Same test description as in clause 5.2.3.1.13\_1.3 with the following exception:

- Table 5.2.3.2.13\_1.4-1 instead of 5.2.3.1.13\_1.4-1

- Table 5.2.3.2.13\_1.3-1 instead of Table 5.2.3.1.13\_1.3.3\_1-5

Table 5.2.3.2.13\_1.3-1: *CSI-ResourcePeriodicityAndOffset* for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots40 | 20 | For CSI-RS resources 1,2,5,6 |  |
| Slots40 | 21 | For CSI-RS resources 3,4,7,8 |  |
| } |  |  |  |

5.2.3.2.13\_1.4 Test requirement

Table 5.2.3.2.13.0-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.13\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.13\_1.4-1: Test requirement

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition (Note 1) | Correlation matrix and antenna configuration (Note 2) | Reference value | |
| Fraction of  maximum  throughput  (%) | SNR (dB) (Note 3) |
| 1-1 | R.PDSCH.2-2.5 TDD | 40 / 30 | 16QAM, 0.54 | FR1.30-1 | TDLA30-10 | 2x4, ULA Low | 70 | 11.5 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 | | | | | | | | |

##### 5.2.3.2.14 4Rx TDD FR1 PDSCH Single-DCI based Inter-slot TDM scheme performance

5.2.3.2.14.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.14.0-3, with the addition of test parameters in Table 5.2.3.2.14.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.14.0-1.

Table 5.2.3.2.14.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH performance under 4 receive antenna conditions when UE is configured with repetitionNumber-r16 with multiple slot level PDSCH transmission occasions of the same TB with two TCI states defined in clause 5.1 of TS 38.214 [12] | 1-1 |

Table 5.2.3.2.14.0-2: Test parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | |
| TRxP #1(Note 1) | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | |  | TRxP #1 | |
| PDCCH configuration | | TCI state | |  | TCI State #1 | |
| CORESETPoolIndex | |  | Not configured | |
| CSI-RS for tracking | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | |
| Density | |  | 3 | |
| CSI-RS periodicity | | Slots | 40 | |
| CSI-RS offset | | Slots | 20 for CSI-RS resources 1 and 2  21 for CSI-RS resources 3 and 4 | 20 for CSI-RS resources 5 and 6  21 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | |
| Duplex mode | | | |  | TDD | |
| Active DL BWP index | | | |  | 1 | |
| PDSCH configuration | Mapping type | | |  | Type A | |
| k0 | | |  | 0 | |
| Starting symbol (S) | | |  | 2 | |
| Length (L) | | |  | 12 | |
| Repetition number | | |  | 2 | |
| PRB bundling type | | |  | Static | |
| PRB bundling size | | |  | 2 | |
| Resource allocation type | | |  | Type 0 | |
| RBG size | | |  | Config2 | |
| VRB-to-PRB mapping type | | |  | Non-interleaved | |
| VRB-to-PRB mapping interleaver bundle size | | |  | N/A | |
| PDSCH DMRS configuration | Antenna port indexes | | |  | 1000 | 1000 |
| TCI state | | |  | TCI State #1 | TCI State #2 |
| DMRS Type | | |  | Type 1 | |
| Number of additional DMRS | | |  | 1 | |
| Maximum number of OFDM symbols for DL front loaded DMRS | | |  | 1 | |
| TCI State #1 | Type 1 QCL information | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | N/A |
| QCL Type |  | Type A | N/A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| TCI State #2 | Type 1 QCL information | | CSI-RS resource |  | N/A | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | Type A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| Timing offset of the second TRxP from the first TRxP | | | | us | 1 | |
| Frequency offset of the second TRxP from the first TRxP | | | | Hz | 300 | |
| Number of HARQ Processes | | | |  | 4 | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | | |  | Specific to each TDD UL-DL pattern  and as defined in Annex A.1.2 (Note 2) | |
| Precoding configuration | | | |  | SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity | |
| Note 1: PDSCH transmission is done from both TRxPs  Note 2: ACK/NACK feedback is generated for PDSCH on slot i, where mod(i,10) = {2, 4, 6}. | | | | | | |

Table 5.2.3.2.14.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition (Note 1) | Correlation matrix and antenna configuration (Note 2) | Reference value | |
| BLER (%) | SNR (dB) (Note 4) |
| 1-1 | R.PDSCH.2-16.2 TDD | 40 / 30 | 16QAM, 0.54 | FR1.30-1 | TDLA30-10 | 2x4, ULA Low | 1 (Note 3) | -0.5 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block.  Note 4: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2 | | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.2.14.

###### 5.2.3.2.14\_1 4Rx TDD FR1 PDSCH Single-DCI based Inter-slot TDM scheme performance - 2x4 MIMO for both SA and NSA

5.2.3.2.14\_1.1 Test purpose

To verify the PDSCH performance under 4 receive antenna conditions when UE is configured with repetitionNumber-r16 with multiple slot level PDSCH transmission occasions of the same TB with two TCI states.

5.2.3.2.14\_1.2 Test applicability

Test 1-1 applies to all types of NR UE release 16 and forward supporting capability IE *supportTDM-SchemeA-r16*.

5.2.3.2.14\_1.3 Test description

Same test description as in clause 5.2.3.1.14\_1.3 with the following exception:

- Table 5.2.3.2.14\_1.4-1 instead of 5.2.3.1.14\_1.4-1

- Table 5.2.3.2.14\_1.3-1 instead of Table 5.2.3.1.14\_1.3.3\_1-5

Table 5.2.3.2.14\_1.3-1: *CSI-ResourcePeriodicityAndOffset* for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots40 | 20 | For CSI-RS resources 1,2,5,6 |  |
| Slots40 | 21 | For CSI-RS resources 3,4,7,8 |  |
| } |  |  |  |

##### 5.2.3.2.15 4Rx TDD FR1 PDSCH mapping type A performance on band with shared spectrum access

5.2.3.2.15.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.15-3, with the addition of test parameters in Table 5.2.3.2.15-2 and the downlink physical channel setup according to Annex C.3.1.

Table 5.2.3.2.15.0-1: Tests purpose

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify PDSCH performance for UE supporting operations in shared spectrum access | 1-1, 1-2, 1-3, 1-4 |

Table 5.2.3.2.15.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Value** |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| DL transmission model | |  | As specified in B.5 |
| Downlink Model Parameters | SSB Q factor(Note 2) |  | 8 |
| Downlink transmission duration values | Slots | {2,4,6,7} |
| Occupied OFDM symbols in slot other than the last slot of the downlink duration | Symbols | 14 |
| Occupied OFDM symbols in the last slot of the downlink duration | Symbols | {6,9,12,14} (Note 1) |
| Downlink period | ms | 5 |
| LBT failure probability (*pLBT*) |  | 0.25 |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S) |  | 2 |
| PDSCH aggregation factor |  | 1 |
| PRB bundling type |  | Static |
| PRB bundling size |  | 2 |
| Resource allocation type |  | Type 0 |
| RBG size |  | Config2 |
| VRB-to-PRB mapping type |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
| dmrs-AdditionalPosition |  | pos1 |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Number of HARQ Processes | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern  and as defined in Annex A.1.2 |
| Note 1: If DL Transmission duration is 2 Slot, the occupied OFDM symbols in the last slot of the downlink duration is 14.  Note 2: SSB Q Factor indicates the QCL relation between SS/PBCH blocks, and equals (see 38.213, Section 4.1). | | | |

Table 5.2.3.2.15.0-3: Minimum performance for Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **TDD UL-DL pattern** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.2-18.1 TDD | 20 / 30 | 16QAM, 0.48 | FR1.30-7 | TDLA30-10 | 2x4, ULA Low | 70 | 8.7 |
| 1-2 | R.PDSCH.2-18.2 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-7 | TDLA30-10 | 2x4, ULA Low | 70 | 8.7 |
| 1-3 | R.PDSCH.2-18.3 TDD | 60 / 30 | 16QAM, 0.48 | FR1.30-7 | TDLA30-10 | 2x4, ULA Low | 70 | 8.9 |
| 1-4 | R.PDSCH.2-18.4 TDD | 80 / 30 | 16QAM, 0.48 | FR1.30-7 | TDLA30-10 | 2x4, ULA Low | 70 | 9.1 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.2.15.

##### 5.2.3.2.15\_1 4Rx TDD FR1 PDSCH mapping type A performance on band with shared spectrum access – 2x4 MIMO for both NSA and SA

5.2.3.2.15\_1.1 Test purpose

To verify the PDSCH mapping Type A performance under 2 receive antenna conditions on a band with shared spectrum access and with different channel bandwidth, for a specific fading channel model for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput.

5.2.3.2.15\_1.2 Test applicability

This test applies to all types of UE release 16 and forward supporting NR/5GC and NR-U and supporting UL on shared channel access.

This test also applies to all types of UE release 16 and forward supporting EN-DC and NR-U.

5.2.3.2.15\_1.3 Test description

5.2.3.2.15\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.3.2.15.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for NR/5GC with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for EN-DC according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.2.15\_1.3.3.

5.2.3.2.15\_1.3.2 Test procedure

1. The downlink signal transmission is as per the parameters defined in Table 5.2.3.2.15.0-2 and as referenced in B.5.1

2. SS transmits PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to Tables 5.2.3.2.15\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

3. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.2.15\_1.4-1 as appropriate.

4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause TBD. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table TBD in Annex G clause TBD.

5. Repeat steps from 1 to 3 for each subtest in Tables 5.2.3.2.15\_1.4-1 as appropriate.

5.2.3.2.15\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.2.15\_1.3.3\_1 Message exceptions for NR/5GC

Same as in Clause 5.2.2.2.15\_1.3.3\_1

5.2.3.2.15\_1.3.3\_2 Message exceptions for EN-DC

Same as in Clause 5.2.2.2.15\_1.3.3\_2

5.2.3.2.15\_1.4 Test requirement

Tables 5.2.3.2.15.0-2 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.15\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.15\_1.4-1: Test requirements for Rank 2

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **TDD UL-DL pattern** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.2-18.1 TDD | 20 / 30 | 16QAM, 0.48 | FR1.30-7 | TDLA30-10 | 2x4, ULA Low | 70 | 9.7 |
| 1-2 | R.PDSCH.2-18.2 TDD | 40 / 30 | 16QAM, 0.48 | FR1.30-7 | TDLA30-10 | 2x4, ULA Low | 70 | 9.7 |
| 1-3 | R.PDSCH.2-18.3 TDD | 60 / 30 | 16QAM, 0.48 | FR1.30-7 | TDLA30-10 | 2x4, ULA Low | 70 | 9.9 |
| 1-4 | R.PDSCH.2-18.4 TDD | 80 / 30 | 16QAM, 0.48 | FR1.30-7 | TDLA30-10 | 2x4, ULA Low | 70 | 10.1 |

##### 5.2.3.2.16 4Rx TDD FR1 for PDSCH with inter-cell interference performance

5.2.3.2.16.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.16.0-3, with the addition of test parameters in Table 5.2.3.2.16.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.16.0-1.

Table 5.2.3.2.16.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH performance under 4 receive antenna conditions, when transmission from the serving cell is interfered by 1 or 2 interfering cells. | 1-1, 1-2 |

Table 5.2.3.2.16.0-2: Test parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | | |
|  | |  | Cell 1 | Cell 2 | Cell 3 |
|  | |  | Enabled | Enabled | Enabled for test 1-1  Disabled for test 1-2 |
| Duplex mode | |  | TDD | | |
| TDD UL-DL pattern | |  | FR1.30-1 | | |
| Active DL BWP index | |  | 1 | | |
| Physical cell ID | |  | 0 | 1 | 2 |
| Transmission rank | |  | 1 | Random rank with 70% and 30% probability for rank 1 and rank 2 | Random rank with 70% and 30% probability for rank 1 and rank 2 for Test 1-1  N/A for Test 1-2 |
| Time offset to Cell 1 | | us | N/A | 1.5 | -0.5 |
| Frequency shift to Cell 1 | | Hz | N/A | 300 | -100 |
| Interference Model | |  | N/A | As specified in B.6.2 | |
| INR (Note 2) | | dB | N/A | 7.77 for Test 1-1  7.58 for Test 1-2 | 2.29 for Test 1-1  N/A for Test 1-2 |
| SSB configuration | SSB position in burst |  | First SSB in Slot #0 | First SSB in Slot #0 for Test 1-1  Second SSB in Slot #0 for Test 1-2 | First SSB in Slot #0 for Test 1-1  N/A for Test 1-2 |
|  | SSB periodicity | ms | 20 | 20 | 20 |
| PDSCH configuration | Mapping type |  | Type A | | |
|  | k0 |  | 0 | | |
|  | Starting symbol (S) |  | 2 | | |
|  | Length (L) |  | 12 | | |
|  | PDSCH aggregation factor |  | 1 | | |
|  | PRB bundling type |  | Static | | |
|  | PRB bundling size |  | 2 | | |
|  | Resource allocation type |  | Type 0 | | |
|  | RBG size |  | Config2 | | |
|  | VRB-to-PRB mapping type |  | Non-interleaved | | |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A | | |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 | | |
|  | Number of additional DMRS |  | 1 | | |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 | | |
| Number of HARQ Processes | |  | 8 | | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 | | |
| Note 1: Cell 1 is the serving cell, Cell 2 , 3 are interference cells.  Note 2: INR is defined in Annex B.6.1 | | | | | |

Table 5.2.3.2.16.0-3: Minimum performance for PDSCH with rank 1 and with inter-cell interference

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Cell1 | Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-2.1 TDD | 40 / 30 | 16QAM, 0.48 | TDLC300-100 | 2x4, ULA Low | 70 | 10.7 |
| 1-2 | R.PDSCH.2-2.1 TDD | 40 / 30 | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 7.6 |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: Bandwidth/ Subcarrier spacing, Propagation Condition, Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.2.16.

5.2.3.2.16\_1 4Rx TDD FR1 for PDSCH with inter-cell interference performance – 2x4 MIMO for both NSA and SA

5.2.3.2.16\_1.1 Test purpose

To verify the PDSCH performance under 4 receive antenna conditions, when transmission from the serving cell is interfered by 1 or 2 interfering cells.

5.2.3.2.16\_1.2 Test applicability

Test 1-1 and test 1-2 applies to all types of NR UEs and E-UTRAN UEs supporting EN-DC for release 15 and release 16 supporting MMSE-IRC processing for scenarios with inter-cell and intra-cell inter-user interference.

Test 1-1 and test 1-2 applies to all types of release 17 and forward NR UEs and E-UTRAN UEs supporting EN-DC.

5.2.3.2.16\_1.3 Test description

5.2.3.2.16\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the serving cell and interfering cells are set up according to Table 5.2-1 and Table 5.2.3.2.16.0-2 as appropriate.

3. Downlink signals for NR serving cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.2.16\_1.3.3.

5.2.3.2.16\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.3.2.16\_1.4-2. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR for the serving cell and interfering cells according to Table 5.2.3.2.16\_1.4-2.

3. Measure the average throughput on the serving cell for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

4. Repeat steps from 1 to 3 for each subtest in Tables 5.2.3.2.16\_1.4-2 as appropriate.

5.2.3.2.16\_1.3.3 Message contentsMessage contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.2.16\_1.3.3\_1 Message exceptions for SA

No message exceptions for SA

5.2.3.2.16\_1.3.3\_1 Message exceptions for NSA

No message exceptions for NSA

5.2.3.2.16\_1.4 Test requirement

Table 5.2.3.2.16\_1.4-1: Test parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | | |
|  | |  | Cell 1 | Cell 2 | Cell 3 |
|  | |  | Enabled | Enabled | Enabled for test 1-1  Disabled for test 1-2 |
| Duplex mode | |  | TDD | | |
| TDD UL-DL pattern | |  | FR1.30-1 | | |
| Active DL BWP index | |  | 1 | | |
| Physical cell ID | |  | 0 | 1 | 2 |
| Transmission rank | |  | 1 | Random rank with 70% and 30% probability for rank 1 and rank 2 | Random rank with 70% and 30% probability for rank 1 and rank 2 for Test 1-1  N/A for Test 1-2 |
| Time offset to Cell 1 | | us | N/A | 1.5 | -0.5 |
| Frequency shift to Cell 1 | | Hz | N/A | 300 | -100 |
| Interference Model | |  | N/A | As specified in B.6.2 | |
| INR (Note 2) | | dB | N/A | 7.77+0.8 for Test 1-1  7.58+0.8 for Test 1-2 | 2.29+0.8 for Test 1-1  N/A for Test 1-2 |
| SSB configuration | SSB position in burst |  | First SSB in Slot #0 | First SSB in Slot #0 for Test 1-1  Second SSB in Slot #0 for Test 1-2 | First SSB in Slot #0 for Test 1-1  N/A for Test 1-2 |
|  | SSB periodicity | ms | 20 | 20 | 20 |
| PDSCH configuration | Mapping type |  | Type A | | |
|  | k0 |  | 0 | | |
|  | Starting symbol (S) |  | 2 | | |
|  | Length (L) |  | 12 | | |
|  | PDSCH aggregation factor |  | 1 | | |
|  | PRB bundling type |  | Static | | |
|  | PRB bundling size |  | 2 | | |
|  | Resource allocation type |  | Type 0 | | |
|  | RBG size |  | Config2 | | |
|  | VRB-to-PRB mapping type |  | Non-interleaved | | |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A | | |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 | | |
|  | Number of additional DMRS |  | 1 | | |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 | | |
| Number of HARQ Processes | |  | 8 | | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 | | |
| Note 1: Cell 1 is the serving cell, Cell 2 , 3 are interference cells.  Note 2: INR is defined in Annex B.6.1 | | | | | |

Table 5.2.3.2.16\_1.4-2: Test requirement for PDSCH with rank 1 and with inter-cell interference

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test num | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Cell1 | Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH.2-2.1 TDD | 40 / 30 | 16QAM, 0.48 | TDLC300-100 | 2x2, ULA Low | 70 | 12.4 |
| 1-2 | R.PDSCH.2-2.1 TDD | 40 / 30 | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 9.4 |
| Note 1: The propagation conditions for Cell 1, Cell 2 and Cell 3 are statistically independent.  Note 2: Bandwidth/ Subcarrier spacing, Propagation Condition, Correlation matrix and antenna configuration parameters apply for each of Cell 1, Cell 2 and Cell 3. | | | | | | | |

##### 5.2.3.2.17 4Rx TDD FR1 for PDSCH with intra-cell inter-user interference

5.2.3.2.17.0 Minimum conformance requirements

The performance requirements are specified in Tables 5.2.3.2.17.0-3 and 5.2.3.2.17.0-4, with the addition of test parameters in Table 5.2.3.2.17.0-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.17.0-1.

Table 5.2.3.2.17.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH performance under 4 receive antenna conditions, when the PDSCH transmission of target UE is interfered by co-scheduled UE. | 1-1, 2-1 |

Table 5.2.3.2.17.0-2: Test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Target UE | Co-scheduled UE |
| Duplex mode | |  | TDD | |
| Active DL BWP index | |  | 1 | |
| PDSCH configuration | Mapping type |  | Type A | |
| k0 |  | 0 | |
| Starting symbol (S) |  | 2 | |
| Length (L) |  | 12 | |
| PDSCH aggregation factor |  | 1 | |
| PRB bundling type |  | Static | |
| PRB bundling size |  | 2 | |
| Resource allocation type |  | Type 0 | |
| RBG size |  | Config2 | |
| VRB-to-PRB mapping type |  | Non-interleaved | |
| VRB-to-PRB mapping interleaver bundle size |  | N/A | |
| PDSCH DMRS configuration (Note 1) | DMRS Type |  | Type 1 | |
| Number of additional DMRS |  | 1 | |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 | |
| Antenna ports indexes |  | {1000} for test 1-1  {1000, 1001} for test 2-1 | {1001} for test 1-1  {1002, 1003} for test 2-1 |
| Number of PDSCH DMRS CDM group(s) without data |  | 1 for test 1-1  2 for test 2-1 | 1 for test 1-1  2 for test 2-1 |
| PDSCH & PDSCH DMRS Precoding configuration | |  | Single Panel Type I, Randomized precoder selection for every PRB bundle and updated per slot, with equal probability of each applicable i1/i2 combination or codebook  Index, chosen from section 5.2.2.2.1 of TS 38.214 [12]. | Single Panel Type I, Randomized precoder selection for every PRB bundle and updated per slot, with equal probability of each applicable i1/i2 combination or codebook  Index, chosen from section 5.2.2.2.1 of TS 38.214 [12].  Any column of precoder matrix is not equal to any column of precoder matrix of Target UE for test 1-1  Select the precoder to ensure any column of precoder is orthogonal to any column of precoder for the target PDSCH for test 2-1 |
| MU-MIMO Beamforming Model | |  | As specified in B.4.2 | |
| Number of HARQ Processes | |  | 8 | N/A |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 | N/A |
| Note 1: DMRS scrambling ID is the same for both target and co-scheduled UEs. | | | | |

Table 5.2.3.2.17.0-3: Minimum performance for target UE with Rank 1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target UE | Co-scheduled UE | Fraction of  maximum  throughput  (%) | SNR (dB) |
| 1-1 | R.PDSCH.7-1.1 TDD | 40 / 30 | 16QAM, 0.48 | Random 16QAM symbols | FR1.30-1 | TDLC300-100 | 2x4, ULA Low | 70 | 11.8 |

Table 5.2.3.2.17.0-4: Minimum performance for target UE with Rank 2

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target UE | Co-scheduled UE | Fraction of  maximum  throughput  (%) | SNR (dB) |
| 2-1 | R.PDSCH.7-1.2 TDD | 40 / 30 | 16QAM, 0.48 | Random 16QAM symbols | FR1.30-1 | TDLA30-10 | 4x4, ULA Low | 70 | 15.5 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.2.17.

###### 5.2.3.2.17\_1 4Rx TDD FR1 for PDSCH with intra cell inter user interference performance – 2x4 MIMO for both NSA and SA

5.2.3.2.17\_1.1 Test purpose

To verify the PDSCH performance under 4 receive antenna conditions, when the PDSCH transmission of target UE is interfered by co-scheduled UE.

5.2.3.2.17\_1.2 Test applicability

This test applies to all types of NR UEs and E-UTRAN UEs supporting EN-DC for release 15 and release 16 supporting MMSE-IRC processing for scenarios with inter-cell and intra-cell inter-user interference.

This test applies to all types of release 17 and forward NR UEs and E-UTRAN UEs supporting EN-DC.

5.2.3.2.17\_1.3 Test description

5.2.3.2.17\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.3.2.17.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.2.17\_1.3.3.

5.2.3.2.17\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.2.17\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.2.17\_1.4-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.2.17\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.2.17\_1.3.3\_1 Message exceptions for SA

No message exceptions for SA

5.2.3.2.17\_1.3.3\_1 Message exceptions for NSA

No message exceptions for NSA

5.2.3.2.17\_1.4 Test requirement

Table 5.2.3.2.17\_1.4-1: Test requirement for target UE with Rank 1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target UE | Co-scheduled UE | Fraction of  maximum  throughput  (%) | SNR (dB) |
| 1-1 | R.PDSCH.7-1.1 TDD | 40 / 30 | 16QAM, 0.48 | Random 16QAM symbols | FR1.30-1 | TDLC300-100 | 2x4, ULA Low | 70 | 12.7 |

###### 5.2.3.2.17\_2 4Rx TDD FR1 for PDSCH with intra cell inter user interference performance – 4x4 MIMO for both NSA and SA

5.2.3.2.17\_2.1 Test purpose

To verify the PDSCH performance under 4 receive antenna conditions, when the PDSCH transmission of target UE is interfered by co-scheduled UE.

5.2.3.2.17\_2.2 Test applicability

This test applies to all types of NR UEs and E-UTRAN UEs supporting EN-DC for release 15 and release 16 supporting MMSE-IRC processing for scenarios with inter-cell and intra-cell inter-user interference.

This test applies to all types of release 17 and forward NR UEs and E-UTRAN UEs supporting EN-DC.

5.2.3.2.17\_2.3 Test description

5.2.3.2.17\_2.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.3.2.17.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.2.17\_2.3.3.

5.2.3.2.17\_2.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.2.17\_2.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.2.17\_2.4-1.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.2.17\_2.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.2.17\_2.3.3\_1 Message exceptions for SA

No message exceptions for SA

5.2.3.2.17\_2.3.3\_1 Message exceptions for NSA

No message exceptions for NSA

5.2.3.2.17\_2.4 Test requirement

Table 5.2.3.2.17\_2.4-1: Test requirement for target UE with Rank 2

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target UE | Co-scheduled UE | Fraction of  maximum  throughput  (%) | SNR (dB) |
| 2-1 | R.PDSCH.7-1.2 TDD | 40 / 30 | 16QAM, 0.48 | Random 16QAM symbols | FR1.30-1 | TDLA30-10 | 4x4, ULA Low | 70 | 16.5 |

##### 5.2.3.2.18 4Rx TDD FR1 for PDSCH CRS interference mitigation under NR-LTE coexistence scenario

5.2.3.2.18.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.18.0-4, with the addition of test parameters in Table 5.2.3.2.18.0-2 for the serving cell and Table 5.2.3.2.18.0-3 for the LTE interference cells and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.18.0-1.

**Table 5.2.3.2.18.0-1: Tests purpose**

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify PDSCH CRS interference mitigation performance under 4 receive antenna conditions with CRS rate matching configured for the serving cell. | 1-1 |

Table 5.2.3.2.18.0-2: Test parameters for the serving cell

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Value** |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 3 |
|  | Length (L) |  | 9 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 1 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CRS for rate  Matching (Note 1) | LTE carrier centre subcarrier location |  | Same as NR carrier centre subcarrier location |
| LTE carrier BW | Hz | 20 |
| Number of antenna ports |  | 4 |
| v-shift |  | 0 |
| Number of HARQ Processes | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |
| Note 1: No MBSFN is configured on LTE carrier.  Note 2: Network-based CRS interference mitigation is disabled on LTE carrier | | | |

Table 5.2.3.2.18.0-3: Test parameters for the LTE interference cells

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Cell 1** | **Cell 2** |
| Duplex mode | |  | TDD | TDD |
| TDD UL-DL pattern | |  | DSUDDDSUDD  S = 10D + 2G + 2U | DSUDDDSUDD  S = 10D + 2G + 2U |
| INR (Note 1) | | dB | 10.45 | 4.6 |
| LTE Bandwidth | | MHz | 20 | 20 |
| Carrier centre subcarrier location | |  | Same as the NR serving carrier centre subcarrier location | Same as the NR serving carrier centre subcarrier location |
| Cyclic Prefix | |  | Normal | Normal |
| Physical cell ID | |  | 1 | 2 |
| CRS pattern | Number of antenna ports |  | 4 | 4 |
| v-shift |  | 1 | 2 |
| Downlink power allocation |  | dB | -6 | -6 |
|  | dB | -6 | -6 |
| σ | dB | 0 | 0 |
| PDSCH transmission mode | |  | TM4 | TM4 |
| PDSCH loading level | | % | 20% probability of occurrence of LTE data transmission in time domain, and full bandwidth allocation in frequency domain. | 20% probability of occurrence of LTE data transmission in time domain, and full bandwidth allocation in frequency domain. |
| Transmission rank | | % | 80% and 20% probability for rank 1 and rank 2 respectively | 80% and 20% probability for rank 1 and rank 2 respectively |
| Interference model | |  | As specified in clause B.7 | As specified in clause B.7 |
| Time offset to the serving cell | | us | 3 | -1 |
| Frequency offset to the serving cell | | Hz | 300 | -100 |
| Propagation conditions and MIMO configuration (Note 2) | |  | TDLA30-10 ULA Low | TDLA30-10 ULA Low |
| Precoding granularity | | PRB | 8 | 8 |
| Note 1: Defined in B.6.1  Note 2: The channel for the LTE interference cells and the serving cell are independent. | | | | |

Table 5.2.3.2.18.0-4: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of  maximum  throughput  (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-1.3 TDD | 20 / 15 | 16QAM, 0.48 | FR1.15-1 | TDLA30-10 | 4x4, ULA Low | 70 | 8.8 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.2.18.

##### 5.2.3.2.18\_1 4Rx TDD FR1 for PDSCH CRS interference mitigation under NR-LTE coexistence scenario – 4x4 MIMO for both NSA and SA

Editor’s Note: This test case is incomplete in following aspects

- Message exceptions are FFS

- MU/TT analysis is pending

5.2.3.2.18\_1.1 Test purpose

To verify PDSCH CRS interference mitigation performance under 4 receive antenna conditions with CRS rate matching configured for the serving cell.

5.2.3.2.18\_1.2 Test applicability

This test applies to all types of NR UE release 17 and forward that support *CRS-IM-DSS-15kHzSCS-r17.*

5.2.3.2.18\_1.3 Test description

5.2.3.2.18\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Tables 5.2.3.2.18.0-2 and 5.2.3.2.18.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.2.18\_1.3.3.

5.2.3.2.18\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.2.18\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2.3.2.18\_1.4-1 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

4. Repeat steps from 1 to 3 for each subtest in Table 5.2.3.2.18\_1.4-1 as appropriate.

5.2.3.2.18\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.2.18\_1.3.3\_1 Message exceptions for SA

FFS

5.2.3.2.18\_1.3.3\_1 Message exceptions for NSA

FFS

5.2.3.2.18\_1.4 Test requirement

Table 5.2.3.2.18\_1.4-1: Test requirement for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of  maximum  throughput  (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-1.3 TDD | 20 / 15 | 16QAM, 0.48 | FR1.15-1 | TDLA30-10 | 4x4, ULA Low | 70 | 8.8+TT |

##### 5.2.3.2.19 4Rx TDD FR1 for PDSCH with inter cell CRS interference

5.2.3.2.19.0 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.19.0-4 and Table 5.2.3.2.19.0-6, with the addition of test parameters in Table 5.2.3.2.19.0-2 for the serving cell and Table 5.2.3.2.19.0-3 for the LTE interference cells and the downlink physical channel setup according to Annex C.3.1.

The requirements for UE capable of performing CRS-IM with the assistance of network signalling on LTE channel bandwidth are specified in Table 5.2.3.2.19.0-4.

The requirements for UE capable of performing CRS-IM without the assistance of network signalling on LTE channel bandwidth are specified in Table 5.2.3.2.19.0-6.

The test purposes are specified in Table 5.2.3.2.19.0-1.

**Table 5.2.3.2.19.0-1: Tests purpose**

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify PDSCH performance under 4 receive antenna conditions when PDSCH is interfered by inter cell CRS signal | 1-1, 1-2, 2-1 and 2-2 |

Table 5.2.3.2.19.0-2: Tests parameter for serving cell PDSCH

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Value** |
| Duplex mode | |  | TDD |
| TDD UL-DL pattern | |  | FR1.15-1 |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 12 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 1 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Number of HARQ Processes | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |

Table 5.2.3.2.19.0-3: Tests parameter for interference cells

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Cell 1** | **Cell 2** |
| Duplex mode | |  | TDD | TDD |
| TDD UL-DL pattern | |  | DSUDDDSUDD  S = 10D + 2G + 2U | DSUDDDSUDD  S = 10D + 2G + 2U |
| INR | | dB | 10.45 | 4.6 |
| LTE Bandwidth (Note 5) | | MHz | 20 | 20 |
| Carrier centre subcarrier location (Note 6) | |  | Same as the NR serving carrier centre subcarrier location | Same as the NR serving carrier centre subcarrier location |
| Cyclic Prefix | |  | Normal | Normal |
| Physical cell ID | |  | 1 | 2 |
| CRS pattern | Number of antenna ports |  | 4 | 4 |
| v-shift |  | 1 | 2 |
| Downlink power allocation |  | dB | -6 | -6 |
|  | dB | -6 | -6 |
| σ | dB | 0 | 0 |
| PDSCH transmission mode | |  | TM4 | TM4 |
| PDSCH loading level | | % | 20% probability of occurrence of LTE data transmission in time domain, and full bandwidth allocation in frequency domain for test 1-1.  10% probability of occurrence of LTE data transmission in time domain, and full bandwidth allocation in frequency domain for test 1-2. | 20% probability of occurrence of LTE data transmission in time domain, and full bandwidth allocation in frequency domain for test 1-1.  10% probability of occurrence of LTE data transmission in time domain, and full bandwidth allocation in frequency domain for test 1-2. |
| Transmission rank | | % | 80% and 20% probability for rank 1 and rank 2 respectively | 80% and 20% probability for rank 1 and rank 2 respectively |
| Interference model | |  | As specified in clause B.7 | As specified in clause B.7 |
| Time offset to the serving cell | | us | 3 for test 1-1  1.5 for test 1-2 | -1 for test 1-1  -0.5 for test 1-2 |
| Frequency offset to the serving cell | | Hz | 300 | -100 |
| Propagation conditions and MIMO configuration (Note 1) | |  | TDLA30-10 ULA Low | TDLA30-10 ULA Low |
| Precoding granularity | | PRB | 8 | 8 |
| Note 1: The channel for the LTE interference cells and the serving cell are independent.  Note 2: No MBSFN is configured on LTE carrier.  Note 3: Network-based CRS interference mitigation is disabled on LTE carrier.  Note 4: The start of transmission of LTE frame is delayed by 2 LTE subframes with respect to the start of transmission of NR frame  Note 5: This parameter is informed to UE via network assistance signalling for Test 1-1 and 1-2 in Table 5.2.3.2.19.0-4.  Note 6: Single entry is included in IE *LTE-NeighCellsCRS-AssistInfoList-r17* that applies for both cells for cases with network signalling assistance | | | | |

Table 5.2.3.2.19.0-4 Minimum performance for Rank 1 with the assistance of network signalling on LTE channel bandwidth

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of  maximum  throughput  (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-4.1 TDD | 20 / 15 | 16QAM, 0.48 | FR1.15-1 | TDLA30-10 | 4x4, ULA Low | 70 | 8.6 |
| 1-2 | R.PDSCH.2-25.1 TDD | 20 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLA30-10 | 4x4, ULA Low | 70 | 8.2 |

Table 5.2.3.2.19.0-5: Measurement Gap configurations

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Measurement Gap Length (mgl) | ms | 6 |
| Measurement Gap Repetition Period (mgrp) | ms | 40 |
| Gap offset (gapoffset) | ms | 1 |
| Measurement gap timing advance (mgta) | ms | 0 |

Table 5.2.3.2.19.0-6: Minimum performance for Rank 1 without the assistance of network signalling on LTE channel bandwidth

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of  maximum  throughput  (%) | SNR (dB) |
| 2-1 | R.PDSCH.1-4.2 TDD | 20 / 15 | 16QAM, 0.48 | FR1.15-1 | TDLA30-10 | 4x4, ULA Low | 70 | 8.6 |
| 2-2 | R.PDSCH.2-26.1 TDD | 20 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLA30-10 | 4x4, ULA Low | 70 | 8.2 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.2.19.

##### 5.2.3.2.19\_1 4Rx TDD FR1 for PDSCH with inter cell CRS interference scenario – 4x4 MIMO for both NSA and SA

Editor’s Note: This test case is incomplete in following aspects

- Message exceptions are FFS

- MU/TT analysis is pending

5.2.3.2.19\_1.1 Test purpose

To verify PDSCH performance under 4 receive antenna conditions when PDSCH is interfered by inter cell CRS signal.

5.2.3.2.19\_1.2 Test applicability

Tests 2-1 and 2-2 apply to all types of NR UE release 17 and forward that support *CRS-IM-nonDSS-15kHzSCS-r17 and/or crs-IM-nonDSS-30kHzSCS-r17.*

Tests 1-1 and 1-2 apply to all types of NR UE release 17 and forward that support *CRS-IM-nonDSS-NWA-15kHzSCS-r17 and/or* crs*-IM-nonDSS-NWA-30kHzSCS-r17.*

5.2.3.2.19\_1.3 Test description

5.2.3.2.19\_1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Tables 5.2.3.2.19.0-2 and 5.2.3.2.19.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.2.19\_1.3.3.

6. For UE capable of performing CRS-IM without the assistance of network signalling on LTE channel bandwidth, ensure the network configures an inter-RAT LTE measurement object of the interfering cells to the tested UE. Inter-RAT measurement is configured at the beginning of the test and applied throughout the test with gap pattern configurations according to Table 5.2.3.2.19.0-5. PDSCH is not scheduled, and throughput is not counted during 4.64s after the beginning of test. PDSCH is not scheduled in the measurement gaps.

5.2.3.2.19\_1.3.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.3.2.19\_1.4-1 and 5.2.3.2.19\_1.4-2 as appropriate. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.2.19\_1.4-1 and 5.2.3.2.19\_1.4-2 as appropriate.

3. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

4. Repeat steps from 1 to 3 for each subtest in Tables 5.2.3.2.19\_1.4-1 and 5.2.3.2.19\_1.4-2 as appropriate.

5.2.3.2.19\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.2.19\_1.3.3\_1 Message exceptions for SA

FFS

5.2.3.2.19\_1.3.3\_1 Message exceptions for NSA

FFS

5.2.3.2.19\_1.4 Test requirement

Table 5.2.3.2.19\_1.4-1: Test requirement for Rank 1 with the assistance of network signalling on LTE channel bandwidth

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of  maximum  throughput  (%) | SNR (dB) |
| 1-1 | R.PDSCH.1-4.1 TDD | 20 / 15 | 16QAM, 0.48 | FR1.15-1 | TDLA30-10 | 4x4, ULA Low | 70 | 8.6+TT |
| 1-2 | R.PDSCH.2-25.1 TDD | 20 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLA30-10 | 4x4, ULA Low | 70 | 8.2+TT |

Table 5.2.3.2.19\_1.4-2: Test requirement for Rank 1 without the assistance of network signalling on LTE channel bandwidth

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of  maximum  throughput  (%) | SNR (dB) |
| 2-1 | R.PDSCH.1-4.2 TDD | 20 / 15 | 16QAM, 0.48 | FR1.15-1 | TDLA30-10 | 4x4, ULA Low | 70 | 8.6+TT |
| 2-2 | R.PDSCH.2-26.1 TDD | 20 / 30 | 16QAM, 0.48 | FR1.30-1 | TDLA30-10 | 4x4, ULA Low | 70 | 8.2+TT |

##### 5.2.3.2.20 4Rx TDD FR1 PDSCH HST-SFN Scheme A performance - 2x4 MIMO for both SA and NSA

Editor's Note: This test cases is incomplete in following aspects:

- Minimum test time is FFS.

5.2.3.2.20.1 Test Purpose

To verify the UE performance in the HST-SFN Scheme A scenario.

5.2.3.2.20.2 Test applicability

This test case applies to all types of NR UE release 17 and forward that support SFN scheme A for PDCCH scheduling SFN Scheme A PDSCH.

5.2.3.2.20.3 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.20.3-3, with the addition of test parameters in Table 5.2.3.2.20.3-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.20.3-1.

**Table 5.2.3.2.20.3-1: Tests purpose**

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify UE performance in the HST-SFN Scheme A scenario defined in B.3.5 | 1-1 |

**Table 5.2.3.2.20.3-2: Test parameters**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Value** |
| Duplex mode | | |  | TDD |
| Active DL BWP index | | |  | 1 |
| PDCCH configuration | TCI state | |  | Note 1 |
| PDSCH configuration | Mapping type | |  | Type A |
| k0 | |  | 0 |
| Starting symbol (S) | |  | 2 |
| Length (L) | |  | 12 |
| PDSCH aggregation factor | |  | 1 |
| PRB bundling type | |  | Static |
| PRB bundling size | |  | 2 |
| Resource allocation type | |  | Type 0 |
| RBG size | |  | Config2 |
| VRB-to-PRB mapping type | |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size | |  | N/A |
| TCI state | |  | Note 1 |
| PDSCH DMRS configuration | DMRS Type | |  | Type 1 |
| Number of additional DMRS | |  | 2 |
| Maximum number of OFDM symbols for DL front loaded DMRS | |  | 1 |
| CSI-RS for tracking | Resource set #1 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 5 for CSI-RS resource 1 and 3  l0 = 9 for CSI-RS resource 2 and 4 |
| CSI-RS periodicity | Slots | 20 for CSI-RS resource 1,2,3,4. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4 |
| QCL info |  | TCI state #3 |
| Resource set #2 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 6 for CSI-RS resource 5 and 6  l0 = 10 for CSI-RS resource 7 and 8 |
| CSI-RS periodicity | Slots | 20 for CSI-RS resource 5,6,7,8. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8 |
| QCL info |  | TCI state #4 |
| Resource set #3 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 4 for CSI-RS resource 9 and 10  l0 = 8 for CSI-RS resource 11 and 12 |
| CSI-RS periodicity | Slots | 20 for CSI-RS resource 9,10,11,12. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 9 and 10 2 for CSI-RS resource 11 and 12 |
| QCL info |  | TCI state #5 |
| NZP CSI-RS for CSI acquisition | Resource set #4 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 12 |
| CSI-RS periodicity | Slots | 40 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #0 |
| Resource set #5 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 13 |
| CSI-RS periodicity | Slots | 40 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #1 |
| Resource set #6 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 7 |
| CSI-RS periodicity | Slots | 40 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #2 |
| TCI state #0 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking Resource set #1' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #2 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 9 from 'CSI-RS for tracking Resource set #3' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #3 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #4 | Type 1 QCL information | SSB index |  | SSB #1 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #5 | Type 1 QCL information | SSB index |  | SSB #2 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| Number of HARQ Processes | | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |
| Note 1: SSB # (k mod 3), CSI-RS (for tracking) resource set # ((k mod 3) + 1) and CSI-RS (for CSI acquisition) resource set # ((k mod 3) + 4) are transmitted by kth RRH.  Codepoint #0 is activated when UE receives PDCCH/PDSCH from RRH#3k and RRH#3k+1 with TCI States TCI state #0, TCI State #1.  Codepoint #1 is activated when UE receives PDCCH/PDSCH from RRH#3k+1 and RRH#3k+2 with TCI States TCI state #1, TCI State #2.  Codepoint #2 is activated when UE receives PDCCH/PDSCH from RRH#3k+2 and RRH#3k+3 with TCI States TCI state #2, TCI State #0. | | | | |

**Table 5.2.3.2.20.3-3: Minimum performance for HST-SFN Scheme A**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | | |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.2-30.1 TDD | 40 / 30 | 16QAM, 0.48 | HST-SFN Scheme A | 2x4 | 70 | 10.3 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.2.20.

5.2.3.2.20.4 Test description

5.2.3.2.20.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.3.2.20.3-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.3.5.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.2.20.4.3.

5.2.3.2.20.4.2 Test procedure

1. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.2.20.5-1 as appropriate.

2. SS is configured to transmit SSB and CSI-RS continuously and schedule PDSCH and PDCCH transmission according to Note 1 in 5.2.3.2.20.3-2. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.3.2.20.5-1. The SS sends downlink MAC padding bits on the DL RMC.

Note: All TCI states are known to the UE through configuration inside RrcReconfiguration. There is no need to configure additional L1-RSRP measurements.

3. Send MAC CE command “Enhanced TCI States Indication for UE-specific PDCCH MAC CE” according to the timing described in Note 1 of Table 5.2.3.2.20.3-2 to active TCI state codepoint 0, 1 or 2 for PDCCH periodically. PDSCH is automatically associated with TCI state codepoint 0, 1 or 2 as tci-PresentInDCI is not present. TCI states 3, 4 and 5 for SSBs are automatically activated through relation of QCL-Info in NZP CSI-RS.

4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.2.20.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2.3.2.20.4.3.1 Message exceptions for SA

Table 5.2.3.2.20.4.3.1-1: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | Not present | n2 is used | Test 1-1 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.2.20.4.3.1-2: DMRS-DownlinkConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24 | | | |
| Information Element | Value/remark | Comment | Condition |
| DMRS-DownlinkConfig ::= SEQUENCE { |  |  |  |
| dmrs-AdditionalPosition | pos2 |  | Test 1-1 |
| } |  |  |  |

Table 5.2.3.2.20.4.3.1-3: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | n8 |  | Test 1-1 |
| } |  |  |  |

Table 5.2.3.2.20.4.3.1-4: NZP-CSI-RS-Resource for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| nzp-CSI-RS-ResourceId | i-1 for CSI-RS resource #i, i=1,2,3,4,5,6,7,8,9,10,11,12 | for test 1-1 |  |
| qcl-InfoPeriodicCSI-RS | 3 for CSI-RS resource #1, #2, #3, #4  4 for CSI-RS resource #5, #6, #7, #8  5 for CSI-RS resource #9, #10, #11, #12 | for test 1-1:  TCI-StateId for TCI-State #3 for CSI-RS resource #1, #2, #3, #4  TCI-StateId for TCI-State #4 for CSI-RS resource #5, #6, #7, #8  TCI-StateId for TCI-State #5 for CSI-RS resource #9, #10, #11, #12 |  |
| } |  |  |  |

Table 5.2.3.2.20.4.3.1-5: CSI-RS-ResourceMapping for TRS (Table 5.2.3.2.20.4.3.1-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 with condition TRS | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 5 for CSI-RS resource #1 and #3  9 for CSI-RS resource #2 and #4  6 for CSI-RS resource #5 and #6  10 for CSI-RS resource #7 and #8  4 for CSI-RS resource #9 and #10  8 for CSI-RS resource #11 and #12 | for test 1-1:  l0 = 5 for CSI-RS resource 1 and 3  l0 = 9 for CSI-RS resource 2 and 4  l0 = 6 for CSI-RS resource 5 and 6  l0 = 10 for CSI-RS resource 7 and 8  l0 = 4 for CSI-RS resource 9 and 10  l0 = 8 for CSI-RS resource 11 and 12 |  |
| } |  |  |  |

Table 5.2.3.2.20.4.3.1-6: CSI-ResourcePeriodicityAndOffset for CSI Tracking (Table 5.2.3.2.20.4.3.1-4)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots20 | 1 for CSI-RS resource #1, #2, #5, #6, #9, #10  2 for CSI-RS resource #3 #4, #7, #8, #11, #12 | For test 1-1:  periodicity:  20 slots.  offset:  1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4  1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8  1 for CSI-RS resource 9 and 10 2 for CSI-RS resource 11 and 12 |  |
| } |  |  |  |

Table 5.2.3.2.20.4.3.1-7: NZP-CSI-RS-ResourceSet for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-12 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-ResourceSet ::= SEQUENCE { |  |  |  |
| nzp\_CSI\_ResourceSetId | 0 for Resource set #1  1 for Resource set #2  2 for Resource set #3 | For test 1-1 |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 4 entries | For test 1-1 | Resource set #1 |
| NZP-CSI-RS-ResourceId[1] | 0 | entry 1  CSI-RS resource #1 |  |
| NZP-CSI-RS-ResourceId[2] | 1 | entry 2  CSI-RS resource #2 |  |
| NZP-CSI-RS-ResourceId[3] | 2 | entry 3  CSI-RS resource #3 |  |
| NZP-CSI-RS-ResourceId[4] | 3 | entry 4  CSI-RS resource #4 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 4 entries | For test 1-1 | Resource set #2 |
| NZP-CSI-RS-ResourceId[1] | 4 | entry 1  CSI-RS resource #5 |  |
| NZP-CSI-RS-ResourceId[2] | 5 | entry 2  CSI-RS resource #6 |  |
| NZP-CSI-RS-ResourceId[3] | 6 | entry 3  CSI-RS resource #7 |  |
| NZP-CSI-RS-ResourceId[4] | 7 | entry 4  CSI-RS resource #8 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 4 entries | For test 1-1 | Resource set #3 |
| NZP-CSI-RS-ResourceId[1] | 8 | entry 1  CSI-RS resource #9 |  |
| NZP-CSI-RS-ResourceId[2] | 9 | entry 2  CSI-RS resource #10 |  |
| NZP-CSI-RS-ResourceId[3] | 10 | entry 3  CSI-RS resource #11 |  |
| NZP-CSI-RS-ResourceId[4] | 11 | entry 4  CSI-RS resource #12 |  |
| } |  |  |  |
| trs-Info | true |  |  |
| } |  |  |  |

Table 5.2.3.2.20.4.3.1-8: NZP-CSI-RS-Resource for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-14 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| nzp-CSI-RS-ResourceId | 12 for CSI-RS resource #13  13 for CSI-RS resource #14  14 for CSI-RS resource #15 | for test 1-1 |  |
| qcl-InfoPeriodicCSI-RS | 0 for CSI-RS resource #13  1 for CSI-RS resource #14  2 for CSI-RS resource #15 | for test 1-1:  TCI-State #0 for CSI-RS resource #13  TCI-State #1 for CSI-RS resource #14  TCI-State #2 for CSI-RS resource #15 |  |
| } |  |  |  |

Table 5.2.3.2.20.4.3.1-9: CSI-RS-ResourceMapping for CSI Acquisition (Table 5.2.3.2.20.4.3.1-8)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 12 for CSI-RS resource #13  13 for CSI-RS resource #14  7 for CSI-RS resource #15 | for test 1-1  l0=12 for CSI-RS resource #13  l0=13 for CSI-RS resource #14  l0=7 for CSI-RS resource #15 |  |
| } |  |  |  |

Table 5.2.3.2.20.4.3.1-10: CSI-ResourcePeriodicityAndOffset for CSI Acquisition (Table 5.2.3.2.20.4.3.1-8)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-16 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots40 | 0 | For test 1-1  periodicity = 40 slots.  offset = 0 slots |  |
| } |  |  |  |

Table 5.2.3.2.20.4.3.1-11: NZP-CSI-RS-ResourceSet for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-18 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-ResourceSet ::= SEQUENCE { |  |  |  |
| nzp\_CSI\_ResourceSetId | 3 for Resource set #4  4 for Resource set #5  5 for Resource set #6 | For test 1-1 |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry | For test 1-1 | Resource set #4 |
| NZP-CSI-RS-ResourceId[1] | 12 | entry 1  CSI-RS resource #13 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry | For test 1-1 | Resource set #5 |
| NZP-CSI-RS-ResourceId[1] | 13 | entry 1  CSI-RS resource #14 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry | For test 1-1 | Resource set #5 |
| NZP-CSI-RS-ResourceId[1] | 14 | entry 1  CSI-RS resource #15 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2.3.2.20.4.3.1-12: *TCI-State*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-190 | | | |
| Information Element | Value/remark | Comment | Condition |
| TCI-State ::= SEQUENCE { |  |  |  |
| tci-StateId | 0 for TCI state #0  1 for TCI state #1  2 for TCI state #2  3 for TCI state #3  4 for TCI state #4  5 for TCI state #5 | For test 1-1 |  |
| qcl-Type1 SEQUENCE { |  |  |  |
| bwp-Id | BWP-Id of active BWP |  | TCI state #0, TCI state #1, TCI state #2 |
|  | Not present |  | TCI state #3, TCI state #4, TCI state #5 |
| referenceSignal CHOICE { |  |  |  |
| csi-rs | 0 | CSI-RS resource #1 | TCI state #0 |
|  | 4 | CSI-RS resource #5 | TCI state #1 |
|  | 8 | CSI-RS resource #9 | TCI state #2 |
| ssb | 0 | SSB #0 | TCI state #3 |
|  | 1 | SSB #1 | TCI state #4 |
|  | 2 | SSB #2 | TCI state #5 |
| } |  |  |  |
| qcl-Type | typeA |  | TCI state #0, TCI state #1, TCI state #2 |
|  | typeC |  | TCI state #3, TCI state #4, TCI state #5 |
| } |  |  |  |
| } |  |  |  |

5.2.3.2.20.4.3.2 Message exceptions for NSA

Same as 5.2.3.2.20.4.3.1.

5.2.3.2.20.5 Test Requirement

Table 5.2.3.2.20.3-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.20.5-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.20.5-1: Test Requirements for HST-SFN Scheme A

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | | |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.2-30.1 TDD | 40 / 30 | 16QAM, 0.48 | HST-SFN Scheme A | 2x4 | 70 | 11.0 |

##### 5.2.3.2.21 4Rx TDD FR1 PDSCH HST-SFN Scheme B performance - 2x4 MIMO for both SA and NSA

Editor's Note: This test cases is incomplete in following aspects:

- Minimum test time is FFS.

5.2.3.2.21.1 Test Purpose

To verify the UE performance in the HST-SFN Scheme B scenario.

5.2.3.2.21.2 Test applicability

This test case applies to all types of NR UE release 17 and forward that support SFN scheme B for PDCCH scheduling SFN Scheme B PDSCH.

5.2.3.2.21.3 Minimum conformance requirements

The performance requirements are specified in Table 5.2.3.2.21.3-3, with the addition of test parameters in Table 5.2.3.2.21.3-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.21.3-1.

**Table 5.2.3.2.21.3-1: Tests purpose**

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify UE performance in the HST-SFN Scheme B scenario defined in B.3.6 | 1-1 |

**Table 5.2.3.2.21.3-2: Test parameters**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Value** |
| Duplex mode | | |  | TDD |
| Active DL BWP index | | |  | 1 |
| PDCCH configuration | TCI state | |  | Note 1 |
| PDSCH configuration | Mapping type | |  | Type A |
| k0 | |  | 0 |
| Starting symbol (S) | |  | 2 |
| Length (L) | |  | Specific to each Reference channel |
| PDSCH aggregation factor | |  | 1 |
| PRB bundling type | |  | Static |
| PRB bundling size | |  | 2 |
| Resource allocation type | |  | Type 0 |
| RBG size | |  | Config2 |
| VRB-to-PRB mapping type | |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size | |  | N/A |
| TCI state | |  | Note 1 |
| PDSCH DMRS configuration | DMRS Type | |  | Type 1 |
| Number of additional DMRS | |  | 2 |
| Maximum number of OFDM symbols for DL front loaded DMRS | |  | 1 |
| CSI-RS for tracking | Resource set #1 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 5 for CSI-RS resource 1 and 3  l0 = 9 for CSI-RS resource 2 and 4 |
| CSI-RS periodicity | Slots | 20 for CSI-RS resource 1,2,3,4. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4 |
| QCL info |  | TCI state #3 |
| Frequency Occupation |  | Start PRB 0 |
|  | Number of PRB = 52 |
| Resource set #2 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 6 for CSI-RS resource 5 and 6  l0 = 10 for CSI-RS resource 7 and 8 |
| CSI-RS periodicity | Slots | 10 for CSI-RS resource 5,6,7,8. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8 |
| QCL info |  | TCI state #4 |
| Frequency Occupation |  | Start PRB 0 |
|  | Number of PRB = 52 |
| Resource set #3 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 4 for CSI-RS resource 9 and 10  l0 = 8 for CSI-RS resource 11 and 12 |
| CSI-RS periodicity | Slots | 10 for CSI-RS resource 9,10,11,12. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 9 and 10 2 for CSI-RS resource 11 and 12 |
| QCL info |  | TCI state #5 |
| Frequency Occupation |  | Start PRB 0 |
|  | Number of PRB = 52 |
| NZP CSI-RS for CSI acquisition | Resource set #4 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 12 |
| CSI-RS periodicity | Slots | 40 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #0 |
| Resource set #5 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 13 |
| CSI-RS periodicity | Slots | 40 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #1 |
| Resource set #6 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 7 |
| CSI-RS periodicity | Slots | 40 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #2 |
| TCI state #0 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking Resource set #1' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #2 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 9 from 'CSI-RS for tracking Resource set #3' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #3 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #4 | Type 1 QCL information | SSB index |  | SSB #1 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #5 | Type 1 QCL information | SSB index |  | SSB #2 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| Number of HARQ Processes | | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |
| Note 1: SSB # (k mod 3), CSI-RS (for tracking) resource set # ((k mod 3) + 1) and CSI-RS (for CSI acquisition) resource set # ((k mod 3) + 4) are transmitted by kth RRH. Codepoint#0 {TCI state #0, TCI State #1} is activated when UE receives PDCCH/PDSCH from RRH#3k and RRH#3k+1. Codepoint#1 {TCI state #1, TCI State #2} is activated when UE receives PDCCH/PDSCH from RRH#3k+1 and RRH#3k+2. Codepoint#2 {TCI state #2, TCI State #0} is activated when UE receives PDCCH/PDSCH from RRH#3k+2 and RRH#3k+3. The second indicated TCI state in each codepoint is not used for quasi co-location parameters {Doppler shift, Doppler spread}. | | | | |

**Table 5.2.3.2.21.3-3: Minimum performance for HST-SFN Scheme B**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | | |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.2-30.1 TDD | 40/30 | 16QAM, 0.48 | HST-SFN-SchemeB | 2x4 | 70 | 9.3 |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2.3.2.21.

5.2.3.2.21.4 Test description

5.2.3.2.21.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2.3.2.21.3-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.3.6.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.3.2.21.4.3.

5.2.3.2.21.4.2 Test procedure

1. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.2.21.5-1 as appropriate.

2. SS is configured to transmit SSB and CSI-RS continuously and schedule PDSCH and PDCCH transmission according to Note 1 in 5.2.3.2.21.3-2. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2.3.2.21.5-1. The SS sends downlink MAC padding bits on the DL RMC.

Note: All TCI states are known to the UE through configuration inside RrcReconfiguration. There is no need to configure additional L1-RSRP measurements.

3. Send MAC CE command “Enhanced TCI States Indication for UE-specific PDCCH MAC CE” according to the timing described in Note 1 of table 5.2.3.2.21.5-1 to active TCI state codepoint 0, 1 or 2 for PDCCH periodically. PDSCH is automatically associated with TCI state codepoint 0, 1 or 2 as tci-PresentInDCI is not present. TCI states 3, 4 and 5 for SSBs are automatically activated through relation of QCL-Info in NZP CSI-RS.

4. Measure the average throughput for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL during each subtest and decide pass or fail according to Table G.1.5-1 in Annex G clause G.1.5.

5.2.3.2.21.4.3 Message contents

Same message contents as in 5.2.3.2.20.4.3.

5.2.3.2.21.5 Test Requirement

Table 5.2.3.2.21.3-3 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.21.5-1 for the specified SNR including test tolerances for all throughput tests.

Table 5.2.3.2.21.5-1: Test Requirements for HST-SFN Scheme B

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | **Bandwidth (MHz) / Subcarrier spacing (kHz)** | **Modulation format and code rate** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | | |
| **Fraction of maximum throughput (%)** | **SNR (dB)** |
| 1-1 | R.PDSCH.2-30.1 TDD | 40/30 | 16QAM, 0.48 | HST-SFN-SchemeB | 2x4 | 70 | 9.9 |

## 5.2A PDSCH demodulation requirements for CA

The parameters specified in Table 5.2-1 for PDSCH single carrier tests are reused for PDSCH CA tests unless otherwise stated.

Table 5.2A-1: Common test parameters for CA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD and TDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S) |  | 2 |
| Length (L) |  | FDD: 12  TDD: Specific to each Reference channel |
| PDSCH aggregation factor |  | 1 |
| PRB bundling type |  | Static |
| PRB bundling size |  | 2 |
| Resource allocation type |  | Type 0 |
| RBG size |  | Config2 |
| VRB-to-PRB mapping type |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
| Number of additional DMRS |  | 1 |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Number of HARQ Processes | |  | As defined in Table 5.2A-2 |
| TDD UL-DL pattern | |  | 15kHz SCS: FR1.15-1  30kHz SCS: FR1.30-1 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | As defined in Table 5.2A-3 |
| PUCCH format for HARQ-ACK feedback | |  | PUCCH format 1 for cases where the number of ACK/NACK to be transmitted on single PUCCH is 2 or less.  PUCCH format 3 for cases where the number of ACK/NACK to be transmitted on single PUCCH is more than 2. |

Table 5.2A-2: Test parameters for number of HARQ processes

|  |  |  |  |
| --- | --- | --- | --- |
| HARQ process number | | CCs with the same duplex mode & SCS with Pcell | CCs with different duplex mode / SCS with Pcell |
| FDD 15 kHz +  TDD 30 kHz CA | FDD PCell | 4 | 8 |
| TDD PCell | 10 | 8 |
| FDD 15 kHz +  TDD 15 kHz CA | FDD PCell | 4 | 4 |
| TDD PCell | 8 | 8 |
| TDD 15 kHz +  TDD 30 kHz CA | 15kHz PCell | 8 | 12 |
| 30kHz PCell | 8 | 8 |
| FDD 15 kHz +  FDD 15 kHz CA | FDD PCell | 4 | N/A |
| TDD 30 kHz +  TDD 30 kHz CA | TDD PCell | 8 | N/A |

Table 5.2A-3: Test parameters for K1 values

|  |  |  |  |
| --- | --- | --- | --- |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | CCs with the same duplex mode and SCS with Pcell | CCs with different duplex mode and/or SCS with Pcell |
| FDD 15 kHz +  TDD 30 kHz CA | FDD PCell | {2} | {2} |
| TDD PCell | {8,7,6,5,5,4,3,11} | {7,5,4,11,9} |
| FDD 15 kHz +  TDD 15 kHz CA | FDD PCell | {2} | {2} |
| TDD PCell | {4,3,2,6} | {4,3,2,6,5} |
| TDD 15 kHz +  TDD 30 kHz CA | 15kHz PCell | {4,3,2,6} | {4,4,3,3,2,2,6,6} |
| 30kHz PCell | {8,7,6,5,5,4,3,2} | {7,5,4,11} |
| FDD 15 kHz +  FDD 15 kHz CA | FDD PCell | {2} | N/A |
| TDD 30 kHz +  TDD 30 kHz CA | TDD PCell | {8,7,6,5,5,4,3,2} | N/A |

### 5.2A.1 1RX requirements (Void)

### 5.2A.2 2RX requirements

#### 5.2A.2.1 Requirements for 2RX normal PDSCH

##### 5.2A.2.1.0 Minimum conformance requirements for 2RX normal PDSCH

For CA with different numbers of DL component carriers, the requirements are defined in Table 5.2A.2.1.0-4 based on the single carrier requirements for different SCSs and different bandwidth specified in Table 5.2A.2.1.0-1 to Table 5.2A.2.1.0-3, with the parameters in Table 5.2A-1 to Table 5.2A-3 and the downlink physical channel setup according to Annex C.2.1. The performance requirements specified in this sub-clause do not apply for UE single carrier test.

Table 5.2A.2.1.0-1: Single carrier performance for FDD 15 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-9.1 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.6 |
| 10 | R.PDSCH.1-2.2 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.6 |
| 15 | R.PDSCH.1-9.2 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.6 |
| 20 | R.PDSCH.1-9.3 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.8 |
| 25 | R.PDSCH.1-9.4 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.0 |
| 30 | R.PDSCH.1-9.5 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.8 |
| 40 | R.PDSCH.1-10.1 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.0 |
| 50 | R.PDSCH.1-10.2 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.4 |

Table 5.2A.2.1.0-2: Single carrier performance for TDD 15 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-2.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.6 |
| 10 | R.PDSCH.1-2.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.8 |
| 15 | R.PDSCH.1-2.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.8 |
| 20 | R.PDSCH.1-2.4 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.9 |
| 25 | R.PDSCH.1-2.5 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.0 |
| 30 | R.PDSCH.1-3.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.9 |
| 40 | R.PDSCH.1-3.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.2 |
| 50 | R.PDSCH.1-3.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.5 |

Table 5.2A.2.1.0-3: Single carrier performance for TDD 30 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.2-13.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.6 |
| 10 | R.PDSCH.2-13.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.6 |
| 15 | R.PDSCH.2-13.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.6 |
| 20 | R.PDSCH.2-13.4 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.7 |
| 25 | R.PDSCH.2-13.5 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.7 |
| 30 | R.PDSCH.2-14.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.7 |
| 40 | R.PDSCH.2-2.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 13.9 |
| 50 | R.PDSCH.2-14.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.1 |
| 60 | R.PDSCH.2-14.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.0 |
| 80 | R.PDSCH.2-14.4 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.5 |
| 90 | R.PDSCH.2-14.5 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.3 |
| 100 | R.PDSCH.2-15.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.7 |

Table 5.2A.2.1.0-4: Minimum performance for multiple CA configurations

|  |  |  |
| --- | --- | --- |
| Test number | CA duplex mode | Minimum performance requirements |
| 1 | FDD 15 kHz + FDD 15 kHz | As defined in Table 5.2A.2.1.0-1 |
| 2 | TDD 30 kHz + TDD 30 kHz | As defined in Table 5.2A.2.1.0-3 |
| 3 | FDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.2.1.0-1 and Table 5.2A.2.1.0-3 per CC |
| 4 | FDD 15 kHz + TDD 15 kHz | As defined in Table 5.2A.2.1.0-1 and Table 5.2A.2.1.0-2 per CC |
| 5 | TDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.2.1.0-2 and Table 5.2A.2.1.0-3 per CC |
| Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 5.1.1.5. | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2A.2.1.

##### 5.2A.2.1.1 2Rx Normal PDSCH Demodulation Performance for CA (2DL CA) for both SA and NSA

5.2A.2.1.1.1 Test Purpose

To verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions for multiple CA configurations and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput per CC.

5.2A.2.1.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 2DL CA.

This test also applies to all types of UE release 15 and forward supporting EN-DC with 2 NR CC.

5.2A.2.1.1.3 Test description

5.2A.2.1.1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

Channel BW to be tested: largest aggregated bandwidth combination as per Table 5.1.1.5.2-2.

CA capability to be tested: As per table 5.1.1.5.2-1

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

Table 5.2A.2.1.1.3.1-1: Test point selection table

|  |  |  |
| --- | --- | --- |
| Test number | CA duplex mode | Configuration |
| 1 | FDD 15 kHz + FDD 15 kHz | As defined in Table 5.2A.2.1.0-1 |
| 2 | TDD 30 kHz + TDD 30 kHz | As defined in Table 5.2A.2.1.0-3 |
| 3 | FDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.2.1.0-1 and Table 5.2A.2.1.0-3 per CC |
| 4 (note 2) | FDD 15 kHz + TDD 15 kHz | As defined in Table 5.2A.2.1.0-1 and Table 5.2A.2.1.0-2 per CC |
| 5 (note 3) | TDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.2.1.0-2 and Table 5.2A.2.1.0-3 per CC |
| Note 1: For each test point, select any one of the CA configurations which contain CA bandwidth combination with the largest aggregated channel bandwidth and supported maximum data rate based on the equation  Note 2: Test point 4 can be skipped if test point 3 is verified.  Note 3: Test point 5 can be skipped if test point 2 is verified. | | |

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.6 for TE diagram and clause A.3.2.6 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2A-1 to Table 5.2A-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On* for EN-DC according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2A.2.1.1.3.3.

5.2A.2.1.1.3.2 Test procedure

1. Configure SCC according to Annex C.0, C.1 and C.2 for all downlink physical channels.

2. The SS shall configure SCC as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 5.2 A.2.1.1.3.3.

3. SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [24], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[25], clause9.3).

4. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2A.2.1.0-1 to 5.2A.2.1.0-4 as appropriate on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.

5. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2A.2.1.0-1 to 5.2A.2.1.0-4 as appropriate on both PCC and SCC.

6. Measure the average throughput on each component carrier simultaneously for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail according to Table G.1.5-1 in Annex G.1.5.

7. Repeat steps from 1 to 6 for each test points in Table 5.2A.2.1.0-4 as appropriate.

5.2A.2.1.1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2A.2.1.1.4 Test Requirement

Tables 5.2A.2.1.1.4-1, 5.2A.2.1.1.4-2 and 5.2A.2.1.1.4-3 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 and A.3.2.2 for each component carrier for throughput test point combination shall meet or exceed the specified value in Table 5.2A.2.1.1.4-1, 5.2A.2.1.1.4-2 and 5.2A.2.1.1.4-3 for the specified SNR including test tolerances for the test points listed in Table 5.2A.2.1.1.3.1-1.

Table 5.2A.2.1.1.4-1: Test requirements for FDD 15 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-9.1 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.6 |
| 10 | R.PDSCH.1-2.2 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.6 |
| 15 | R.PDSCH.1-9.2 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.6 |
| 20 | R.PDSCH.1-9.3 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.8 |
| 25 | R.PDSCH.1-9.4 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 15.0 |
| 30 | R.PDSCH.1-9.5 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.8 |
| 40 | R.PDSCH.1-10.1 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 15.0 |
| 50 | R.PDSCH.1-10.2 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 15.4 |

Table 5.2A.2.1.1.4-2: Test requirements for TDD 15 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-2.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.6 |
| 10 | R.PDSCH.1-2.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.8 |
| 15 | R.PDSCH.1-2.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.8 |
| 20 | R.PDSCH.1-2.4 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.9 |
| 25 | R.PDSCH.1-2.5 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 15.0 |
| 30 | R.PDSCH.1-3.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.9 |
| 40 | R.PDSCH.1-3.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 15.2 |
| 50 | R.PDSCH.1-3.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 15.5 |

Table 5.2A.2.1.1.4-3: Test requirements for TDD 30 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.2-13.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.6 |
| 10 | R.PDSCH.2-13.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.6 |
| 15 | R.PDSCH.2-13.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.6 |
| 20 | R.PDSCH.2-13.4 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.7 |
| 25 | R.PDSCH.2-13.5 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.7 |
| 30 | R.PDSCH.2-14.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.7 |
| 40 | R.PDSCH.2-2.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.9 |
| 50 | R.PDSCH.2-14.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 15.1 |
| 60 | R.PDSCH.2-14.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 15.0 |
| 80 | R.PDSCH.2-14.4 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 15.5 |
| 90 | R.PDSCH.2-14.5 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 15.3 |
| 100 | R.PDSCH.2-15.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 15.7 |

##### 5.2A.2.1.2 2Rx Normal PDSCH Demodulation Performance for CA (3DL CA) for both SA and NSA

5.2A.2.1.2.1 Test Purpose

Same as 5.2A.2.1.1

5.2A.2.1.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 3DL CA.

This test also applies to all types of UE release 15 and forward supporting EN-DC with 3 NR CC.

5.2A.2.1.2.3 Test description

5.2A.2.1.2.3.1 Initial conditions

Same as 5.2A.2.1.1.3.1

5.2A.2.1.2.3.2 Test procedure

1. Configure SCC according to Annex C.0, C.1 and C.2 for all downlink physical channels.

2. The SS shall configure SCCs as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 5.2 A.2.1.2.3.3.

3. SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [24], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[25], clause9.3).

4. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2A.2.1.0-1 to 5.2A.2.1.0-4 as appropriate on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.

5. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2A.2.1.0-1 to 5.2A.2.1.0-4 as appropriate on both PCC and SCCs.

6. Measure the average throughput on each component carrier simultaneously for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail according to Table G.1.5-1 in Annex G.1.5.

7. Repeat steps from 1 to 6 for each test points in Table 5.2A.2.1.0-4 as appropriate.

5.2A.2.1.2.3.3 Message contents

Same as 5.2A.2.1.1.3.3.

5.2A.2.1.2.4 Test Requirement

Same as 5.2A.2.1.1.4 evaluated per component carrier.

##### 5.2A.2.1.3 2Rx Normal PDSCH Demodulation Performance for CA (4DL CA) for both SA and NSA

5.2A.2.1.3.1 Test Purpose

Same as 5.2A.2.1.1

5.2A.2.1.3.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 4DL CA.

This test also applies to all types of UE release 15 and forward supporting EN-DC with 4 NR CC.

5.2A.2.1.3.3 Test description

5.2A.2.1.3.3.1 Initial conditions

Same as 5.2A.2.1.1.3.1

5.2A.2.1.3.3.2 Test procedure

1. Configure SCC according to Annex C.0, C.1 and C.2 for all downlink physical channels.

2. The SS shall configure SCCs as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 5.2 A.2.1.3.3.3.

3. SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [24], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[25], clause9.3).

4. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2A.2.1.0-1 to 5.2A.2.1.0-4 as appropriate on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.

5. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2A.2.1.0-1 to 5.2A.2.1.0-4 as appropriate on both PCC and SCCs.

6. Measure the average throughput on each component carrier simultaneously for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail according to Table G.1.5-1 in Annex G.1.5.

7. Repeat steps from 1 to 6 for each test points in Table 5.2A.2.1.0-4 as appropriate.

5.2A.2.1.3.3.3 Message contents

Same as 5.2A.2.1.1.3.3.

5.2A.2.1.3.4 Test Requirement

Same as 5.2A.2.1.1.4 evaluated per component carrier.

#### 5.2A.2.2 Requirements for 2RX PDSCH carrier aggregation with power imbalance

##### 5.2A.2.2.0 Minimum conformance requirements for 2RX PDSCH CA with power imbalance

The performance requirements are specified in Table 5.2A.2.2.0-3 and Table 5.2A.2.2.0-4, with the addition of test parameters in Table 5.2A.2.2.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2A.2.2.0-1.

Table 5.2A.2.2.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the ability of an intra-band adjacent carrier aggregation UE to demodulate the signal transmitted by the PCell or SCell in the presence of a stronger SCell or PCell signal on an adjacent frequency. Throughput is measured on the PCell or SCell only |  |

Table 5.2A.2.2.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD and TDD |
| Active DL BWP index | |  | 1 |
| Propagation condition | |  | Static propagation condition  No external noise sources are applied |
| Antenna configuration | |  | 1x2 |
| PDSCH configuration | Length (L) |  | FDD: 12TDD: 12 for DL slot, 4 for special slot |
| PRB bundling size |  | WB |
| Modulation and code rate | |  | 64QAM, MCS 26 |
| Number of HARQ Processes | |  | FDD: 4  TDD: 8 |
| Maximum number of HARQ transmission | |  | 1 |
| Redundancy version coding sequence | |  | {0} |
| TDD UL-DL pattern | |  | 30kHz SCS: FR1.30-1 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | As defined in Table A.1.2-2 for FR1.30-1 |
| PUCCH format for HARQ-ACK feedback | |  | PUCCH format 1 |
| Overhead for TBS determination | |  | 0 |
| SSB transmission | |  | Slot#0 with periodicity 20ms |
| RB assignment | |  | Full applicable test bandwidth as defined in Table 5.3.5-1 of TS 38.101-1 [2] |

Table 5.2A.2.2.0-3: Minimum performance for FDD CA with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Bandwidth (MHz) | | Reference channel | | Power at antenna port (dBm/Hz) | | Reference value  Fraction of Maximum  Throughput (%) | |
| PCell | SCell | PCell | SCell | for PCell | for Scell | PCell | SCell |
| 1 | Selected Channel bandwidth as per section 5.1.1.6 | | Derived as per section 5.1.3.2 of TS 38.214 [12] | NA | -112 | -106 | 85 | NA |

Table 5.2A.2.2.0-4: Minimum performance for TDD CA with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Bandwidth (MHz) | | Reference channel | | Power at antenna port (dBm/Hz) | | Reference value  Fraction of Maximum  Throughput (%) | |
| PCell | SCell | PCell | SCell | for PCell | for Scell | PCell | SCell |
| 1 | Selected Channel bandwidth as per section 5.1.1.6 | | Derived as per section 5.1.3.2 of TS 38.214 [12] | NA | -112 | -106 | 85 | NA |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2A.2.2.

##### 5.2A.2.2.1 2Rx PDSCH Demodulation Performance for CA with power imbalance (2DL CA)

5.2A.2.2.1.1 Test Purpose

To verify the ability of an intra-band adjacent carrier aggregation UE to demodulate the signal transmitted by the PCell or SCell in the presence of a stronger SCell or PCell signal on an adjacent frequency. Throughput is measured on the PCell or SCell only.

5.2A.2.2.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 2DL intra-band contiguous CA.

5.2A.2.2.1.3 Test description

5.2A.2.2.1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

Band selection: Supported intra-band contiguous CA configurations covering the lowest and highest operating bands,

Channel BW combination to be tested: Select bandwidth combination with same bandwidth in each carrier. If not supported, select bandwidth combination with smallest bandwidth difference between the two carriers and the carrier with smaller bandwidth will be used for the test.

CA capability to be tested: Either FDD or TDD intra-band contiguous CA

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.2A for TE diagram and clause A.3.2.3 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2A-1 to Table 5.2A-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2A.2.2.1.3.3.

5.2A.2.2.1.3.2 Test procedure

1. Configure SCC according to Annex C.0, C.1 and C.2 for all downlink physical channels.

2. The SS shall configure SCC as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 5.2A.2.2.1.3.3.

3. SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [24], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[25], clause9.3).

4. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the MCS according to Table 5.2A.2.2.0-2 on PCC. The SS sends downlink MAC padding bits on the DL RMC.

5. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix according to Tables 5.2A.2.2.0-2 to 5.2A.2.2.0-4 as appropriate on both PCC and SCC.

6. Measure the average throughput on PCC for at least 300 frames.. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail based on measured throughput > 85% of the maximum scheduled throughput..

5.2A.2.2.1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2A.2.2.1.4 Test Requirement

Table 5.2A.2.2.0-2, Table 5.2A.2.2.1.4-1 and Table 5.2A.2.2.1.4-2 define the primary level settings.

The fraction of maximum throughput percentage for the MCS scheduled as specified in Table 5.2A.2.2.0-2 for the throughput test shall meet or exceed the specified value in Table 5.2A.2.2.1.4-1 or Table 5.2A.2.2.1.4-2 as applicable for the specified cell power levels.

Table 5.2A.2.2.1.4-1: Test Requirements for FDD CA with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Bandwidth (MHz) | | Reference channel | | Power at antenna port (dBm/Hz) | | Reference value  Fraction of Maximum  Throughput (%) | |
| PCell | SCell | PCell | SCell | for PCell | for Scell | PCell | SCell |
| 1 | Selected Channel bandwidth as per section 5.1.1.6 | | Derived as per section 5.1.3.2 of TS 38.214 [12] | NA | -112 | -106 | 85 | NA |

Table 5.2A.2.2.1.4-2: Test Requirements for TDD CA with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Bandwidth (MHz) | | Reference channel | | Power at antenna port (dBm/Hz) | | Reference value  Fraction of Maximum  Throughput (%) | |
| PCell | SCell | PCell | SCell | for PCell | for Scell | PCell | SCell |
| 1 | Selected Channel bandwidth as per section 5.1.1.6 | | Derived as per section 5.1.3.2 of TS 38.214 [12] | NA | -112 | -106 | 85 | NA |

##### 5.2A.2.2.2 Void

##### 5.2A.2.2.3 Void

#### 5.2A.2.3 2Rx TDD FR1 PDSCH mapping type A performance of SCell on band with shared spectrum access

Editor’s Note: This test case is incomplete. Following aspects are either missing or TBD

- period-r16 IE is FFS in 38.508-1

- Minimum test time analysis FFS

5.2A.2.3.0 Minimum conformance requirements

The performance requirements for SCell on band with shared spectrum access are specified in Table 5.2.2.2.15.0-3, with the additional test parameters for SCell in Table 5.2.2.2.15.0-2, and the test parameters for PCell are specified in Table 5.2A.2.3.0-2 and the downlink physical channel setup according to Annex C.2.1.

Table 5.2A.2.3.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the PDSCH performance of SCell for UE supporting operations in shared spectrum access | 1-1, 1-2, 1-3, 1-4 |

Table 5.2A.2.3.0-2: Test parameters for PCell

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Bandwidth | | MHz | 20 |
| Subcarrier spacing | | kHz | 30 |
| Active DL BWP index | |  | 1 |
| TDD pattern | |  | FR1.30-1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 12 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Dmrs-AdditionalPosition |  | pos1 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Number of HARQ Processes | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |

5.2A.2.3.1 Test purpose

To verify the PDSCH mapping Type A performance under 2 receive antenna conditions for SCell on a band with shared spectrum access and with different channel bandwidth, for a specific fading channel model for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput.

During the test, only the PDSCH performance of the SCell should be verified.

5.2A.2.3.2 Test applicability

This test applies to all types of UE release 16 and forward supporting NR/5GC and NR-U 2DLCA and supporting UL on shared channel access.

This test also applies to all types of UE release 16 and forward supporting EN-DC and NR-U 2DLCA and supporting UL on shared channel access.

5.2A.2.3.3 Test description

5.2A.2.3.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2A.2.3.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for NR/5GC with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for EN-DC according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2A.2.3.3.3.

5.2A.2.3.3.2 Test procedure

1. Configure SCell according to Annex C.0, C.1 and C.2 for all downlink physical channels.

2. The SS shall configure SCell as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 5.2A.2.1.1.3.3.

3. SS activates SCell by sending the activation MAC-CE (Refer TS 38.321 [24], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[25], clause9.3).

4. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.2.2.15.0-3 on SCell. The SS sends downlink MAC padding bits on the DL RMC.

5. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.2.2.15.0-3 on SCell.

6. Measure the average throughput on SCell for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail according to Table G.1.5-1 in Annex G.1.5.

7. Repeat steps from 1 to 6 for each test point in Table 5.2.2.2.15.0-3 as appropriate.

5.2A.2.3.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2A.2.3.3.3\_1 Message exceptions for NR/5GC

Same as in Clause 5.2.2.2.15\_1.3.3\_1

5.2A.2.3.3.3\_2 Message exceptions for EN-DC

Same as in Clause 5.2.2.2.15\_1.3.3\_2

5.2A.2.3.3.4 Test requirement

Table 5.2.2.2.15.3.4-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.2.2.15.3.4-1 for the specified SNR including test tolerances for all throughput tests.

#### 5.2A.2.4 Requirements for 2RX HST-SFN CA PDSCH

##### 5.2A.2.4.0 Minimum conformance requirements for 2RX HST-SFN CA PDSCH

For HST-SFN CA with different numbers of DL component carriers, the requirements are defined in Table 5.2A.2.4.0-5 based on the single carrier requirements for different SCSs and different bandwidth specified in Table 5.2A.2.4.0-3 and Table 5.2A.2.4.0-4. Test parameters are specified in Table 5.2A.2.4.0-2, Table 5.2A-2, and Table 5.2A-3 with downlink physical channel setup according to Annex C.2.1. The performance requirements specified in this sub-clause do not apply for UE single carrier test.

The test purpose is specified in Table 5.2A.2.4.0-1.

Table 5.2A.2.4.0-1: Test purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH performance under 2 receive antenna conditions in the HST-SFN scenario defined in B.3.2 with CA | 1,2,3 |

Table 5.2A.2.4.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD and TDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 12 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 2 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CSI-RS for tracking | CSI-RS periodicity | Slots | FDD: 10 for CSI-RS resource 1,2,3,4.  TDD: 20 for CSI-RS resource 1,2,3,4. |
|  | CSI-RS offset | Slots | 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4. |
| Number of HARQ Processes | |  | As defined in Table 5.2A-2 |
| TDD UL-DL pattern | |  | 15 kHz SCS: FR1.15-1  30 kHz SCS: FR1.30-1 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | As defined in Table 5.2A-3 |
| Number of PUCCH ResourceGroups | |  | 1 |
| PUCCH format for HARQ-ACK feedback | |  | PUCCH format 1 for cases with no more than 2 DL CCs  PUCCH format 3 for cases with more than 2 DL CCs |

Table 5.2A.2.4.0-3: Single carrier performance for FDD 15 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-13.1 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 12.9 |
| 10 | R.PDSCH.1-8.3 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 13.1 |
| 15 | R.PDSCH.1-13.2 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 13.4 |
| 20 | R.PDSCH.1-13.3 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 13.9 |
| 25 | R.PDSCH.1-13.4 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.0 |
| 30 | R.PDSCH.1-13.5 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 13.9 |
| 35 | R.PDSCH.1-14.3 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 13.8 |
| 40 | R.PDSCH.1-14.1 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.0 |
| 45 | R.PDSCH.1-14.4 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 13.9 |
| 50 | R.PDSCH.1-14.2 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.0 |

Table 5.2A.2.4.0-4: Single carrier performance for TDD 30 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.2-19.1 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 13.4 |
| 10 | R.PDSCH.2-19.2 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 13.7 |
| 15 | R.PDSCH.2-19.3 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 13.8 |
| 20 | R.PDSCH.2-19.4 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 13.8 |
| 25 | R.PDSCH.2-19.5 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.1 |
| 30 | R.PDSCH.2-20.1 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.4 |
| 40 | R.PDSCH.2-10.4 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.6 |
| 50 | R.PDSCH.2-20.2 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.7 |
| 60 | R.PDSCH.2-20.3 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.4 |
| 80 | R.PDSCH.2-20.4 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.9 |
| 90 | R.PDSCH.2-20.5 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 15.4 |
| 100 | R.PDSCH.2-21.1 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.8 |

Table 5.2A.2.4.0-5: Minimum performance for multiple CA configurations

|  |  |  |
| --- | --- | --- |
| Test number | CA duplex mode | Minimum performance requirements |
| 1 | FDD 15 kHz + FDD 15 kHz | As defined in Table 5.2A.2.4.0-3 |
| 2 | TDD 30 kHz + TDD 30 kHz | As defined in Table 5.2A.2.4.0-4 |
| 3 | FDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.2.4.0-3 and Table 5.2A.2.4.0-4 per CC |
| Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 5.1.1.7 | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2A.2.4.

##### 5.2A.2.4.1 2Rx PDSCH Demodulation Performance for HST-SFN CA

5.2A.2.4.1.1 Test Purpose

Verify PDSCH performance under 2 receive antenna conditions in the HST-SFN scenario defined in B.3.2 with multiple CA configurations.

5.2A.2.4.1.2 Test applicability

This test applies to all types of NR UE release 16 and forward that supports enhanced demodulation processing for carrier aggregation for HST-SFN joint transmission scheme.

5.2A.2.4.1.3 Test description

5.2A.2.4.1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

Channel BW to be tested: largest aggregated bandwidth combination as per Table 5.1.1.5.2-2.

CA capability to be tested: As per table 5.1.1.5.2-1

Table 5.2A.2.4.1.3.1-1: Test point selection table

|  |  |  |
| --- | --- | --- |
| Test number | CA duplex mode | Minimum performance requirements |
| 1 | FDD 15 kHz + FDD 15 kHz | As defined in Table 5.2A.2.4.0-3 |
| 2 | TDD 30 kHz + TDD 30 kHz | As defined in Table 5.2A.2.4.0-4 |
| 3 | FDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.2.4.0-3 and Table 5.2A.2.4.0-4 per CC |
| Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 5.1.1.7 | | |

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2A-1 to Table 5.2A-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.3.2.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2A.2.4.1.3.3.

5.2A.2.4.1.3.2 Test procedure

1. Configure SCC according to Annex C.0, C.1 and C.2 for all downlink physical channels.

2. The SS shall configure SCC as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 5.2A.2.4.1.3.3.

3. SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[19], clause 9.3).

4. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2A.2.4.0-2 to 5.2A.2.4.0-5 as appropriate on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.

5. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to 5.2A.2.4.1.3.4-1 and 5.2A.2.4.1.3.4-2 as appropriate on both PCC and SCC.

6. Measure the average throughput on each component carrier simultaneously for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail according to Table G.1.5-1 in Annex G.1.5.

7. Repeat steps from 1 to 6 for each test points in Table 5.2A.2.4.1.3.1-1 as appropriate.

5.2A.2.4.1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2 with the following exceptions:

Table 5.2A.2.4.1.3.3-1: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | Not present | n2 is used |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2A.2.4.1.3.3-2: DMRS-DownlinkConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24 | | | |
| Information Element | Value/remark | Comment | Condition |
| DMRS-DownlinkConfig ::= SEQUENCE { |  |  |  |
| dmrs-AdditionalPosition | Not present |  |  |
| } |  |  |  |

Table 5.2A.2.4.1.3.3-3: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | n4 | test 1-1 |  |
| n8 | test 1-2  test 1-3 (FDD and TDD) |  |
| } |  |  |  |

Table 5.2A.2.4.1.3.3-4: CSI-ResourcePeriodicityAndOffset for CSI Tracking

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots10 | 1 for CSI-RS resource #1 and #2  2 for CSI-RS resource #3 and #4 | periodicity:  10 slots for resource 1,2,3,4.  offset = 1 for CSI-RS resource 1 and 2  offset =2 for CSI-RS resource 3 and 4. | FDD/ SCS 15 kHz |
| slots20 | 1 for CSI-RS resource #1 and #2  2 for CSI-RS resource #3 and #4 | periodicity:  20 slots for resource 1,2,3,4.  offset = 1 for CSI-RS resource 1 and 2  offset =2 for CSI-RS resource 3 and 4. | TDD/ SCS 30 kHz |
| } |  |  |  |

5.2A.2.4.1.3.4 Test Requirement

Tables 5.2A.2.4.1.3.4-1 and 5.2A.2.4.1.3.4-2 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 and A.3.2.2 for each component carrier for throughput test point combination shall meet or exceed the specified value in Table 5.2A.2.4.1.3.4-1 and 5.2A.2.4.1.3.4-2 for the specified SNR including test tolerances for the test points listed in Table 5.2A.2.4.1.3.1-1.

Table 5.2A.2.4.1.3.4-1: Single carrier performance for FDD 15 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-13.1 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 13.5 |
| 10 | R.PDSCH.1-8.3 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 13.7 |
| 15 | R.PDSCH.1-13.2 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.0 |
| 20 | R.PDSCH.1-13.3 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.5 |
| 25 | R.PDSCH.1-13.4 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.6 |
| 30 | R.PDSCH.1-13.5 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 4.51 |
| 35 | R.PDSCH.1-14.3 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.4 |
| 40 | R.PDSCH.1-14.1 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.6 |
| 45 | R.PDSCH.1-14.4 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.5 |
| 50 | R.PDSCH.1-14.2 FDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.6 |

Table 5.2A.2.4.1.3.4-2: Single carrier performance for TDD 30 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.2-19.1 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.0 |
| 10 | R.PDSCH.2-19.2 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.3 |
| 15 | R.PDSCH.2-19.3 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.4 |
| 20 | R.PDSCH.2-19.4 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.4 |
| 25 | R.PDSCH.2-19.5 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 14.7 |
| 30 | R.PDSCH.2-20.1 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 15.0 |
| 40 | R.PDSCH.2-10.4 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 15.2 |
| 50 | R.PDSCH.2-20.2 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 15.3 |
| 60 | R.PDSCH.2-20.3 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 15.0 |
| 80 | R.PDSCH.2-20.4 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 15.5 |
| 90 | R.PDSCH.2-20.5 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 16.0 |
| 100 | R.PDSCH.2-21.1 TDD | 16QAM, 0.48 | HST-SFN | 2x2 | 70 | 15.4 |

#### 5.2A.2.5 Requirements for 2RX HST-DPS CA PDSCH

##### 5.2A.2.5.0 Minimum conformance requirements for 2RX HST-DPS CA PDSCH

For HST-DPS CA with different numbers of DL component carriers, the requirements are defined in Table 5.2A.2.5.0-7 and Table 5.2A.2.5.0-8 based on the single carrier requirements for different SCSs and different bandwidth specified in Table 5.2A.2.5.0-3 ~ Table 5.2A.2.5.0-6, with the parameters in Table 5.2A.2.5.0-2, Table 5.2A-2 and Table 5.2A-3 and the downlink physical channel setup according to Annex C.2.1. The performance requirements specified in this sub-clause do not apply for UE single carrier test.

The test purpose is specified in Table 5.2A.2.5.0-1.

Table 5.2A.2.5.0-1: Test purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify UE performance in the HST-DPS scenario defined in B.3.3 with CA with 1 active PDSCH TCI states | 1-1, 1-2, 1-3 |
| Verify UE performance in the HST-DPS scenario defined in B.3.3 with CA with 2 active PDSCH TCI states | 2-1, 2-2, 2-3 |

Table 5.2A.2.5.0-2: Test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Value |
| Duplex mode | | |  | FDD and TDD |
| Active DL BWP index | | |  | 1 |
| PDCCH configuration | TCI state | |  | Note 1 |
| PDSCH configuration | Mapping type | |  | Type A |
| k0 | |  | 0 |
| Starting symbol (S) | |  | 2 |
| Length (L) | |  | FDD: 12  TDD: Specific to each Reference channel |
| PDSCH aggregation factor | |  | 1 |
| PRB bundling type | |  | Static |
| PRB bundling size | |  | 2 |
| Resource allocation type | |  | Type 0 |
| RBG size | |  | Config2 |
| VRB-to-PRB mapping type | |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size | |  | N/A |
| TCI state | |  | Note 1 |
| PDSCH DMRS configuration | DMRS Type | |  | Type 1 |
| Number of additional DMRS | |  | 2 |
| Maximum number of OFDM symbols for DL front loaded DMRS | |  | 1 |
| CSI-RS for tracking | Resource set #1 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 5 for CSI-RS resource 1 and 3  l0 = 9 for CSI-RS resource 2 and 4 |
| CSI-RS periodicity | Slots | 15kHz SCS: 10 for CSI-RS resource 1,2,3,4.  30kHz SCS: 20 for CSI-RS resource 1,2,3,4 |
| CSI-RS offset | Slots | 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4 |
| QCL info |  | TCI state #2 |
| Frequency Occupation |  | Start PRB 0  Number of PRB = min(52, ceil(BWP size/4)\*4) |
| Resource set #2 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 6 for CSI-RS resource 5 and 6  l0 = 10 for CSI-RS resource 7 and 8 |
| CSI-RS periodicity | Slots | 15kHz SCS: 10 for CSI-RS resource 5,6,7,8.  30kHz SCS: 20 for CSI-RS resource 5,6,7,8. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8 |
| QCL info |  | TCI state #3 |
| Frequency Occupation |  | Start PRB 0  Number of PRB = min(52, ceil(BWP size/4)\*4) |
| NZP CSI-RS for CSI acquisition | Resource set #3 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 12 |
| CSI-RS periodicity | Slots | 15kHz SCS:20  30kHz SCS: 40 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #0 |
| Resource set #4 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 13 |
| CSI-RS periodicity | Slots | 15kHz SCS:20  30kHz SCS: 40 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #1 |
| TCI state #0 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking Resource set #1' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #2 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #3 | Type 1 QCL information | SSB index |  | SSB #1 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| Number of HARQ Processes | | |  | As defined in Table 5.2A-2 |
| TDD UL-DL pattern | | |  | 15kHz SCS: FR1.15-1  30kHz SCS: FR1.30-1 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | |  | As defined in Table 5.2A-3 |
| Number of PUCCH ResourceGroups | | |  | 1 |
| PUCCH format for HARQ-ACK feedback | | |  | PUCCH format 1 for cases with no more chan 2 DL CCs  PUCCH format 3 for cases with more than 2 DL CCs |
| Note 1: SSB # (k mod 2), CSI-RS (for tracking) resource set # ((k mod 2) + 1) and CSI-RS (for CSI acquisition) resource set # ((k mod 2) + 3) are transmitted by kth RRH.  For Test 1-1, TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy. PDCCH and PDSCH associated with TCI # (k mod 2) is transmitted by kth RRH from slot#  to slot#  ,  PDCCH and PDSCH are DTXed in other slots in which throughput statistics are not considered.  For Test 1-2, TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy. PDCCH and PDSCH associated with TCI # (k mod 2) is transmitted by kth RRH from slot#  to slot#  Where k=0, 1, 2… is the RRH number, n = 2520 is half of the number of slots between two RRH, = 2 is the number of slots between PDSCH and corresponding HARQ-ACK information, = 3 is the number of slots for MAC CE processing, = 6 is the number of slots to first TRS transmission occasion after MAC CE command is decoded by the UE, = 2 is the number of slots for TRS processing. | | | | |

Table 5.2A.2.5.0-3: Single carrier performance for FDD 15 kHz SCS for HST-DPS CA configurations with 1 active PDSCH TCI states

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Number of active PDSCH TCI states | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-15.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.2 |
| 10 | R.PDSCH.1-8.4 FDD | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.6 |
| 15 | R.PDSCH.1-15.2 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.6 |
| 20 | R.PDSCH.1-15.3 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.4 |
| 25 | R.PDSCH.1-15.4 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.6 |
| 30 | R.PDSCH.1-15.5 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.6 |
| 35 | [R.PDSCH.1-16.3] | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.4 |
| 40 | R.PDSCH.1-16.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.6 |
| 45 | [R.PDSCH.1-16.4] | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.4 |
| 50 | R.PDSCH.1-16.2 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.7 |

Table 5.2A.2.5.0-4: Single carrier performance for FDD 15 kHz SCS for HST-DPS CA configurations with 2 active PDSCH TCI states

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Number of active PDSCH TCI states | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-15.1 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.2 |
| 10 | R.PDSCH.1-8.4 FDD | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.6 |
| 15 | R.PDSCH.1-15.2 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.6 |
| 20 | R.PDSCH.1-15.3 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.4 |
| 25 | R.PDSCH.1-15.4 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.6 |
| 30 | R.PDSCH.1-15.5 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.6 |
| 35 | [R.PDSCH.1-16.3] | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.4 |
| 40 | R.PDSCH.1-16.1 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.6 |
| 45 | [R.PDSCH.1-16.4] | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.4 |
| 50 | R.PDSCH.1-16.2 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.7 |

Table 5.2A.2.5.0-5: Single carrier performance for TDD 30 kHz SCS for HST-DPS CA configurations with 1 active PDSCH TCI states

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Number of active PDSCH TCI states | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.2-22.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.3 |
| 10 | R.PDSCH.2-22.2 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.3 |
| 15 | R.PDSCH.2-22.3 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.2 |
| 20 | R.PDSCH.2-22.4 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.3 |
| 25 | R.PDSCH.2-22.5 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.4 |
| 30 | R.PDSCH.2-23.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.4 |
| 40 | R.PDSCH.2-10.5 TDD | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.3 |
| 50 | R.PDSCH.2-23.2 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.5 |
| 60 | R.PDSCH.2-23.3 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.5 |
| 80 | R.PDSCH.2-23.4 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.4 |
| 90 | R.PDSCH.2-23.5 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.6 |
| 100 | R.PDSCH.2-24.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.5 |

Table 5.2A.2.5.0-6: Single carrier performance for TDD 30 kHz SCS for HST-DPS CA configurations with 2 active PDSCH TCI states

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Number of active PDSCH TCI states | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.2-22.1 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.3 |
| 10 | R.PDSCH.2-22.2 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.3 |
| 15 | R.PDSCH.2-22.3 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.2 |
| 20 | R.PDSCH.2-22.4 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.3 |
| 25 | R.PDSCH.2-22.5 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.4 |
| 30 | R.PDSCH.2-23.1 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.4 |
| 40 | R.PDSCH.2-10.5 TDD | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.3 |
| 50 | R.PDSCH.2-23.2 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.5 |
| 60 | R.PDSCH.2-23.3 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.5 |
| 80 | R.PDSCH.2-23.4 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.4 |
| 90 | R.PDSCH.2-23.5 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.6 |
| 100 | R.PDSCH.2-24.1 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.5 |

Table 5.2A.2.5.0-7: Minimum performance for HST-DPS CA configurations with 1 active PDSCH TCI states

|  |  |  |
| --- | --- | --- |
| Test number | CA duplex mode | Minimum performance requirements |
| 1-1 | FDD 15 kHz + FDD 15 kHz | As defined in Table 5.2A.2.5.0-3 |
| 1-2 | TDD 30 kHz + TDD 30 kHz | As defined in Table 5.2A.2.5.0-5 |
| 1-3 | FDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.2.5.0-3 and Table 5.2A.2.5.0-5 per CC |
| Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 5.1.1.7.4. | | |

Table 5.2A.2.5.0-8: Minimum performance for HST-DPS CA configurations with 2 active PDSCH TCI states

|  |  |  |
| --- | --- | --- |
| Test number | CA duplex mode | Minimum performance requirements |
| 2-1 | FDD 15 kHz + FDD 15 kHz | As defined in Table 5.2A.2.5.0-4 |
| 2-2 | TDD 30 kHz + TDD 30 kHz | As defined in Table 5.2A.2.5.0-6 |
| 2-3 | FDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.2.5.0-4 and Table 5.2A.2.5.0-6 per CC |
| Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 5.1.1.7.4. | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2A.2.5.

##### 5.2A.2.5.1 2RX PDSCH Demodulation Performance for HST-DPS CA

5.2A.2.5.1.1 Test Purpose

To verify the PDSCH mapping Type A normal performance under 2 receive antenna conditions in the HST-DPS scenario for multiple CA configurations and with different channel models, MCSs and SCS for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput per CC.

5.2A.2.5.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 2DL CA.

5.2A.2.5.1.3 Test description

5.2A.2.5.1.3.1 Initial conditions

Same initial conditions as specified in clause 5.2A.2.1.1.3.1 with the following exception

Channel BW to be tested: largest aggregated bandwidth combination as per Table 5.1.1.5.2-2.

CA capability to be tested: As per table 5.1.1.5.2-1

Table 5.2A.2.5.1.3.1-1: Test point selection table

|  |  |  |
| --- | --- | --- |
| Test number | CA duplex mode | Minimum performance requirements |
| 1 | FDD 15 kHz + FDD 15 kHz | As defined in Table 5.2A.3.1.0-1 |
| 2 | TDD 30 kHz + TDD 30 kHz | As defined in Table 5.2A.3.1.0-3 |
| 3 | FDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.3.1.0-1 and Table 5.2A.3.1.0-3 per CC |
| 4 (note 2) | FDD 15 kHz + TDD 15 kHz | As defined in Table 5.2A.3.1.0-1 and Table 5.2A.3.1.0-2 per CC |
| 5 (note 3) | TDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.3.1.0-2 and Table 5.2A.3.1.0-3 per CC |
| Note 1: For each test point, select any one of the CA configurations which contain CA bandwidth combination with the largest aggregated channel bandwidth and supported maximum data rate based on the equation  Note 2: Test point 4 can be skipped if test point 3 is verified.  Note 3: Test point 5 can be skipped if test point 3 or 4 is verified. | | |

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2A-1 to Table 5.2A-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.3.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2A.2.5.1.3.3.

5.2A.2.5.1.3.2 Test procedure

1. Configure SCC according to Annex C.0, C.1 and C.2 for all downlink physical channels.

2. The SS shall configure SCCs as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 5.2A.2.5.1.3.3.

3. SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[19], clause 9.3).

4. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2A.2.5.0-2 as appropriate on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.

5. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to 5.2A.2.5.1.3.4-1 to 5.2A.2.5.1.3.4-4 as appropriate on both PCC and SCCs.

6. Measure the average throughput on each component carrier simultaneously for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail according to Table G.1.5-1 in Annex G.1.5.

7. Repeat steps from 1 to 6 for each test points in Table 5.2A.2.5.1.3.1-1 as appropriate.

5.2A.2.5.1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2 with the following exceptions:

Table 5.2A.2.5.1.3.3-1: DMRS-DownlinkConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24 | | | |
| Information Element | Value/remark | Comment | Condition |
| DMRS-DownlinkConfig ::= SEQUENCE { |  |  |  |
| dmrs-AdditionalPosition | Not present |  |  |
| } |  |  |  |

Table 5.2A.2.5.1.3.3-2: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | n8 |  |  |
| } |  |  |  |

Table 5.2A.2.5.1.3.3-3: NZP-CSI-RS-Resource for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| nzp-CSI-RS-ResourceId | i-1 for CSI-RS resource #i, i=1,2,3,4,5,6,7,8 |  |  |
| qcl-InfoPeriodicCSI-RS | 2 for CSI-RS resource #1, #2, #3, #4  3 for CSI-RS resource #5, #6, #7, #8 | TCI-StateId for TCI-State #2 for CSI-RS resource #1, #2, #3, #4  TCI-StateId for TCI-State #3 for CSI-RS resource #5, #6, #7, #8 |  |
| } |  |  |  |

Table 5.2A.2.5.1.3.3-4: CSI-RS-ResourceMapping for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 with condition TRS | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 5 for CSI-RS resource #1 and #3  9 for CSI-RS resource #2 and #4  6 for CSI-RS resource #5 and #6  10 for CSI-RS resource #7 and #8 | l0 = 5 for CSI-RS resource 1 and 3  l0 = 9 for CSI-RS resource 2 and 4  l0 = 6 for CSI-RS resource 5 and 6  l0 = 10 for CSI-RS resource 7 and 8 |  |
| } |  |  |  |

Table 5.2A.2.5.1.3.3-5: CSI-ResourcePeriodicityAndOffset for CSI Tracking

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots10 | 1 for CSI-RS resource #1, #2, #5, #6  2 for CSI-RS resource #3 #4, #7, #8 | periodicity:  10 slots.  offset:  1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4  1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8 | SCS 15kHz |
| Slots20 | 1 for CSI-RS resource #1, #2, #5, #6  2 for CSI-RS resource #3 #4, #7, #8 | periodicity:  20 slots.  offset:  1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4  1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8 | SCS 30kHz |
| } |  |  |  |

Table 5.2A.2.5.1.3.3-6: NZP-CSI-RS-ResourceSet for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-12 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-ResourceSet ::= SEQUENCE { |  |  |  |
| nzp\_CSI\_ResourceSetId | 0 for Resource set #1  1 for Resource set #2 |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 4 entries |  | Resource set #1 |
| NZP-CSI-RS-ResourceId[1] | 0 | entry 1  CSI-RS resource #1 |  |
| NZP-CSI-RS-ResourceId[2] | 1 | entry 2  CSI-RS resource #2 |  |
| NZP-CSI-RS-ResourceId[3] | 2 | entry 3  CSI-RS resource #3 |  |
| NZP-CSI-RS-ResourceId[4] | 3 | entry 4  CSI-RS resource #4 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 4 entries |  | Resource set #2 |
| NZP-CSI-RS-ResourceId[1] | 4 | entry 1  CSI-RS resource #5 |  |
| NZP-CSI-RS-ResourceId[2] | 5 | entry 2  CSI-RS resource #6 |  |
| NZP-CSI-RS-ResourceId[3] | 6 | entry 3  CSI-RS resource #7 |  |
| NZP-CSI-RS-ResourceId[4] | 7 | entry 4  CSI-RS resource #8 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2A.2.5.1.3.3-7: NZP-CSI-RS-Resource for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-14 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| nzp-CSI-RS-ResourceId | 8 for CSI-RS resource #9  9 for CSI-RS resource #10 |  |  |
| qcl-InfoPeriodicCSI-RS | 0 for CSI-RS resource #9  1 for CSI-RS resource #10 | TCI-State #0 for CSI-RS resource #9  TCI-State #1 for CSI-RS resource #10 |  |
| } |  |  |  |

Table 5.2A.2.5.1.3.3-8: CSI-RS-ResourceMapping for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 12 for CSI-RS resource #9  13 for CSI-RS resource #10 | l0=12 for CSI-RS resource #9  l0=13 for CSI-RS resource #10 |  |
| } |  |  |  |

Table 5.2A.2.5.1.3.3-9: CSI-ResourcePeriodicityAndOffset for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-16 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots20 | 0 | periodicity = 20slots.  offset = 0 slots | SCS 15kHz |
| Slots40 | 0 | periodicity = 40 slots.  offset = 0 slots | SCS 30kHz |
| } |  |  |  |

Table 5.2A.2.5.1.3.3-10: NZP-CSI-RS-ResourceSet for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-18 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-ResourceSet ::= SEQUENCE { |  |  |  |
| nzp\_CSI\_ResourceSetId | 2 for Resource set #3  3 for Resource set #4 |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry |  | Resource set #3 |
| NZP-CSI-RS-ResourceId[1] | 8 | entry 1  CSI-RS resource #9 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry |  | Resource set #4 |
| NZP-CSI-RS-ResourceId[1] | 9 | entry 1  CSI-RS resource #10 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2A.2.5.1.3.3-11: *TCI-State*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-190 | | | |
| Information Element | Value/remark | Comment | Condition |
| TCI-State ::= SEQUENCE { |  |  |  |
| tci-StateId | 0 for TCI state #0  1 for TCI state #1  2 for TCI state #2  3 for TCI state #3 |  |  |
| qcl-Type1 SEQUENCE { |  |  |  |
| bwp-Id | BWP-Id of active BWP |  | TCI state #0, TCI state #1 |
|  | Not present |  | TCI state #2, TCI state #3 |
| referenceSignal CHOICE { |  |  |  |
| csi-rs | 0 | CSI-RS resource #1 | TCI state #0 |
|  | 4 | CSI-RS resource #5 | TCI state #1 |
| ssb | 0 | SSB #0 | TCI state #2 |
|  | 1 | SSB #1 | TCI state #3 |
| } |  |  |  |
| qcl-Type | typeA |  | TCI state #0, TCI state #1 |
|  | typeC |  | TCI state #2, TCI state #3 |
| } |  |  |  |
| } |  |  |  |

5.2A.2.5.1.3.4 Test Requirement

Tables 5.2A.2.5.1.3.4-1, 5.2A.2.5.1.3.4-2 and 5.2A.2.5.1.3.4-3 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 and A.3.2.2 for each component carrier for throughput test point combination shall meet or exceed the specified value in Table 5.2A.2.5.1.3.4-1, 5.2A.2.5.1.3.4-2 and 5.2A.2.5.1.3.4-3 for the specified SNR including test tolerances for the combination selected following the test rules outlined in 5.1.1.5.2-2.

Table 5.2A.2.5.1.3.4-1: Test requirements for Single carrier performance for FDD 15 kHz SCS for HST-DPS CA configurations with 1 active PDSCH TCI states

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Number of active PDSCH TCI states | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-15.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.8 |
| 10 | R.PDSCH.1-8.4 FDD | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 14.2 |
| 15 | R.PDSCH.1-15.2 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 14.2 |
| 20 | R.PDSCH.1-15.3 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 14.0 |
| 25 | R.PDSCH.1-15.4 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 14.2 |
| 30 | R.PDSCH.1-15.5 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 14.2 |
| 35 | [R.PDSCH.1-16.3] | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 14.0 |
| 40 | R.PDSCH.1-16.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 14.2 |
| 45 | [R.PDSCH.1-16.4] | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 14.0 |
| 50 | R.PDSCH.1-16.2 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 14.3 |

Table 5.2A.2.5.1.3.4-2: Test requirements for Single carrier performance for FDD 15 kHz SCS for HST-DPS CA configurations with 2 active PDSCH TCI states

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Number of active PDSCH TCI states | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-15.1 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.8 |
| 10 | R.PDSCH.1-8.4 FDD | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 14.2 |
| 15 | R.PDSCH.1-15.2 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 14.2 |
| 20 | R.PDSCH.1-15.3 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 14.0 |
| 25 | R.PDSCH.1-15.4 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 14.2 |
| 30 | R.PDSCH.1-15.5 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 14.2 |
| 35 | [R.PDSCH.1-16.3] | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 14.0 |
| 40 | R.PDSCH.1-16.1 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 14.2 |
| 45 | [R.PDSCH.1-16.4] | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 14.0 |
| 50 | R.PDSCH.1-16.2 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 14.3 |

Table 5.2A.2.5.1.3.4-3: Test requirements for Single carrier performance for TDD 30 kHz SCS for HST-DPS CA configurations with 1 active PDSCH TCI states

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Number of active PDSCH TCI states | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.2-22.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.9 |
| 10 | R.PDSCH.2-22.2 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.9 |
| 15 | R.PDSCH.2-22.3 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.8 |
| 20 | R.PDSCH.2-22.4 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.9 |
| 25 | R.PDSCH.2-22.5 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 14.0 |
| 30 | R.PDSCH.2-23.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 14.0 |
| 40 | R.PDSCH.2-10.5 TDD | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 13.9 |
| 50 | R.PDSCH.2-23.2 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 14.1 |
| 60 | R.PDSCH.2-23.3 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 14.1 |
| 80 | R.PDSCH.2-23.4 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 14.0 |
| 90 | R.PDSCH.2-23.5 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 14.2 |
| 100 | R.PDSCH.2-24.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x2 | 70 | 14.1 |

Table 5.2A.2.5.1.3.4-4: Test requirements for Single carrier performance for TDD 30 kHz SCS for HST-DPS CA configurations with 2 active PDSCH TCI states

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Number of active PDSCH TCI states | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.2-22.1 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.9 |
| 10 | R.PDSCH.2-22.2 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.9 |
| 15 | R.PDSCH.2-22.3 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.8 |
| 20 | R.PDSCH.2-22.4 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.9 |
| 25 | R.PDSCH.2-22.5 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 14.0 |
| 30 | R.PDSCH.2-23.1 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 14.0 |
| 40 | R.PDSCH.2-10.5 TDD | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 13.9 |
| 50 | R.PDSCH.2-23.2 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 14.1 |
| 60 | R.PDSCH.2-23.3 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 14.1 |
| 80 | R.PDSCH.2-23.4 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 14.0 |
| 90 | R.PDSCH.2-23.5 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 14.2 |
| 100 | R.PDSCH.2-24.1 | 64QAM, 0.43 | HST-DPS | 2 | 2x2 | 70 | 14.1 |

### 5.2A.3 4RX requirements

#### 5.2A.3.1 Requirements for 4RX normal PDSCH

##### 5.2A.3.1.0 Minimum conformance requirements for 4RX normal PDSCH

For CA with different numbers of DL component carriers, the requirements are defined in Table 5.2A.3.1.0-4 based on the single carrier requirements for different SCSs and different bandwidth specified in Table 5.2A.3.1.0-1 to Table 5.2A.3.1.0-3, with the parameters in Table 5.2A-1 to Table 5.2A-3 and the downlink physical channel setup according to Annex C.2.1. The performance requirements specified in this sub-clause do not apply for UE single carrier test.

Table 5.2A.3.1.0-1: Single carrier performance for FDD 15 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-9.1 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.5 |
| 10 | R.PDSCH.1-2.2 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.5 |
| 15 | R.PDSCH.1-9.2 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.6 |
| 20 | R.PDSCH.1-9.3 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.6 |
| 25 | R.PDSCH.1-9.4 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.7 |
| 30 | R.PDSCH.1-9.5 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.6 |
| 40 | R.PDSCH.1-10.1 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.7 |
| 50 | R.PDSCH.1-10.2 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.9 |

Table 5.2A.3.1.0-2: Single carrier performance for TDD 15 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-2.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.5 |
| 10 | R.PDSCH.1-2.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.6 |
| 15 | R.PDSCH.1-2.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.7 |
| 20 | R.PDSCH.1-2.4 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.6 |
| 25 | R.PDSCH.1-2.5 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.8 |
| 30 | R.PDSCH.1-3.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.6 |
| 40 | R.PDSCH.1-3.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.8 |
| 50 | R.PDSCH.1-3.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.0 |

Table 5.2A.3.1.0-3: Single carrier performance for TDD 30 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.2-13.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.5 |
| 10 | R.PDSCH.2-13.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.5 |
| 15 | R.PDSCH.2-13.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.5 |
| 20 | R.PDSCH.2-13.4 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.6 |
| 25 | R.PDSCH.2-13.5 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.6 |
| 30 | R.PDSCH.2-14.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.6 |
| 40 | R.PDSCH.2-2.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.7 |
| 50 | R.PDSCH.2-14.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.9 |
| 60 | R.PDSCH.2-14.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 8.8 |
| 80 | R.PDSCH.2-14.4 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.1 |
| 90 | R.PDSCH.2-14.5 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.0 |
| 100 | R.PDSCH.2-15.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.3 |

Table 5.2A.3.1.0-4: Minimum performance for multiple CA configurations

|  |  |  |
| --- | --- | --- |
| Test number | CA duplex mode | Minimum performance requirements |
| 1 | FDD 15 kHz + FDD 15 kHz | As defined in Table 5.2A.3.1.0-1 |
| 2 | TDD 30 kHz + TDD 30 kHz | As defined in Table 5.2A.3.1.0-3 |
| 3 | FDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.3.1.0-1 and Table 5.2A.3.1.0-3 per CC |
| 4 | FDD 15 kHz + TDD 15 kHz | As defined in Table 5.2A.3.1.0-1 and Table 5.2A.3.1.0-2 per CC |
| 5 | TDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.3.1.0-2 and Table 5.2A.3.1.0-3 per CC |
| Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 5.1.1.5. | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2A.3.1.

##### 5.2A.3.1.1 4Rx Normal PDSCH Demodulation Performance for CA (2DL CA)

5.2A.3.1.1.1 Test Purpose

To verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions for multiple CA configurations and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput per CC.

5.2A.3.1.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 2DL CA and 4Rx antenna ports on each CC.

5.2A.3.1.1.3 Test description

5.2A.3.1.1.3.1 Initial conditions

Same initial conditions as specified in clause 5.2A.2.1.1.3.1 with the following exception

Channel BW to be tested: largest aggregated bandwidth combination as per Table 5.1.1.5.2-2.

CA capability to be tested: As per table 5.1.1.5.2-1

Table 5.2A.3.1.1.3.1-1: Test point selection table

|  |  |  |
| --- | --- | --- |
| Test number | CA duplex mode | Minimum performance requirements |
| 1 | FDD 15 kHz + FDD 15 kHz | As defined in Table 5.2A.3.1.0-1 |
| 2 | TDD 30 kHz + TDD 30 kHz | As defined in Table 5.2A.3.1.0-3 |
| 3 | FDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.3.1.0-1 and Table 5.2A.3.1.0-3 per CC |
| 4 (note 2) | FDD 15 kHz + TDD 15 kHz | As defined in Table 5.2A.3.1.0-1 and Table 5.2A.3.1.0-2 per CC |
| 5 (note 3) | TDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.3.1.0-2 and Table 5.2A.3.1.0-3 per CC |
| Note 1: For each test point, select any one of the CA configurations which contain CA bandwidth combination with the largest aggregated channel bandwidth and supported maximum data rate based on the equation  Note 2: Test point 4 can be skipped if test point 3 is verified.  Note 3: Test point 5 can be skipped if test point 2 is verified. | | |

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.7 for TE diagram and clause A.3.2.6 for UE diagram.

5.2A.3.1.1.3.2 Test procedure

1. Configure SCC according to Annex C.0, C.1 and C.2 for all downlink physical channels.

2. The SS shall configure SCCs as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 5.2 A.3.1.1.3.3.

3. SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [24], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[25], clause9.3).

4. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2A.3.1.0-1 to 5.2A.3.1.0-4 as appropriate on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.

5. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2A.3.1.0-1 to 5.2A.3.1.0-4 as appropriate on both PCC and SCCs.

6. Measure the average throughput on each component carrier simultaneously for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail according to Table G.1.5-1 in Annex G.1.5.

7. Repeat steps from 1 to 6 for each test points in Table 5.2A.3.1.0-4 as appropriate.

5.2A.3.1.1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2A.3.1.1.4 Test Requirement

Tables 5.2A.3.1.1.4-1, 5.2A.3.1.1.4-2 and 5.2A.3.1.1.4-3 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 and A.3.2.2 for each component carrier for throughput test point combination shall meet or exceed the specified value in Table 5.2A.3.1.1.4-1, 5.2A.3.1.1.4-2 and 5.2A.3.1.1.4-3 for the specified SNR including test tolerances for the combination selected following the test rules outlined in 5.1.1.5.2-2.

Table 5.2A.3.1.1.4-1: Test requirements for FDD 15 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-9.1 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.4 |
| 10 | R.PDSCH.1-2.2 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.4 |
| 15 | R.PDSCH.1-9.2 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.5 |
| 20 | R.PDSCH.1-9.3 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.5 |
| 25 | R.PDSCH.1-9.4 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.6 |
| 30 | R.PDSCH.1-9.5 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.5 |
| 40 | R.PDSCH.1-10.1 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.6 |
| 50 | R.PDSCH.1-10.2 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.8 |

Table 5.2A.3.1.1.4-2: Test requirements for TDD 15 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-2.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.4 |
| 10 | R.PDSCH.1-2.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.5 |
| 15 | R.PDSCH.1-2.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.6 |
| 20 | R.PDSCH.1-2.4 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.5 |
| 25 | R.PDSCH.1-2.5 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.7 |
| 30 | R.PDSCH.1-3.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.5 |
| 40 | R.PDSCH.1-3.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.7 |
| 50 | R.PDSCH.1-3.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.9 |

Table 5.2A.3.1.1.4-3: Test requirements for TDD 30 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.2-13.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.4 |
| 10 | R.PDSCH.2-13.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.4 |
| 15 | R.PDSCH.2-13.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.4 |
| 20 | R.PDSCH.2-13.4 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.5 |
| 25 | R.PDSCH.2-13.5 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.5 |
| 30 | R.PDSCH.2-14.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.5 |
| 40 | R.PDSCH.2-2.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.6 |
| 50 | R.PDSCH.2-14.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.8 |
| 60 | R.PDSCH.2-14.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.7 |
| 80 | R.PDSCH.2-14.4 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 10.0 |
| 90 | R.PDSCH.2-14.5 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.9 |
| 100 | R.PDSCH.2-15.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 10.2 |

##### 5.2A.3.1.2 4Rx Normal PDSCH Demodulation Performance for CA (3DL CA)

5.2A.3.1.2.1 Test Purpose

Same as 5.2A.3.1.1.1

5.2A.3.1.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 3DL CA and 4Rx antenna ports on each CC.

5.2A.3.1.2.3 Test description

5.2A.3.1.2.3.1 Initial conditions

Same as 5.2A.3.1.1.3.1

5.2A.3.1.2.3.2 Test procedure

1. Configure SCC according to Annex C.0, C.1 and C.2 for all downlink physical channels.

2. The SS shall configure SCCs as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 5.2 A.3.1.2.3.3.

3. SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [24], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[25], clause9.3).

4. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2A.3.1.0-1 to 5.2A.3.1.0-4 as appropriate on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.

5. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2A.3.1.0-1 to 5.2A.3.1.0-4 as appropriate on both PCC and SCCs.

6. Measure the average throughput on each component carrier simultaneously for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail according to Table G.1.5-1 in Annex G.1.5.

7. Repeat steps from 1 to 6 for each test points in Table 5.2A.3.1.0-4 as appropriate.

5.2A.3.1.2.3.3 Message contents

Same as 5.2A.3.1.1.3.3

5.2A.3.1.2.4 Test Requirement

Same as 5.2A.3.1.1.4 evaluated per component carrier.

##### 5.2A.3.1.3 4Rx Normal PDSCH Demodulation Performance for CA (4DL CA)

5.2A.3.1.3.1 Test Purpose

Same as 5.2A.3.1.1.1

5.2A.3.1.3.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4DL CA and 4Rx antenna ports on each CC.

5.2A.3.1.3.3 Test description

5.2A.3.1.3.3.1 Initial conditions

Same as 5.2A.3.1.1.3.1

5.2A.3.1.3.3.2 Test procedure

1. Configure SCC according to Annex C.0, C.1 and C.2 for all downlink physical channels.

2. The SS shall configure SCCs as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 5.2 A.3.1.3.3.3.

3. SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [24], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[25], clause9.3).

4. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2A.3.1.0-1 to 5.2A.3.1.0-4 as appropriate on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.

5. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2A.3.1.0-1 to 5.2A.3.1.0-4 as appropriate on both PCC and SCCs.

6. Measure the average throughput on each component carrier simultaneously for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail according to Table G.1.5-1 in Annex G.1.5.

7. Repeat steps from 1 to 6 for each test points in Table 5.2A.3.1.0-4 as appropriate.

5.2A.3.1.3.3.3 Message contents

Same as 5.2A.3.1.1.3.3

5.2A.3.1.3.4 Test Requirement

Same as 5.2A.3.1.1.3.4 evaluated per component carrier.

#### 5.2A.3.2 Requirements for 4RX PDSCH carrier aggregation with power imbalance

##### 5.2A.3.2.0 Minimum requirements for carrier aggregation with power imbalance

The performance requirements are specified in Table 5.2A.3.2.0-3 and Table 5.2A.3.2.0-4, with the addition of test parameters in Table 5.2A.3.2.0-2 and the downlink physical channel setup according to Annex C.2.1.

The test purposes are specified in Table 5.2A.3.2.0-1.

Table 5.2A.3.2.0-1: Tests purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify the ability of an intra-band adjacent carrier aggregation UE to demodulate the signal transmitted by the PCell or SCell in the presence of a stronger SCell or PCell signal on an adjacent frequency. Throughput is measured on the PCell or SCell only |  |

Table 5.2A.3.2.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD and TDD |
| Active DL BWP index | |  | 1 |
| Propagation condition | |  | Static propagation condition  No external noise sources are applied |
| Antenna configuration | |  | 1x4 |
| PDSCH configuration | Length (L) |  | FDD: 12TDD: 12 for DL slot, 4 for special slot |
| PRB bundling size |  | WB |
| Modulation and code rate | |  | 64QAM, MCS 27 |
| Number of HARQ Processes | |  | FDD: 4  TDD: 8 |
| Maximum number of HARQ transmission | |  | 1 |
| Redundancy version coding sequence | |  | {0} |
| TDD UL-DL pattern | |  | 30kHz SCS: FR1.30-1 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | As defined in Table A.1.2-2 for FR1.30-1 |
| PUCCH format for HARQ-ACK feedback | |  | PUCCH format 1 |
| Overhead for TBS determination | |  | 0 |
| SSB transmission | |  | Slot#0 with periodicity 20ms |
| RB assignment | |  | Full applicable test bandwidth as defined in Table 5.3.5-1 of TS 38.101-1 [2] |

Table 5.2A.3.2.0-3: Minimum performance for FDD CA with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Bandwidth (MHz) | | Reference channel | | Power at antenna port (dBm/Hz) | | Reference value  Fraction of Maximum  Throughput (%) | |
| PCell | SCell | PCell | SCell | for PCell | for Scell | PCell | SCell |
| 1 | Selected Channel bandwidth as per section 5.1.1.6 | | Derived as per section 5.1.3.2 of TS 38.214 [12] | NA | -112 | -106 | 85 | NA |

Table 5.2A.3.2.0-4: Minimum performance for TDD CA with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Bandwidth (MHz) | | Reference channel | | Power at antenna port (dBm/Hz) | | Reference value  Fraction of Maximum  Throughput (%) | |
| PCell | SCell | PCell | SCell | for PCell | for Scell | PCell | SCell |
| 1 | Selected Channel bandwidth as per section 5.1.1.6 | | Derived as per section 5.1.3.2 of TS 38.214 [12] | NA | -112 | -106 | 85 | NA |

The normative reference for this requirement is TS 38.101-4 [5], clause 5.2A.3.2.

##### 5.2A.3.2.1 4Rx PDSCH Demodulation Performance for CA with power imbalance (2DL CA)

5.2A.3.2.1.1 Test Purpose

To verify the ability of an intra-band adjacent carrier aggregation UE to demodulate the signal transmitted by the PCell or SCell in the presence of a stronger SCell or PCell signal on an adjacent frequency. Throughput is measured on the PCell or SCell only.

5.2A.3.2.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 2DL intra-band contiguous CA and 4Rx antenna ports.

5.2A.3.2.1.3 Test description

5.2A.3.2.1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 4.3.1.1.

Band selection: Supported intra-band contiguous CA configurations covering the lowest and highest operating bands,

Channel BW combination to be tested: Select bandwidth combination with same bandwidth in each carrier. If not supported, select bandwidth combination with smallest bandwidth difference between the two carriers and the carrier with smaller bandwidth will be used for the test.

CA capability to be tested: Either FDD or TDD intra-band contiguous CA

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.2A for TE diagram and clause A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2A-1 to Table 5.2A-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2A.3.2.1.3.3.

5.2A.3.2.1.3.2 Test procedure

Same test procedure as specified in clause 5.2A.2.2.1.3.2 with the following exception.

Instead of Table 5.2A.2.2.1.3.3 🡪 5.2A.3.2.1.3.3

Instead of Table 5.2A.2.2.0-2 🡪 5.2A.3.2.0-2

Instead of Table 5.2A.2.2.0-4 🡪 5.2A.3.2.0-4

5.2A.3.2.1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2A.3.2.1.4 Test Requirement

Table 5.2A.3.2.0-2, Table 5.2A.3.2.1.4-1 and Table 5.2A.3.2.1.4-2 define the primary level settings.

The fraction of maximum throughput percentage for the MCS scheduled as specified in Table 5.2A.3.2.0-2 for the throughput test shall meet or exceed the specified value in Table 5.2A.3.2.1.4-1 or Table 5.2A.3.2.1.4-2 as applicable for the specified cell power levels.

Table 5.2A.3.2.1.4-1: Test Requirements for FDD CA with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Bandwidth (MHz) | | Reference channel | | Power at antenna port (dBm/Hz) | | Reference value  Fraction of Maximum  Throughput (%) | |
| PCell | SCell | PCell | SCell | for PCell | for Scell | PCell | SCell |
| 1 | Selected Channel bandwidth as per section 5.1.1.6 | | Derived as per section 5.1.3.2 of TS 38.214 [12] | NA | -112 | -106 | 85 | NA |

Table 5.2A.3.2.1.4-2: Test Requirements for TDD CA with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Number | Bandwidth (MHz) | | Reference channel | | Power at antenna port (dBm/Hz) | | Reference value  Fraction of Maximum  Throughput (%) | |
| PCell | SCell | PCell | SCell | for PCell | for Scell | PCell | SCell |
| 1 | Selected Channel bandwidth as per section 5.1.1.6 | | Derived as per section 5.1.3.2 of TS 38.214 [12] | NA | -112 | -106 | 85 | NA |

##### 5.2A.3.3 4Rx TDD FR1 PDSCH mapping type A performance of SCell on band with shared spectrum access

Editor’s Note: This test case is incomplete. Following aspects are either missing or TBD

- period-r16 IE is FFS in 38.508-1

- Minimum test time analysis FFS

5.2A.3.3.0 Minimum conformance requirements

The performance requirements for SCell on band with shared spectrum access are specified in Table 5.2.3.2.15.0-3, with the additional test parameters for SCell in Table 5.2.3.2.15.0-2, and the test parameters for PCell are specified in Table 5.2A.3.3.0-2 and the downlink physical channel setup according to Annex C.2.1.

Table 5.2A.3.3.0-1: Tests purpose

|  |  |
| --- | --- |
| **Purpose** | **Test index** |
| Verify the PDSCH performance of SCell for UE supporting operations in shared spectrum access | 1-1, 1-2, 1-3, 1-4 |

Table 5.2A.3.3.0-2: Test parameters for PCell

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Bandwidth | | MHz | 20 |
| Subcarrier spacing | | kHz | 30 |
| Active DL BWP index | |  | 1 |
| TDD pattern | |  | FR1.30-1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 12 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Dmrs-AdditionalPosition |  | pos1 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Number of HARQ Processes | |  | 8 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.2 |

5.2A.3.3.1 Test purpose

To verify the PDSCH mapping Type A performance under 4 receive antenna conditions for SCell on a band with shared spectrum access and with different channel bandwidth, for a specific fading channel model for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput.

During the test, only the PDSCH performance of the SCell shall be verified.

5.2A.3.3.2 Test applicability

This test applies to all types of UE release 16 and forward supporting NR/5GC and NR-U 2DLCA and supporting UL on shared channel access.

This test also applies to all types of UE release 16 and forward supporting EN-DC and NR-U 2DLCA and supporting UL on shared channel access.

5.2A.3.3.3 Test description

5.2A.3.3.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1 and Table 5.2A.3.3.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for NR/5GC with *Connected without Release On, Test Mode* On or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On for EN-DC according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2A.3.3.3.3.

5.2A.3.3.3.2 Test procedure

1. Configure SCell according to Annex C.0, C.1 and C.2 for all downlink physical channels.

2. The SS shall configure SCell as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 5.2A.3.1.1.3.3.

3. SS activates SCell by sending the activation MAC-CE (Refer TS 38.321 [24], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[25], clause9.3).

4. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.2.3.2.15.0-3 on SCell. The SS sends downlink MAC padding bits on the DL RMC.

5. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 5.2.3.2.15.0-3 on SCell.

6. Measure the average throughput on SCell for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail according to Table G.1.5-1 in Annex G.1.5.

7. Repeat steps from 1 to 6 for each test point in Table 5.2.3.2.15.0-3 as appropriate.

5.2A.3.3.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2A.3.3.3.3\_1 Message exceptions for NR/5GC

Same as in Clause 5.2.2.2.15\_1.3.3\_1

5.2A.3.3.3.3\_2 Message exceptions for EN-DC

Same as in Clause 5.2.2.2.15\_1.3.3\_2

5.2A.3.3.3.4 Test requirement

Table 5.2.3.2.15.3.4-1 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 for each throughput test shall meet or exceed the specified value in Table 5.2.3.2.15.3.4-1 for the specified SNR including test tolerances for all throughput tests.

#### 5.2A.3.4 Requirements for 4RX HST-SFN CA PDSCH

##### 5.2A.3.4.0 Minimum conformance requirements for 4RX HST-SFN CA PDSCH

For HST-SFN CA with different numbers of DL component carriers, the requirements are defined in Table 5.2A.3.4.0-5 based on the single carrier requirements for different SCSs and different bandwidth specified in Table 5.2A.3.4.0-3 and Table 5.2A.3.4.0-4, with the parameters in Table 5.2A.3.4.0-2, Table 5.2A-2, Table 5.2A-3, and the downlink physical channel setup according to Annex C.2.1. The performance requirements specified in this sub-clause do not apply for UE single carrier test.

The test purpose is specified in Table 5.2A.3.4.0-1.

Table 5.2A.3.4.0-1: Test purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH performance under 4 receive antenna conditions in the HST-SFN scenario defined in B.3.2 with CA | 1, 2, 3 |

Table 5.2A.3.4.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD and TDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
|  | k0 |  | 0 |
|  | Starting symbol (S) |  | 2 |
|  | Length (L) |  | 12 |
|  | PDSCH aggregation factor |  | 1 |
|  | PRB bundling type |  | Static |
|  | PRB bundling size |  | 2 |
|  | Resource allocation type |  | Type 0 |
|  | RBG size |  | Config2 |
|  | VRB-to-PRB mapping type |  | Non-interleaved |
|  | VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
|  | Number of additional DMRS |  | 2 |
|  | Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| CSI-RS for tracking | CSI-RS periodicity | Slots | FDD: 10 for CSI-RS resource 1,2,3,4.  TDD: 20 for CSI-RS resource 1,2,3,4. |
|  | CSI-RS offset | Slots | 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4. |
| Number of HARQ Processes | |  | As defined in Table 5.2A-2 |
| TDD UL-DL pattern | |  | 15 kHz SCS: FR1.15-1  30 kHz SCS: FR1.30-1 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | As defined in Table 5.2A-3 |
| Number of PUCCH ResourceGroups | |  | 1 |
| PUCCH format for HARQ-ACK feedback | |  | PUCCH format 1 for cases with no more than 2 DL CCs  PUCCH format 3 for cases with more than 2 DL CCs |

Table 5.2A.3.4.0-3: Single carrier performance for FDD 15 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-13.1 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 10.5 |
| 10 | R.PDSCH.1-8.3 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 10.7 |
| 15 | R.PDSCH.1-13.2 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.1 |
| 20 | R.PDSCH.1-13.3 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.5 |
| 25 | R.PDSCH.1-13.4 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.6 |
| 30 | R.PDSCH.1-13.5 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.8 |
| 35 | R.PDSCH.1-14.3 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.7 |
| 40 | R.PDSCH.1-14.1 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.9 |
| 45 | R.PDSCH.1-14.4 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.7 |
| 50 | R.PDSCH.1-14.2 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.9 |

Table 5.2A.3.4.0-4: Single carrier performance for TDD 30 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.2-19.1 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.0 |
| 10 | R.PDSCH.2-19.2 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.8 |
| 15 | R.PDSCH.2-19.3 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.1 |
| 20 | R.PDSCH.2-19.4 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.8 |
| 25 | R.PDSCH.2-19.5 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.9 |
| 30 | R.PDSCH.2-20.1 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.2 |
| 40 | R.PDSCH.2-10.4 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.4 |
| 50 | R.PDSCH.2-20.2 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.6 |
| 60 | R.PDSCH.2-20.3 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.5 |
| 80 | R.PDSCH.2-20.4 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.7 |
| 90 | R.PDSCH.2-20.5 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.7 |
| 100 | R.PDSCH.2-21.1 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.7 |

Table 5.2A.3.4.0-5: Minimum performance for multiple CA configurations

|  |  |  |
| --- | --- | --- |
| Test number | CA duplex mode | Minimum performance requirements |
| 1 | FDD 15 kHz + FDD 15 kHz | As defined in Table 5.2A.3.4.0-3 |
| 2 | TDD 30 kHz + TDD 30 kHz | As defined in Table 5.2A.3.4.0-4 |
| 3 | FDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.3.4.0-3 and Table 5.2A.3.4.0-4 per CC |
| Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in Section 5.1.1.7. | | |

The normative reference for this requirement is TS38.101-4 [5], clause 5.2A.3.4.

##### 5.2A.3.4.1 4RX PDSCH Demodulation Performance for HST-SFN CA

5.2A.3.4.1.1 Test Purpose

Verify PDSCH performance under 4 receive antenna conditions in the HST-SFN scenario defined in B.3.2 with CA.

5.2A.3.4.1.2 Test applicability

This test applies to all types of NR UE release 16 and forward that supports enhanced demodulation processing for carrier aggregation for HST-SFN joint transmission scheme and 4Rx antenna ports.

5.2A.3.4.1.3 Test description

5.2A.3.4.1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

Channel BW to be tested: largest aggregated bandwidth combination as per Table 5.1.1.5.2-2.

CA capability to be tested: As per table 5.1.1.5.2-1

Table 5.2A.3.4.1.3.1-1: Test point selection table

|  |  |  |
| --- | --- | --- |
| Test number | CA duplex mode | Minimum performance requirements |
| 1 | FDD 15 kHz + FDD 15 kHz | As defined in Table 5.2A.3.4.0-3 |
| 2 | TDD 30 kHz + TDD 30 kHz | As defined in Table 5.2A.3.4.0-4 |
| 3 | FDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.3.4.0-3 and Table 5.2A.3.4.0-4 per CC |
| Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in Section 5.1.1.7. | | |

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2A-1 to Table 5.2A-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.3.2.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2A.3.4.1.3.3.

5.2A.3.4.1.3.2 Test procedure

1. Configure SCC according to Annex C.0, C.1 and C.2 for all downlink physical channels.

2. The SS shall configure SCC as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 5.2A.3.4.1.3.3.

3. SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[19], clause 9.3).

4. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2A.3.4.0-2 to 5.2A.3.4.0-5 as appropriate on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.

5. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to 5.2A.3.4.1.3.4-1 and 5.2A.3.4.1.3.4-2 as appropriate on both PCC and SCC.

6. Measure the average throughput on each component carrier simultaneously for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail according to Table G.1.5-1 in Annex G.1.5.

7. Repeat steps from 1 to 6 for each test points in Table 5.2A.3.4.1.3.1-1 as appropriate.

5.2A.3.4.1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2 with the following exceptions:

Table 5.2A.3.4.1.3.3-1: DMRS-DownlinkConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24 | | | |
| Information Element | Value/remark | Comment | Condition |
| DMRS-DownlinkConfig ::= SEQUENCE { |  |  |  |
| dmrs-AdditionalPosition | Not present |  |  |
| } |  |  |  |

Table 5.2A.3.4.1.3.3-2: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | n8 |  |  |
| } |  |  |  |

Table 5.2A.3.4.1.3.3-3: CSI-ResourcePeriodicityAndOffset for CSI Tracking

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots10 | 1 for CSI-RS resource #1 and #2  2 for CSI-RS resource #3 and #4 | periodicity:  10 slots for resource 1,2,3,4.  offset = 1 for CSI-RS resource 1 and 2  offset =2 for CSI-RS resource 3 and 4. | SCS 15 kHz |
| slots20 | 1 for CSI-RS resource #1 and #2  2 for CSI-RS resource #3 and #4 | periodicity:  20 slots for resource 1,2,3,4.  offset = 1 for CSI-RS resource 1 and 2  offset =2 for CSI-RS resource 3 and 4. | SCS 30 kHz |
| } |  |  |  |

5.2A.3.4.1.3.4 Test Requirement

Tables 5.2A.3.4.1.3.4-1 and 5.2A.3.4.1.3.4-2 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 and A.3.2.2 for each component carrier for throughput test point combination shall meet or exceed the specified value in Table 5.2A.3.4.1.3.4-1 and 5.2A.3.4.1.3.4-2 for the specified SNR including test tolerances for the test points listed in Table 5.2A.3.4.1.3.1-1.

Table 5.2A.3.4.1.3.4-1: Test requirements for single carrier performance for FDD 15 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-13.1 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.1 |
| 10 | R.PDSCH.1-8.3 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.3 |
| 15 | R.PDSCH.1-13.2 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 11.7 |
| 20 | R.PDSCH.1-13.3 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.1 |
| 25 | R.PDSCH.1-13.4 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.2 |
| 30 | R.PDSCH.1-13.5 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.4 |
| 35 | R.PDSCH.1-14.3 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.3 |
| 40 | R.PDSCH.1-14.1 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.5 |
| 45 | R.PDSCH.1-14.4 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.3 |
| 50 | R.PDSCH.1-14.2 FDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.5 |

Table 5.2A.3.4.1.3.4-2: Test requirements for single carrier performance for TDD 30 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.2-19.1 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.6 |
| 10 | R.PDSCH.2-19.2 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.4 |
| 15 | R.PDSCH.2-19.3 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.7 |
| 20 | R.PDSCH.2-19.4 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.4 |
| 25 | R.PDSCH.2-19.5 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.5 |
| 30 | R.PDSCH.2-20.1 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 12.8 |
| 40 | R.PDSCH.2-10.4 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 13.0 |
| 50 | R.PDSCH.2-20.2 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 13.2 |
| 60 | R.PDSCH.2-20.3 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 13.1 |
| 80 | R.PDSCH.2-20.4 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 13.3 |
| 90 | R.PDSCH.2-20.5 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 13.3 |
| 100 | R.PDSCH.2-21.1 TDD | 16QAM, 0.48 | HST-SFN | 2x4 | 70 | 13.3 |

#### 5.2A.3.5 Requirements for 4RX HST-DPS CA PDSCH

##### 5.2A.3.5.0 Minimum conformance requirements for 4RX HST-DPS CA PDSCH

For HST-DPS CA with different numbers of DL component carriers, the requirements are defined in Table 5.2A.3.5.0-7 and Table 5.2A.3.5.0-8 based on the single carrier requirements for different SCSs and different bandwidth specified in Table 5.2A.3.5.0-3 to Table 5.2A.3.5.0-6, with the parameters in Table 5.2A.3.5.0-2, Table 5.2A-2 and Table 5.2A-3 and the downlink physical channel setup according to Annex C.2.1. The performance requirements specified in this sub-clause do not apply for UE single carrier test.

The test purpose is specified in Table 5.2A.3.5.0-1.

Table 5.2A.3.5.0-1: Test purpose

|  |  |
| --- | --- |
| Purpose | Test index |
| Verify PDSCH performance of UE under 4 receive antenna conditions in the HST-DPS scenario defined in B.3.3 with CA with 1 active TCI state | 1-1, 1-2, 1-3 |
| Verify PDSCH performance of UE under 4 receive antenna conditions in the HST-DPS scenario defined in B.3.3 with CA with 2 active TCI states | 2-1, 2-2, 2-3 |

Table 5.2A.3.5.0-2: Test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Value |
| Duplex mode | | |  | FDD and TDD |
| Active DL BWP index | | |  | 1 |
| PDCCH configuration | TCI state | |  | Note 1 |
| PDSCH configuration | Mapping type | |  | Type A |
| k0 | |  | 0 |
| Starting symbol (S) | |  | 2 |
| Length (L) | |  | FDD: 12  TDD: Specific to each Reference channel |
| PDSCH aggregation factor | |  | 1 |
| PRB bundling type | |  | Static |
| PRB bundling size | |  | 2 |
| Resource allocation type | |  | Type 0 |
| RBG size | |  | Config2 |
| VRB-to-PRB mapping type | |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size | |  | N/A |
| TCI state | |  | Note 1 |
| PDSCH DMRS configuration | DMRS Type | |  | Type 1 |
| Number of additional DMRS | |  | 2 |
| Maximum number of OFDM symbols for DL front loaded DMRS | |  | 1 |
| CSI-RS for tracking | Resource set #1 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 5 for CSI-RS resource 1 and 3  l0 = 9 for CSI-RS resource 2 and 4 |
| CSI-RS periodicity | Slots | 15kHz SCS: 10 for CSI-RS resource 1,2,3,4.  30kHz SCS: 20 for CSI-RS resource 1,2,3,4 |
| CSI-RS offset | Slots | 1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4 |
| QCL info |  | TCI state #2 |
| Frequency Occupation |  | Start PRB 0  Number of PRB = min(52, ceil(BWP size/4)\*4) |
| Resource set #2 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 6 for CSI-RS resource 5 and 6  l0 = 10 for CSI-RS resource 7 and 8 |
| CSI-RS periodicity | Slots | 15kHz SCS: 10 for CSI-RS resource 5,6,7,8.  30kHz SCS: 20 for CSI-RS resource 5,6,7,8. |
| CSI-RS offset | Slots | 1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8 |
| QCL info |  | TCI state #3 |
| Frequency Occupation |  | Start PRB 0  Number of PRB = min(52, ceil(BWP size/4)\*4) |
| NZP CSI-RS for CSI acquisition | Resource set #3 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 12 |
| CSI-RS periodicity | Slots | 15kHz SCS:20  30kHz SCS: 40 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #0 |
| Resource set #4 | First OFDM symbol in the PRB used for CSI-RS |  | l0 = 13 |
| CSI-RS periodicity | Slots | 15kHz SCS:20  30kHz SCS: 40 |
| CSI-RS offset | Slots | 0 |
| QCL info |  | TCI state #1 |
| TCI state #0 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking Resource set #1' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| TCI state #2 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #3 | Type 1 QCL information | SSB index |  | SSB #1 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| Number of HARQ Processes | | |  | As defined in Table 5.2A-2 |
| TDD UL-DL pattern | | |  | 15kHz SCS: FR1.15-1  30kHz SCS: FR1.30-1 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | |  | As defined in Table 5.2A-3 |
| Number of PUCCH ResourceGroups | | |  | 1 |
| PUCCH format for HARQ-ACK feedback | | |  | PUCCH format 1 for cases with no more than 2 DL CCs  PUCCH format 3 for cases with more than 2 DL CCs |
| Note 1: SSB # (k mod 2), CSI-RS (for tracking) resource set # ((k mod 2) + 1) and CSI-RS (for CSI acquisition) resource set # ((k mod 2) + 3) are transmitted by kth RRH.  For Test 1-1, TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy. PDCCH and PDSCH associated with TCI # (k mod 2) is transmitted by kth RRH from slot#  to slot#  ,  PDCCH and PDSCH are DTXed in other slots in which throughput statistics are not considered.  For Test 1-2, TCI state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy. PDCCH and PDSCH associated with TCI # (k mod 2) is transmitted by kth RRH from slot#  to slot#  Where k=0, 1, 2… is the RRH number, n = 2520 is half of the number of slots between two RRH, = 2 is the number of slots between PDSCH and corresponding HARQ-ACK information, = 3 is the number of slots for MAC CE processing, = 6 is the number of slots to first TRS transmission occasion after MAC CE command is decoded by the UE, = 2 is the number of slots for TRS processing. | | | | |

Table 5.2A.3.5.0-3: Single carrier performance for FDD 15 kHz SCS for HST-DPS CA configurations with 1 active PDSCH TCI state

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Number of active PDSCH TCI states | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-15.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 10.5 |
| 10 | R.PDSCH.1-8.4 FDD | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 10.8 |
| 15 | R.PDSCH.1-15.2 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 10.7 |
| 20 | R.PDSCH.1-15.3 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 10.5 |
| 25 | R.PDSCH.1-15.4 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 10.8 |
| 30 | R.PDSCH.1-15.5 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 10.9 |
| 35 | R.PDSCH.1-16.3 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 10.6 |
| 40 | R.PDSCH.1-16.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 10.7 |
| 45 | R.PDSCH.1-16.4 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 10.6 |
| 50 | R.PDSCH.1-16.2 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 11.0 |

Table 5.2A.3.5.0-4: Single carrier performance for FDD 15 kHz SCS for HST-DPS CA configurations with 2 active PDSCH TCI states

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | | Propagation condition | Number of active PDSCH TCI states | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-15.1 | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | 10.5 |
| 10 | R.PDSCH.1-8.4 FDD | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | 10.8 |
| 15 | R.PDSCH.1-15.2 | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | 10.7 |
| 20 | R.PDSCH.1-15.3 | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | 10.5 |
| 25 | R.PDSCH.1-15.4 | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | 10.8 |
| 30 | R.PDSCH.1-15.5 | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | 10.9 |
| 35 | R.PDSCH.1-16.3 | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | 10.6 |
| 40 | R.PDSCH.1-16.1 | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | 10.7 |
| 45 | R.PDSCH.1-16.4 | | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 10.6 |
| 50 | R.PDSCH.1-16.2 | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | 11.0 |

Table 5.2A.3.5.0-5 Single carrier performance for TDD 30 kHz SCS for HST-DPS CA configurations with 1 active PDSCH TCI state

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Number of active PDSCH TCI states | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.2-22.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 10.4 |
| 10 | R.PDSCH.2-22.2 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 10.5 |
| 15 | R.PDSCH.2-22.3 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 10.5 |
| 20 | R.PDSCH.2-22.4 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 10.5 |
| 25 | R.PDSCH.2-22.5 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 10.6 |
| 30 | R.PDSCH.2-23.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 10.5 |
| 40 | R.PDSCH.2-10.5 TDD | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 10.5 |
| 50 | R.PDSCH.2-23.2 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 10.7 |
| 60 | R.PDSCH.2-23.3 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 10.7 |
| 80 | R.PDSCH.2-23.4 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 10.5 |
| 90 | R.PDSCH.2-23.5 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 10.7 |
| 100 | R.PDSCH.2-24.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 10.7 |

Table 5.2A.3.5.0-6 Single carrier performance for TDD 30 kHz SCS for HST-DPS CA configurations with 2 active PDSCH TCI states

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Number of active PDSCH TCI states | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.2-22.1 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 10.4 |
| 10 | R.PDSCH.2-22.2 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 10.5 |
| 15 | R.PDSCH.2-22.3 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 10.5 |
| 20 | R.PDSCH.2-22.4 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 10.5 |
| 25 | R.PDSCH.2-22.5 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 10.6 |
| 30 | R.PDSCH.2-23.1 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 10.5 |
| 40 | R.PDSCH.2-10.5 TDD | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 10.5 |
| 50 | R.PDSCH.2-23.2 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 10.7 |
| 60 | R.PDSCH.2-23.3 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 10.7 |
| 80 | R.PDSCH.2-23.4 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 10.5 |
| 90 | R.PDSCH.2-23.5 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 10.7 |
| 100 | R.PDSCH.2-24.1 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 10.7 |

Table 5.2A.3.5.0-7: Minimum performance for multiple CA configurations for HST-DPS with 1 active TCI state

|  |  |  |
| --- | --- | --- |
| Test number | CA duplex mode | Minimum performance requirements |
| 1-1 | FDD 15 kHz + FDD 15 kHz | As defined in Table 5.2A.3.5.0-3 |
| 1-2 | TDD 30 kHz + TDD 30 kHz | As defined in Table 5.2A.3.5.0-5 |
| 1-3 | FDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.3.5.0-3 and Table 5.2A.3.5.0-5 per CC |
| Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 5.1.1.7. | | |

Table 5.2A.3.5.0-8: Minimum performance for multiple CA configurations for HST-DPS with 2 active TCI states

|  |  |  |
| --- | --- | --- |
| Test number | CA duplex mode | Minimum performance requirements |
| 2-1 | FDD 15 kHz + FDD 15 kHz | As defined in Table 5.2A.3.5.0-4 |
| 2-1 | TDD 30 kHz + TDD 30 kHz | As defined in Table 5.2A.3.5.0-6 |
| 2-3 | FDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.3.5.0-4 and Table 5.2A.3.5.0-6 per CC |
| Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 5.1.1.7. | | |

The normative reference for this requirement is TS38.101-4 [5], clause 5.2A.3.5.

##### 5.2A.3.5.1 4RX PDSCH Demodulation Performance for HST-DPS CA

5.2A.3.5.1.1 Test Purpose

To verify the PDSCH mapping Type A normal performance under 4 receive antenna conditions in the HST-DPS scenario for multiple CA configurations and with different channel models, MCSs and SCS for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput per CC.

5.2A.3.5.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 2DL CA and 4Rx antenna ports.

5.2A.3.5.1.3 Test description

5.2A.3.5.1.3.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

Channel BW to be tested: largest aggregated bandwidth combination as per Table 5.1.1.5.2-2.

CA capability to be tested: As per table 5.1.1.5.2-1.

Table 5.2A.3.5.1.3.1-1: Test point selection table for multiple CA configurations for HST-DPS with 1 active TCI state

|  |  |  |
| --- | --- | --- |
| Test number | CA duplex mode | Minimum performance requirements |
| 1-1 | FDD 15 kHz + FDD 15 kHz | As defined in Table 5.2A.3.5.0-3 |
| 1-2 | TDD 30 kHz + TDD 30 kHz | As defined in Table 5.2A.3.5.0-5 |
| 1-3 | FDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.3.5.0-3 and Table 5.2A.3.5.0-5 per CC |
| Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 5.1.1.7. | | |

Table 5.2A.3.5.1.3.1-2: Test point selection table for multiple CA configurations for HST-DPS with 2 active TCI states

|  |  |  |
| --- | --- | --- |
| Test number | CA duplex mode | Minimum performance requirements |
| 2-1 | FDD 15 kHz + FDD 15 kHz | As defined in Table 5.2A.3.5.0-4 |
| 2-1 | TDD 30 kHz + TDD 30 kHz | As defined in Table 5.2A.3.5.0-6 |
| 2-3 | FDD 15 kHz + TDD 30 kHz | As defined in Table 5.2A.3.5.0-4 and Table 5.2A.3.5.0-6 per CC |
| Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 5.1.1.7. | | |

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and clause A.3.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.2-1, Table 5.2A-1 to Table 5.2A-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.3.3.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode* On according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2A.3.5.1.3.3.

5.2A.3.5.1.3.2 Test procedure

1. Configure SCC according to Annex C.0, C.1 and C.2 for all downlink physical channels.

2. The SS shall configure SCC as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 5.2A.3.5.1.3.3.

3. SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[19], clause 9.3).

4. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 5.2A.3.5.0-2 to 5.2A.3.5.0-8 as appropriate on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.

5. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 5.2A.3.5.1.3.4-1 to 5.2A.3.5.1.3.4-4 as appropriate on both PCC and SCC.

6. Measure the average throughput on each component carrier simultaneously for a duration sufficient to achieve statistical significance according to Annex G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL and decide pass or fail according to Table G.1.5-1 in Annex G.1.5.

7. Repeat steps from 1 to 6 for each test points in Table 5.2A.3.5.1.3.1-1 and Table 5.2A.3.5.1.3.1-2 as appropriate.

5.2A.3.5.1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2 with the following exceptions:

Table 5.2A.3.5.1.3.3-1: DMRS-DownlinkConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-24 | | | |
| Information Element | Value/remark | Comment | Condition |
| DMRS-DownlinkConfig ::= SEQUENCE { |  |  |  |
| dmrs-AdditionalPosition | Not present |  |  |
| } |  |  |  |

Table 5.2A.3.5.1.3.3-2: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | n8 |  |  |
| } |  |  |  |

Table 5.2A.3.5.1.3.3-3: NZP-CSI-RS-Resource for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| nzp-CSI-RS-ResourceId | i-1 for CSI-RS resource #i, i=1,2,3,4,5,6,7,8 |  |  |
| qcl-InfoPeriodicCSI-RS | 2 for CSI-RS resource #1, #2, #3, #4  3 for CSI-RS resource #5, #6, #7, #8 | TCI-StateId for TCI-State #2 for CSI-RS resource #1, #2, #3, #4  TCI-StateId for TCI-State #3 for CSI-RS resource #5, #6, #7, #8 |  |
| } |  |  |  |

Table 5.2A.3.5.1.3.3-4: CSI-RS-ResourceMapping for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-9 with condition TRS | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 5 for CSI-RS resource #1 and #3  9 for CSI-RS resource #2 and #4  6 for CSI-RS resource #5 and #6  10 for CSI-RS resource #7 and #8 | l0 = 5 for CSI-RS resource 1 and 3  l0 = 9 for CSI-RS resource 2 and 4  l0 = 6 for CSI-RS resource 5 and 6  l0 = 10 for CSI-RS resource 7 and 8 |  |
| } |  |  |  |

Table 5.2A.3.5.1.3.3-5: CSI-ResourcePeriodicityAndOffset for CSI Tracking

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots10 | 1 for CSI-RS resource #1, #2, #5, #6  2 for CSI-RS resource #3 #4, #7, #8 | periodicity:  10 slots.  offset:  1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4  1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8 | SCS 15kHz |
| Slots20 | 1 for CSI-RS resource #1, #2, #5, #6  2 for CSI-RS resource #3 #4, #7, #8 | periodicity:  20 slots.  offset:  1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4  1 for CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8 | SCS 30kHz |
| } |  |  |  |

Table 5.2A.3.5.1.3.3-6: NZP-CSI-RS-ResourceSet for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-12 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-ResourceSet ::= SEQUENCE { |  |  |  |
| nzp\_CSI\_ResourceSetId | 0 for Resource set #1  1 for Resource set #2 |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 4 entries |  | Resource set #1 |
| NZP-CSI-RS-ResourceId[1] | 0 | entry 1  CSI-RS resource #1 |  |
| NZP-CSI-RS-ResourceId[2] | 1 | entry 2  CSI-RS resource #2 |  |
| NZP-CSI-RS-ResourceId[3] | 2 | entry 3  CSI-RS resource #3 |  |
| NZP-CSI-RS-ResourceId[4] | 3 | entry 4  CSI-RS resource #4 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 4 entries |  | Resource set #2 |
| NZP-CSI-RS-ResourceId[1] | 4 | entry 1  CSI-RS resource #5 |  |
| NZP-CSI-RS-ResourceId[2] | 5 | entry 2  CSI-RS resource #6 |  |
| NZP-CSI-RS-ResourceId[3] | 6 | entry 3  CSI-RS resource #7 |  |
| NZP-CSI-RS-ResourceId[4] | 7 | entry 4  CSI-RS resource #8 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2A.3.5.1.3.3-7: NZP-CSI-RS-Resource for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-14 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| nzp-CSI-RS-ResourceId | 8 for CSI-RS resource #9  9 for CSI-RS resource #10 |  |  |
| qcl-InfoPeriodicCSI-RS | 0 for CSI-RS resource #9  1 for CSI-RS resource #10 | TCI-State #0 for CSI-RS resource #9  TCI-State #1 for CSI-RS resource #10 |  |
| } |  |  |  |

Table 5.2A.3.5.1.3.3-8: CSI-RS-ResourceMapping for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 12 for CSI-RS resource #9  13 for CSI-RS resource #10 | l0=12 for CSI-RS resource #9  l0=13 for CSI-RS resource #10 |  |
| } |  |  |  |

Table 5.2A.3.5.1.3.3-9: CSI-ResourcePeriodicityAndOffset for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-16 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots20 | 0 | periodicity = 20slots.  offset = 0 slots | SCS 15kHz |
| Slots40 | 0 | periodicity = 40 slots.  offset = 0 slots | SCS 30kHz |
| } |  |  |  |

Table 5.2A.3.5.1.3.3-10: NZP-CSI-RS-ResourceSet for CSI Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-18 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-ResourceSet ::= SEQUENCE { |  |  |  |
| nzp\_CSI\_ResourceSetId | 2 for Resource set #3  3 for Resource set #4 |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry |  | Resource set #3 |
| NZP-CSI-RS-ResourceId[1] | 8 | entry 1  CSI-RS resource #9 |  |
| } |  |  |  |
| nzp-CSI-RS-Resources SEQUENCE (SIZE (1..maxNrofNZP-CSI-RS-ResourcesPerSet)) OF NZP-CSI-RS-ResourceId { | 1 entry |  | Resource set #4 |
| NZP-CSI-RS-ResourceId[1] | 9 | entry 1  CSI-RS resource #10 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.2A.3.5.1.3.3-11: *TCI-State*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-190 | | | |
| Information Element | Value/remark | Comment | Condition |
| TCI-State ::= SEQUENCE { |  |  |  |
| tci-StateId | 0 for TCI state #0  1 for TCI state #1  2 for TCI state #2  3 for TCI state #3 |  |  |
| qcl-Type1 SEQUENCE { |  |  |  |
| bwp-Id | BWP-Id of active BWP |  | TCI state #0, TCI state #1 |
|  | Not present |  | TCI state #2, TCI state #3 |
| referenceSignal CHOICE { |  |  |  |
| csi-rs | 0 | CSI-RS resource #1 | TCI state #0 |
|  | 4 | CSI-RS resource #5 | TCI state #1 |
| ssb | 0 | SSB #0 | TCI state #2 |
|  | 1 | SSB #1 | TCI state #3 |
| } |  |  |  |
| qcl-Type | typeA |  | TCI state #0, TCI state #1 |
|  | typeC |  | TCI state #2, TCI state #3 |
| } |  |  |  |
| } |  |  |  |

5.2A.3.5.1.3.4 Test Requirement

Tables 5.2A.3.5.1.3.4-1 to 5.2A.3.5.1.3.4-4 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 and A.3.2.2 for each component carrier for throughput test point combination shall meet or exceed the specified value in Tables 5.2A.3.5.1.3.4-1 to 5.2A.3.5.1.3.4-4 for the specified SNR including test tolerances for the test points listed in Table 5.2A.3.5.1.3.1-1 and Table 5.2A.3.5.1.3.1-2.

Table 5.2A.3.5.1.3.4-1: Test requirements for single carrier performance for FDD 15 kHz SCS for HST-DPS CA configurations with 1 active PDSCH TCI state

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Number of active PDSCH TCI states | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-15.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 11.1 |
| 10 | R.PDSCH.1-8.4 FDD | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 11.4 |
| 15 | R.PDSCH.1-15.2 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 11.3 |
| 20 | R.PDSCH.1-15.3 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 11.1 |
| 25 | R.PDSCH.1-15.4 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 11.4 |
| 30 | R.PDSCH.1-15.5 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 11.5 |
| 35 | R.PDSCH.1-16.3 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 11.2 |
| 40 | R.PDSCH.1-16.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 11.3 |
| 45 | R.PDSCH.1-16.4 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 11.2 |
| 50 | R.PDSCH.1-16.2 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 11.6 |

Table 5.2A.3.5.1.3.4-2: Test requirements for single carrier performance for FDD 15 kHz SCS for HST-DPS CA configurations with 2 active PDSCH TCI states

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | | Propagation condition | Number of active PDSCH TCI states | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-15.1 | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | 11.1 |
| 10 | R.PDSCH.1-8.4 FDD | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | 11.4 |
| 15 | R.PDSCH.1-15.2 | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | 11.3 |
| 20 | R.PDSCH.1-15.3 | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | 11.1 |
| 25 | R.PDSCH.1-15.4 | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | 11.4 |
| 30 | R.PDSCH.1-15.5 | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | 11.5 |
| 35 | R.PDSCH.1-16.3 | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | 11.2 |
| 40 | R.PDSCH.1-16.1 | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | 11.3 |
| 45 | R.PDSCH.1-16.4 | | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 11.2 |
| 50 | R.PDSCH.1-16.2 | 64QAM, 0.43 | | HST-DPS | 2 | 2x4 | 70 | 11.6 |

Table 5.2A.3.5.1.3.4-3: Test requirements for single carrier performance for TDD 30 kHz SCS for HST-DPS CA configurations with 1 active PDSCH TCI state

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Number of active PDSCH TCI states | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.2-22.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 11.0 |
| 10 | R.PDSCH.2-22.2 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 11.1 |
| 15 | R.PDSCH.2-22.3 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 11.1 |
| 20 | R.PDSCH.2-22.4 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 11.1 |
| 25 | R.PDSCH.2-22.5 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 11.2 |
| 30 | R.PDSCH.2-23.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 11.1 |
| 40 | R.PDSCH.2-10.5 TDD | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 11.1 |
| 50 | R.PDSCH.2-23.2 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 11.3 |
| 60 | R.PDSCH.2-23.3 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 11.3 |
| 80 | R.PDSCH.2-23.4 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 11.1 |
| 90 | R.PDSCH.2-23.5 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 11.3 |
| 100 | R.PDSCH.2-24.1 | 64QAM, 0.43 | HST-DPS | 1 | 2x4 | 70 | 11.3 |

Table 5.2A.3.5.1.3.4-4: Test requirements for single carrier performance for TDD 30 kHz SCS for HST-DPS CA configurations with 2 active PDSCH TCI states

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Number of active PDSCH TCI states | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.2-22.1 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 11.0 |
| 10 | R.PDSCH.2-22.2 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 11.1 |
| 15 | R.PDSCH.2-22.3 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 11.1 |
| 20 | R.PDSCH.2-22.4 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 11.1 |
| 25 | R.PDSCH.2-22.5 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 11.2 |
| 30 | R.PDSCH.2-23.1 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 11.1 |
| 40 | R.PDSCH.2-10.5 TDD | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 11.1 |
| 50 | R.PDSCH.2-23.2 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 11.3 |
| 60 | R.PDSCH.2-23.3 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 11.3 |
| 80 | R.PDSCH.2-23.4 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 11.1 |
| 90 | R.PDSCH.2-23.5 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 11.3 |
| 100 | R.PDSCH.2-24.1 | 64QAM, 0.43 | HST-DPS | 2 | 2x4 | 70 | 11.3 |

### 5.2A.3A 2Rx-4RX requirements

#### 5.2A.3A.1 Requirements for 2Rx-4RX normal PDSCH

##### 5.2A.3A.1.0 Minimum conformance requirements for 2Rx-4RX normal PDSCH

For UE supporting a combination of 2Rx and 4Rx antenna port per component carrier,

The 2Rx requirements are defined in Table 5.2A.2.1.0-4 based on the single carrier requirements for different SCSs and different bandwidth specified in Table 5.2A.2.1.0-1 to Table 5.2A.2.1.0-3.

The 4Rx requirements are defined in Table 5.2A.3.1.0-4 based on the single carrier requirements for different SCSs and different bandwidth specified in Table 5.2A.3.1.0-1 to Table 5.2A.3.1.0-3.

Parameters are specified in Table 5.2A-1 to Table 5.2A-3 and the downlink physical channel setup according to Annex C.2.1.

##### 5.2A.3A.1.1 2Rx-4Rx Normal PDSCH Demodulation Performance for CA (2DL CA)

5.2A.3A.1.1.1 Test Purpose

To verify the PDSCH mapping Type A normal performance under combination of 2 and 4 receive antenna conditions for multiple CA configurations and with different channel models, MCSs and number of MIMO layers for a specified downlink Reference Measurement Channel (RMC) to achieve a certain throughput per CC.

5.2A.3A.1.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 2DL CA and 4Rx antenna ports on some of the CC.

5.2A.3A.1.1.3 Test description

5.2A.3A.1.1.3.1 Initial conditions

Same initial conditions as specified in clause 5.2A.2.1.1.3.1 with the following exception

Channel BW to be tested: largest aggregated bandwidth combination as per Table 5.1.1.5.2-2.

CA capability to be tested: As per table 5.1.1.5.2-1

Table 5.2A.3A.1.1.3.1-1: Test point selection table

|  |  |  |
| --- | --- | --- |
| Test number | CA duplex mode | Configuration |
| 1 | FDD 15 kHz + FDD 15 kHz | For 2Rx CC, As defined in Table 5.2A.2.1.0-1  For 4Rx CC, as defined in Table 5.2A.3.1.0-1 |
| 2 | TDD 30 kHz + TDD 30 kHz | For 2Rx CC, As defined in Table 5.2A.2.1.0-3  For 4Rx CC, as defined in Table 5.2A.3.1.0-3 |
| 3 | FDD 15 kHz + TDD 30 kHz | For 2Rx CC, As defined in Table 5.2A.2.1.0-1 and Table 5.2A.2.1.0-3 per CC  For 4Rx CC, as defined in Table 5.2A.3.1.0-1 and Table 5.2A.3.1.0-3 per CC |
| 4 (note 2) | FDD 15 kHz + TDD 15 kHz | For 2Rx CC, As defined in Table 5.2A.2.1.0-1 and Table 5.2A.2.1.0-2 per CC  For 4Rx CC, as defined in Table 5.2A.3.1.0-1 and Table 5.2A.3.1.0-2 per CC |
| 5 (note 3) | TDD 15 kHz + TDD 30 kHz | For 2Rx CC, As defined in Table 5.2A.2.1.0-2 and Table 5.2A.2.1.0-3 per CC  For 4Rx CC, as defined in Table 5.2A.3.1.0-2 and Table 5.2A.3.1.0-3 per CC |
| Note 1: For each test point, select any one of the CA configurations which contain CA bandwidth combination with the largest aggregated channel bandwidth and supported maximum data rate based on the equation  Note 2: Test point 4 can be skipped if test point 3 is verified.  Note 3: Test point 5 can be skipped if test point 2 is verified. | | |

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.6 and A.3.1.7.7 for TE diagram for 2Rx and 4Rx CC respectively and clause A.3.2.6 for UE diagram

5.2A.3A.1.1.3.2 Test procedure

Same test procedure as specified in clause 5.2A.2.1.1.3.2 for 2Rx CC and with the following exception for 4Rx CC

Instead of Table 5.2A.2.1.0-1 🡪 5.2A.3.1.0-1 for 4Rx CC

Instead of Table 5.2A.2.1.0-4 🡪 5.2A.3.1.0-4 for 4Rx CC

Instead of Table 5.2A.2.1.1.3.3 🡪 5.2A.3.1.1.3.3 for 4Rx CC

5.2A.3A.1.1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.2A.3A.1.1.3.4 Test Requirement

Tables 5.2A.3A.1.1.4-1, 5.2A.3A.1.1.4-2, 5.2A.3A.1.1.4-3, 5.2A.3A.1.1.4-4, 5.2A.3A.1.1.4-5, 5.2A.3A.1.1.4-6 define the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.1 and A.3.2.2 for each component carrier for throughput test point combination shall meet or exceed the specified value in Table 5.2A.3A.1.1.4-1, 5.2A.3A.1.1.4-2, 5.2A.3A.1.1.4-3, 5.2A.3A.1.1.4-4, 5.2A.3A.1.1.4-5, 5.2A.3A.1.1.4-6 for the specified SNR including test tolerances for the combination selected following the test rules outlined in 5.1.1.5.2-2.

Table 5.2A.3A.1.1.4-1: Test requirements for FDD 15 kHz SCS for CA configurations (2Rx CC)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-9.1 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.6 |
| 10 | R.PDSCH.1-2.2 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.6 |
| 15 | R.PDSCH.1-9.2 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.6 |
| 20 | R.PDSCH.1-9.3 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.8 |
| 25 | R.PDSCH.1-9.4 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 15.0 |
| 30 | R.PDSCH.1-9.5 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.8 |
| 40 | R.PDSCH.1-10.1 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 15.0 |
| 50 | R.PDSCH.1-10.2 FDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 15.4 |

Table 5.2A.3A.1.1.4-2: Test requirements for TDD 15 kHz SCS for CA configurations (2Rx CC)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-2.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.6 |
| 10 | R.PDSCH.1-2.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.8 |
| 15 | R.PDSCH.1-2.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.8 |
| 20 | R.PDSCH.1-2.4 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.9 |
| 25 | R.PDSCH.1-2.5 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 15.0 |
| 30 | R.PDSCH.1-3.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.9 |
| 40 | R.PDSCH.1-3.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 15.2 |
| 50 | R.PDSCH.1-3.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 15.5 |

Table 5.2A.3A.1.1.4-3: Test requirements for TDD 30 kHz SCS for CA configurations (2Rx CC)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.2-13.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.6 |
| 10 | R.PDSCH.2-13.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.6 |
| 15 | R.PDSCH.2-13.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.6 |
| 20 | R.PDSCH.2-13.4 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.7 |
| 25 | R.PDSCH.2-13.5 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.7 |
| 30 | R.PDSCH.2-14.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.7 |
| 40 | R.PDSCH.2-2.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 14.9 |
| 50 | R.PDSCH.2-14.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 15.1 |
| 60 | R.PDSCH.2-14.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 15.0 |
| 80 | R.PDSCH.2-14.4 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 15.5 |
| 90 | R.PDSCH.2-14.5 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 15.3 |
| 100 | R.PDSCH.2-15.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x2, ULA Low | 70 | 15.7 |

Table 5.2A.3A.1.1.4-4: Test requirements for FDD 15 kHz SCS for CA configurations (4Rx CC)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-9.1 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.4 [ |
| 10 | R.PDSCH.1-2.2 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.4 |
| 15 | R.PDSCH.1-9.2 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.5 |
| 20 | R.PDSCH.1-9.3 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.5 |
| 25 | R.PDSCH.1-9.4 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.6 |
| 30 | R.PDSCH.1-9.5 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.5 |
| 40 | R.PDSCH.1-10.1 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.6 |
| 50 | R.PDSCH.1-10.2 FDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.8 |

Table 5.2A.3A.1.1.4-5: Test requirements for TDD 15 kHz SCS for CA configurations (4Rx CC)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.1-2.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.4 |
| 10 | R.PDSCH.1-2.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.5 |
| 15 | R.PDSCH.1-2.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.6 |
| 20 | R.PDSCH.1-2.4 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.5 |
| 25 | R.PDSCH.1-2.5 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.7 |
| 30 | R.PDSCH.1-3.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.5 |
| 40 | R.PDSCH.1-3.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.7 |
| 50 | R.PDSCH.1-3.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.9 |

Table 5.2A.3A.1.1.4-6: Test requirements for TDD 30 kHz SCS for CA configurations (4Rx CC)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 5 | R.PDSCH.2-13.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.4 |
| 10 | R.PDSCH.2-13.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.4 |
| 15 | R.PDSCH.2-13.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.4 |
| 20 | R.PDSCH.2-13.4 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.5 |
| 25 | R.PDSCH.2-13.5 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.5 |
| 30 | R.PDSCH.2-14.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.5 |
| 40 | R.PDSCH.2-2.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.6 |
| 50 | R.PDSCH.2-14.2 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.8 |
| 60 | R.PDSCH.2-14.3 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.7 |
| 80 | R.PDSCH.2-14.4 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 10.0 |
| 90 | R.PDSCH.2-14.5 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 9.9 |
| 100 | R.PDSCH.2-15.1 TDD | 16QAM, 0.48 | TDLA30-10 | 2x4, ULA Low | 70 | 10.2 |

##### 5.2A.3A.1.2 2Rx-4Rx Normal PDSCH Demodulation Performance for CA (3DL CA)

5.2A.3A.1.2.1 Test Purpose

Same as 5.2A.3A.1.1.1

5.2A.3A.1.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 3DL CA and 4Rx antenna ports on some of the CC.

5.2A.3A.1.2.3 Test description

5.2A.3A.1.2.3.1 Initial conditions

Same as 5.2A.3A.1.1.3.1

5.2A.3A.1.2.3.2 Test procedure

Same as 5.2A.3A.1.1.3.2

5.2A.3A.1.1.3.3 Message contents

Same as 5.2A.3A.1.1.3.3

5.2A.3A.1.1.3.4 Test Requirement

Same as 5.2A.3A.1.1.4 evaluated per component carrier.

##### 5.2A.3A.1.3 2Rx-4Rx Normal PDSCH Demodulation Performance for CA (4DL CA)

5.2A.3A.1.3.1 Test Purpose

Same as 5.2A.3A.1.1.1

5.2A.3A.1.3.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4DL CA and 4Rx antenna ports on some of the CC.

5.2A.3A.1.3.3 Test description

5.2A.3A.1.3.3.1 Initial conditions

Same as 5.2A.3A.1.1.3.1

5.2A.3A.1.3.3.2 Test procedure

Same as 5.2A.3A.1.1.3.2

5.2A.3A.1.3.3.3 Message contents

Same as 5.2A.3A.1.1.3.3

5.2A.3A.1.3.3.4 Test Requirement

Same as 5.2A.3A.1.1.4 evaluated per component carrier

## 5.3 PDCCH demodulation requirements

The receiver characteristics of the PDCCH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg).

The parameters specified in Table 5.3-1 are valid for all PDCCH tests unless otherwise stated.

Table 5.3-1: Common test Parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Value |
| Carrier configuration | Offset between Point A and the lowest usable subcarrier on this carrier (Note 1) | |  | 0 |
| DL BWP configuration #1 | Cyclic prefix | |  | Normal |
| RB offset | | RBs | 0 |
| Common serving cell parameters | Physical Cell ID | |  | 0 |
| SSB position in burst | |  | 1 |
| SSB periodicity | | ms | 20 |
| PDCCH configuration | Slots for PDCCH monitoring | |  | Each slot |
| Number of PDCCH candidates | |  | 1 |
| Frequency domain resource allocation for CORESET | |  | Start from RB = 0 with contiguous RB allocation |
| TCI state | |  | TCI state #1 |
| CSI-RS for tracking | First subcarrier index in the PRB used for CSI-RS (*k0*) | |  | 0 |
| First OFDM symbol in the PRB used for CSI-RS (*l0*) | |  | CSI-RS resource 1: 4 CSI-RS resource 2: 8 CSI-RS resource 3: 4 CSI-RS resource 4: 8 |
| Number of CSI-RS ports (*X*) | |  | 1 |
| CDM Type | |  | No CDM |
| Density (*ρ*) | |  | 3 |
| CSI-RS periodicity | | Slots | 15 kHz SCS: 20  30 kHz SCS: 40 |
| CSI-RS offset | | Slots | 15 kHz SCS:  10 for CSI-RS resource 1 and 2  11 for CSI-RS resource 3 and 4  30 kHz SCS:  20 for CSI-RS resource 1 and 2  21 for CSI-RS resource 3 and 4 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = BWP size |
| QCL info | |  | TCI state #0 |
| TCI state #0 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type D |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type D |
| PDCCH & PDCCH DMRS Precoding configuration | | |  | For number of Tx=1: No precoding;  For number of Tx>1: Single Panel Type I, Randomized precoder selection for every REG bundle and updated per slot with equal probability of each applicable i1/i2 combination or codebook  index, chosen from section 5.2.2.2.1 of TS 38.214 [12] |
| Physical signals, channels mapping and precoding | | |  | As specified in Annex B.4.1 |
| Symbols for all unused REs | | |  | OP.1 FDD as defined in Annex A.5.1.1  OP.1 TDD as defined in Annex A.5.2.1 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | |  | 2 for FDD.  For TDD, specific to each TDD UL-DL pattern and as defined in Annex A.1.2. |
| Note 1: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-1 [2] for tested channel bandwidth and subcarrier spacing. | | | | |

The normative reference for this requirement is TS 38.101-4 [2] clause 5.3.

### 5.3.1 1RX requirements

#### 5.3.1.1 FDD

The parameters specified in Table 5.3.1.1-1 are valid for all FDD tests unless otherwise stated.

Table 5.3.1.1-1: Test Parameters

|  |  |  |
| --- | --- | --- |
| Parameter | Unit |  |
| CCE to REG mapping type |  | nonInterleaved |
| REG bundle size |  | 6 |
| Shift index |  | 0 |

##### 5.3.1.1.1 1Rx FDD FR1 PDCCH performance for RedCap

5.3.1.1.1.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 1 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.1.1.1.3-1. The downlink physical setup is in accordance with Annex C.2.1.

5.3.1.1.1.2 Test applicability

This test case applies to all types of NR UE release 17 and forward that support NR RedCap.

5.3.1.1.1.3 Minimum conformance requirements

For the parameters specified in Table 5.3.1.1-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.1.1.1.3-1. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.1.1.1.3-1: Minimum performance for UE supporting full-duplex FDD or half-duplex FDD

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 10 | 48 | 1 | 8 | R.PDCCH. 1-1.3 FDD | TDLA30-10 | 2x1 Low | 1 | 5.8 |

The normative reference for this requirement is TS 38.101-4 [2] clause 5.3.1.1.1.

5.3.1.1.1.4 Test description

5.3.1.1.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A in Figure A.3.1.7.0 for TE diagram and clause A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.3-1 and Table 5.3.1.1.1.3-1 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, *Connected without Release On, Test Mode* On according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.1.1.1.4.3.

5.3.1.1.1.4.2 Test procedure

1. SS transmits PDCCH with DCI format as specified in PDCCH Reference Channel for C\_RNTI to transmit the DL RMC according to Table 5.3.1.1.1.3-1. The details of PDCCH are specified in Table 5.3.1, Table 5.3.1.1-1, Table 5.3.1.1.1.3-1 respectively. The details of PDSCH are specified in Table A.3.3.1.1-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.1.1.1.5-1 as appropriate.

3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.1.1.1.5-1, pass the UE. Otherwise fail the UE.

5.3.1.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2 with the following exceptions:

Table 5.3.1.1.1.4.3-1: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| frequencyDomainResources | 11111111 00000000 00000000 00000000 00000000 00000 | CORESET to use the least significant 48 RBs of the BWP |  |
| } |  |  |  |

Table 5.3.1.1.1.4.3-2: PDCCH *Search Space*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 with condition USS | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel8 | n1 | AL8 |  |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| common SEQUENCE { |  |  | CSS, SISS |
| ue-Specific SEQUENCE { |  |  | USS |
| dci-Formats | formats0-1-And-1-1 | DCI Format 1\_1 | Long\_DCI |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.1.1.1.4.3-3: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| resourceAllocation | resourceAllocationType0 |  |  |
| } |  |  |  |

5.3.1.1.1.5 Test requirement

Table 5.3.1.1.1.5-1 defines the primary level settings.

For the parameters specified in Table 5.3.1.1-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.1.1.1.5-1.

Table 5.3.1.1.1.5-1: Test Requirement for PDCCH with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 10 | 48 | 1 | 8 | R.PDCCH. 1-1.3 FDD | TDLA30-10 | 2x1 Low | 1 | 6.8 |

#### 5.3.1.2 TDD

The parameters specified in Table 5.3.1.2-1 are valid for all TDD tests unless otherwise stated.

**Table 5.3.1.2-1: Test Parameters**

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** |  |
| TDD UL-DL pattern |  | FR1.30-1 |
| CCE to REG mapping type |  | interleaved |
| Interleaver size |  | 3 |
| REG bundle size |  | 2 |
| Shift Index |  | 0 |

##### 5.3.1.2.1 1Rx TDD FR1 PDCCH performance for RedCap

5.3.1.2.1.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 1 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.1.2.1.3-1. The downlink physical setup is in accordance with Annex C.2.1.

5.3.1.2.1.2 Test applicability

This test case applies to all types of NR UE release 17 and forward that support NR RedCap.

5.3.1.2.1.3 Minimum conformance requirements

For the parameters specified in Table 5.3.1.2-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.1.2.1.3-1. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.1.2.1.3-1: Minimum performance for PDCCH with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 20 | 48 | 1 | 4 | R.PDCCH.2-1.5 TDD | TDLC300-100 | 1x1 | 1 | 8.6 |

The normative reference for this requirement is TS 38.101-4 [2] clause 5.3.1.2.1.

5.3.1.2.1.4 Test description

5.3.1.2.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A in Figure A.3.1.7.0 for TE diagram and clause A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.3-1 and Table 5.3.1.2.1.3-1 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, *Connected without Release On, Test Mode* On according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.1.2.1.4.3.

5.3.1.2.1.4.2 Test procedure

1. SS transmits PDCCH with DCI format as specified in PDCCH Reference Channel for C\_RNTI to transmit the DL RMC according to Table 5.3.1.2.1.3-1. The details of PDCCH are specified in Table 5.3.1, Table 5.3.1.2-1, Table 5.3.1.2.1.3-1 respectively. The details of PDSCH are specified in Table A.3.3.2.2-3.. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.1.2.1.5-1 as appropriate.

3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.1.2.1.5-1, pass the UE. Otherwise fail the UE.

5.3.1.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2 with the following exceptions:

Table 5.3.1.2.1.4.3-1: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| frequencyDomainResources | 11111111 00000000 00000000 00000000 00000000 00000 | CORESET to use the least significant 48 RBs of the BWP |  |
| cce-REG-MappingType CHOICE { |  |  |  |
| interleaved ::= SEQUENCE { |  |  |  |
| reg-BundleSize | n2 |  |  |
| interleaverSize | n3 |  |  |
| shiftIndex | 0 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.1.2.1.4.3-2: PDCCH *Search Space*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 with condition USS | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel4 | n1 | AL4 |  |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| common SEQUENCE { |  |  | CSS, SISS |
| ue-Specific SEQUENCE { |  |  | USS |
| dci-Formats | formats0-1-And-1-1 | DCI Format 1\_1 | Long\_DCI |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.1.2.1.4.3-3: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| resourceAllocation | resourceAllocationType0 |  |  |
| } |  |  |  |

5.3.1.2.1.5 Test requirement

Table 5.3.1.2.1.5-1 defines the primary level settings.

For the parameters specified in Table 5.3.1.2-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.1.2.1.5-1.

Table 5.3.1.2.1.5-1: Test Requirement for PDCCH with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 20 | 48 | 1 | 4 | R.PDCCH.2-1.5 TDD | TDLC300-100 | 1x1 | 1 | 9.6 |

### 5.3.2 2RX requirements

#### 5.3.2.1 FDD

The parameters specified in Table 5.3.2.1-1 are valid for all FDD tests unless otherwise stated.

Table 5.3.2.1-1: Test Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | 1 Tx Antenna | 2 Tx Antenna |
| CCE to REG mapping type |  | nonInterleaved | |
| REG bundle size |  | 6 | |
| Shift index |  | 0 | |

##### 5.3.2.1.1 2Rx FDD FR1 PDCCH 1 Tx antenna performance for both SA and NSA

5.3.2.1.1.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 2 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.2.1.1.3-1. The downlink physical setup is in accordance with Annex C.2.1.

5.3.2.1.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC.

5.3.2.1.1.3 Minimum conformance requirements

For the parameters specified in Table 5.3.2.1-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.1.1.3-1. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.2.1.1.3-1: Minimum performance for 1 Tx PDCCH with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 10 MHz | 24 | 2 | 2 | R.PDCCH.1-2.1 FDD | TDLA30-10 | 1x2 Low | 1 | 8.1 |
| 2 | 10 MHz | 24 | 2 | 2 | R.PDCCH.1-2.3 FDD | TDLC300-100 | 1x2 Low | 1 | 8.2 |
| 3 | 10 MHz | 48 | 2 | 4 | R.PDCCH.1-2.4 FDD | TDLA30-10 | 1x2 Low | 1 | 5.5 |
| 4 | 10 MHz | 48 | 1 | 4 | R.PDCCH.1-1.1 FDD | TDLA30-10 | 1x2 Low | 1 | 4.4 |
| 5 | 10 MHz | 48 | 2 | 16 | R.PDCCH.1-2.6 FDD | TDLA30-10 | 1x2 Low | 1 | -2.1 |

The normative reference for this requirement is TS 38.101-4 [2] clause 5.3.

5.3.2.1.1.4 Test description

5.3.2.1.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A in Figure A.3.1.7.2 for TE diagram and clause A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.3-1 and Table 5.3.2.1.1-1 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.1.4.3.

5.3.2.1.1.4.2 Test procedure

1. SS transmits PDCCH with DCI format as specified in PDCCH Reference Channel for C\_RNTI to transmit the DL RMC according to Table 5.3.2.1.1.3-1. The details of PDCCH are specified in Table 5.3.1, Table 5.3.2.1-1, Table 5.3.2.1.1.3-1 respectively. The details of PDSCH are specified in Table A.3.3.1.1-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.2.1.1.4.4-1 as appropriate.

3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.2.1.1.4.4-1, pass the UE. Otherwise fail the UE.

4. Repeat steps from 1 to 3 for each subtest in Table 5.3.2.1.1.4.4-1 as appropriate.

5.3.2.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.3.2.1.1.4.3.1 Message exceptions for SA

Table 5.3.2.1.1.4.3.1-1: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| frequencyDomainResources | 11111111 00000000 00000000 00000000 00000000 00000 | CORESET to use the least significant 48 RBs of the BWP  Test 3, 4, 5 |  |
| 11110000 00000000 00000000 00000000 00000000 00000 | CORESET to use the least significant 24 RBs of the BWP  Test 1, 2 |  |
| Duration | 2 | SearchSpace duration of 2 symbols  Test 1, 2, 3, 5 |  |
| 1 | SearchSpace duration of 1 symbol  Test 4 |  |
| } |  |  |  |

Table 5.3.2.1.1.4.3.1-2: PDCCH *Search Space*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 with condition USS | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel1 | n0 |  |  |
| aggregationLevel2 | n1 | AL2 | Test 1, Test 2 |
| aggregationLevel4 | n1 | AL4 | Test 3, Test 4 |
| aggregationLevel8 | n0 |  |  |
| aggregationLevel16 | n1 | AL16 | Test 5 |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| common SEQUENCE { |  |  | CSS, SISS |
| ue-Specific SEQUENCE { |  |  | USS |
| dci-Formats | formats0-1-And-1-1 | DCI Format 1\_1 for tests 2 and 3 | Long\_DCI |
|  | formats0-0-And-1-0 | DCI Format 1\_0 for tests 1, 4, 5 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.1.1.4.3.1-3: Void

Table 5.3.2.1.1.4.3.1-3A: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| resourceAllocation | resourceAllocationType1 |  | Test 1,  Test 4,  Test 5 |
| } |  |  |  |

5.3.2.1.1.4.3.2 Message exceptions for NSA

Same as 5.3.2.1.1.4.3.1

5.3.2.1.1.4.4 Test requirement

Table 5.3.2.1.1.4.4-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.1.1.4.4-1.

Table 5.3.2.1.1.4.4-1: Test Requirement for 1Tx PDCCH with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 10 MHz | 24 | 2 | 2 | R.PDCCH.1-2.1 FDD | TDLA30-10 | 1x2 Low | 1 | 9.0 |
| 2 | 10 MHz | 24 | 2 | 2 | R.PDCCH.1-2.3 FDD | TDLC300-100 | 1x2 Low | 1 | 9.1 |
| 3 | 10 MHz | 48 | 2 | 4 | R.PDCCH.1-2.4 FDD | TDLA30-10 | 1x2 Low | 1 | 6.4 |
| 4 | 10 MHz | 48 | 1 | 4 | R.PDCCH.1-1.1 FDD | TDLA30-10 | 1x2 Low | 1 | 5.3 |
| 5 | 10MHz | 48 | 2 | 16 | R.PDCCH.1-2.6 FDD | TDLA30-10 | 1x2 Low | 1 | -1.2 |

##### 5.3.2.1.2 2Rx FDD FR1 PDCCH 2 Tx antenna performance for both SA and NSA

5.3.2.1.2.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 2 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.2.1.2.3-1. The downlink physical setup is in accordance with Annex C.2.1.

5.3.2.1.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC.

5.3.2.1.2.3 Minimum conformance requirements

For the parameters specified in Table 5.3.2.1-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.1.2.3-1. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.2.1.2.3-1: Minimum performance for 2 Tx PDCCH with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 10 MHz | 24 | 2 | 4 | R.PDCCH. 1-2.2 FDD | TDLC300-100 | 2x2 Low | 1 | 2.0 |
| 2 | 10 MHz | 48 | 2 | 8 | R.PDCCH. 1-2.5 FDD | TDLC300-100 | 2x2 Low | 1 | -1.3 |
| 3 | 10 MHz | 48 | 1 | 8 | R.PDCCH.1-1.3 FDD | TDLA30-10 | 2x2 Low | 1 | -0.2 |

The normative reference for this requirement is TS 38.101-4 [2] clause 5.3.

5.3.2.1.2.4 Test description

5.3.2.1.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.2.1-1 and Table 5.3.2.1.2.3-1 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.2.1.2.4.3.

5.3.2.1.2.4.2 Test procedure

1. SS transmits PDCCH with DCI format as specified in PDCCH Reference Channelfor C\_RNTI to transmit the DL RMC according to Table 5.3.2.1.2.3-1. The details of PDCCH are specified in Table 5.3.1, Table 5.3.2.1-1, Table 5.3.2.1.2.3-1 respectively. The details of PDSCH are specified in Table A.3.3.1.1-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.2.1.2.4.4-1as appropriate.

3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.2.1.2.4.4-1, pass the UE. Otherwise fail the UE.

4. Repeat steps from 1 to 3 for each subtest in Table 5.3.2.1.2.4.4-1 as appropriate.

5.3.2.1.2.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.3.2.1.2.4.3.1 Message exceptions for SA

Table 5.3.2.1.2.4.3.1-1: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| frequencyDomainResources | 11111111 00000000 00000000 00000000 00000000 00000 | CORESET to use the least significant 48 RBs of the BWP  Test 2, 3 |  |
| 11110000 00000000 00000000 00000000 00000000 00000 | CORESET to use the least significant 24 RBs of the BWP  Test 1 |  |
| Duration | 2 | SearchSpace duration of 2 symbols  Test 1, 2 |  |
| 1 | SearchSpace duration of 1 symbol  Test 3 |  |
| } |  |  |  |

Table 5.3.2.1.2.4.3.1-2: PDCCH *Search Space*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel1 | n0 |  |  |
| aggregationLevel2 | n0 |  |  |
| aggregationLevel4 | n1 | AL4 | Test 1 |
| aggregationLevel8 | n1 | AL8 | Test 2, 3 |
| aggregationLevel16 | n0 |  |  |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| common SEQUENCE { |  |  | CSS, SISS |
| ue-Specific SEQUENCE { |  |  | USS |
| dci-Formats | formats0-1-And-1-1 | DCI Format 1\_1 for tests 2 and 3 | Long\_DCI |
|  | formats0-0-And-1-0 | DCI Format 1\_0 for test 1 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.1.2.4.3.1-3: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| resourceAllocation | resourceAllocationType1 |  | Test 1 |
| } |  |  |  |

5.3.2.1.2.4.3.2 Message exceptions for NSA

Same as 5.3.2.1.2.4.3.1

5.3.2.1.2.4.4 Test requirement

Table 5.3.2.1.2.4.4-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.1.2.4.4-1.

Table 5.3.2.1.2.4.4-1: Test Requirements for 2 Tx PDCCH with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 10 MHz | 24 | 2 | 4 | R.PDCCH. 1-2.2 FDD | TDLC300-100 | 2x2 Low | 1 | 3.0 |
| 2 | 10 MHz | 48 | 2 | 8 | R.PDCCH. 1-2.5 FDD | TDLC300-100 | 2x2 Low | 1 | -0.3 |
| 3 | 10 MHz | 48 | 1 | 8 | R.PDCCH.1-1.3 FDD | TDLA30-10 | 2x2 Low | 1 | 0.8 |

##### 5.3.2.1.3 2Rx FDD FR1 PDCCH 1 Tx antenna performance for power saving

5.3.2.1.3.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 2 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.2.1.3.3-2. The downlink physical setup is in accordance with Annex C.2.1.

5.3.2.1.3.2 Test applicability

This test applies to all types of NR UE release 16 and forward supporting Long DRX and DRX adaptation

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and Long DRX and DRX adaptation.

5.3.2.1.3.3 Minimum conformance requirements

The parameters specified in Table 5.3.2.1.3.3-1 are valid for FDD test unless otherwise stated.

Table 5.3.2.1.3.3-1: Test Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | 1 Tx Antenna |
| CCE to REG mapping type | |  | nonInterleaved |
| REG bundle size | |  | 6 |
| Shift Index | |  | 0 |
| DRX cycle | | ms | 10 |
| ps-WakeUp-r16 | |  | absent |
| Wake-up indication bit in DCI format 2\_6 | |  | 1 |
| PDCCH DCI format 2\_6 configuration | PS-offset |  |  |
| Number of PDCCH candidates |  | 1 |
| Frequency domain resource allocation for CORESET |  | Start from RB = 0 with contiguous RB allocation |
| TCI state |  | TCI state #1 |
| PDCCH configuration | Slots for PDCCH monitoring |  | Each slot during DRX-on period |
|  | |  |  |
| Note: TminimumTimeGap is signalled as a part of *drx-Adaptation-r16*UE capability. | | | |

For the parameters specified in Table 5.3.2.1.3.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.1.3.3-2. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.2.1.3.3-2: Minimum performance for PDCCH with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 10 | 48 | 2 | 4 | R.PDCCH. 1-2.4 FDD | TDLA30-10 | 1x2 Low | 1 | 5.5 |
| 2 | 8 | R.PDCCH. 1-2.7 FDD |

The normative reference for this requirement is TS 38.101-4 [2] clause 5.3.2.1.3.

5.3.2.1.3.4 Test description

5.3.2.1.3.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.2.1-1, Table 5.3.2.1.3.3-1 and Table 5.3.2.1.3.3-2 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.2.1.3.4.3.

5.3.2.1.3.4.2 Test procedure

1. SS transmits PDCCH with DCI format2\_6 as specified in PDCCH Reference Channel for PS\_RNTI within DRX off state. The Wake-up indication bit in PDCCH is set to 1.

2. SS transmits PDSCH via PDCCH with DCI format 1\_1 as specified in PDCCH Reference Channel for C\_RNTI to transmit the DL RMC according to Table 5.3.2.1.3.3-2 in DRX on period. The details of PDCCH are specified in Table 5.3.1, Table 5.3.2.1-1, Table 5.3.2.1.3.3-1 and Table 5.3.2.1.3.3-2 respectively. The details of PDSCH are specified in Table A.3.3.1.1-3. The SS sends downlink MAC padding bits on the DL RMC. During the test the UE shall monitor the DCI format 2\_6 PDCCH in DRX off state and decide whether to receive the following PDCCH in DRX on period.

3. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.2.1.3.4.4-1as appropriate.

4. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.2.1.3.4.4-1, pass the UE. Otherwise fail the UE.

5. Repeat steps from 2 to 4 for each subtest in Table 5.3.2.1.3.3-2 as appropriate.

5.3.2.1.3.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.3.2.1.3.4.3.1 Message exceptions for SA

Table 5.3.2.1.3.4.3.1-1: DRX-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6],Table 4.6.3-56 | | | |
| Information Element | Value/remark | Comment | Condition |
| DRX-Config ::= SEQUENCE { |  |  |  |
| drx-onDurationTimer CHOICE { |  |  |  |
| milliSeconds | ms5 |  |  |
| } |  |  |  |
| drx-InactivityTimer | ms0 |  |  |
| drx-HARQ-RTT-TimerDL | 0 |  |  |
| drx-HARQ-RTT-TimerUL | 0 |  |  |
| drx-RetransmissionTimerDL | sl1 |  |  |
| drx-RetransmissionTimerUL | sl1 |  |  |
| drx-LongCycleStartOffset CHOICE { |  |  |  |
| ms10 | 0 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.1.3.4.3.1-2: DCP-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-106 | | | |
| Information Element | Value/remark | Comment | Condition |
| dcp-Config-r16 CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| ps-Offset-r16 | 32 |  | Scs-15kHz-r16 = sl3 |
| sizeDCI-2-6-r16 | 2 |  |  |
| ps-PositionDCI-2-6-r16 | 0 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.1.3.4.3.1-3: PDCCH-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6],Table 4.6.3-95 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-Config::= SEQUENCE { |  |  |  |
| controlResourceSetToAddModList SEQUENCE(SEQUENCE(SIZE (1..3)) OF ControlResourceSet ::= SEQUENCE { | 1 entry |  |  |
| ControlResourceSet[1] | ControlResourceSet |  |  |
| } |  |  |  |
| searchSpacesToAddModList  SEQUENCE(SIZE (1..10)) OF SearchSpace ::= SEQUENCE { | 2 entries |  |  |
| SearchSpace[1] | SearchSpace1 |  |  |
| SearchSpace[2] | SearchSpace2 |  |  |
| } |  |  |  |
| searchSpacesToAddModListExt-r16 SEQUENCE(SIZE (1..10)) OF SearchSpace { | 2 entries |  |  |
| searchSpaceExt-r16[1] | SearchSpaceExt1 |  |  |
| searchSpaceExt-r16[2] | SearchSpaceExt2 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.1.3.4.3.1-4: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 1 |  |  |
| frequencyDomainResources | 11111111 00000000 00000000 00000000 00000000 00000 | CORESET to use the least significant 48 RBs of the BWP |  |
| Duration | 2 | SearchSpace duration of 2 symbol |  |
| cce-REG-MappingType CHOICE { |  |  |  |
| nonInterleaved SEQUENCE |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.1.3.4.3.1-5: Void

Table 5.3.2.1.3.4.3.1-6: PDCCH *Search Space1*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| searchSpaceId | 2 | SearchSpaceId with condition USS | USS |
| controlResourceSetId | 1 | ControlResourceSetId |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel4 | n1 | Test AL4 |  |
| aggregationLevel8 | n1 | Test AL8 |  |
| } |  |  |  |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| ue-Specific SEQUENCE { |  |  | USS |
| dci-Formats | formats0-1-And-1-1 | DCI Format 1\_1 | Long\_DCI |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.1.3.4.3.1-6A: PDCCH *Search Space2*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| searchSpaceId | 4 |  |  |
| controlResourceSetId | 1 | ControlResourceSetId |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel4 | n1 | Test AL4 |  |
| aggregationLevel8 | n1 | Test AL8 |  |
| } |  |  |  |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| common SEQUENCE { |  |  | CSS, SISS |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.1.3.4.3.1-7: PDCCH *Search Space Ext1*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7a | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpaceExt-r16 ::= SEQUENCE { |  |  |  |
| controlResourceSetId-r16 | 1 |  |  |
| } |  |  |  |

Table 5.3.2.1.3.4.3.1-7A: PDCCH *Search Space Ext2*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7a | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpaceExt-r16 ::= SEQUENCE { |  |  |  |
| controlResourceSetId-r16 | 1 |  |  |
| searchSpaceType-r16 SEQUENCE { |  |  |  |
| common SEQUENCE { |  |  |  |
| dci-Format2-6-r16 SEQUENCE { | NULL |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.1.3.4.3.1-8: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| TCI-State[1] | TCI-StateId 0 |  |  |
| qcl-type1 { |  | Type 1 QCL information |  |
| Cell | ServCellIndex |  |  |
| Bwp-id | 1 | BWP ID |  |
| referenceSignal | Ssb : 0 | SSB # 0 |  |
| Qcl-Type | Type C |  |  |
| } |  |  |  |
| qcl-type2 { |  | Type 2 QCL information |  |
| Cell | ServCellIndex |  |  |
| Bwp-id | 1 | BWP ID |  |
| referenceSignal | Ssb : 0 | SSB # 0 |  |
| Qcl-Type | Type D |  |  |
| } |  |  |  |
| TCI-State[2] | TCI-StateId 1 | Type 1 QCL information |  |
| qcl-type1 { |  |  |  |
| Cell | ServCellIndex |  |  |
| Bwp-id | 1 | BWP ID |  |
| referenceSignal | csi-rs : 0 | CSI-RS # 0 |  |
| Qcl-Type | Type A |  |  |
| } |  |  |  |
| qcl-type2 { |  | Type 2 QCL information |  |
| Cell | ServCellIndex |  |  |
| Bwp-id | 1 | BWP ID |  |
| referenceSignal | csi-rs : 0 | SSB # 0 |  |
| Qcl-Type | Type D |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.3.2.1.3.4.3.2 Message exceptions for NSA

Same as 5.3.2.1.3.4.3.1

5.3.2.1.3.4.4 Test requirement

Table 5.3.2.1.3.4.4-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.1.3.4.4-1.

Table 5.3.2.1.3.4.4-1: Test Requirements for PDCCH with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 10 | 48 | 2 | 4 | R.PDCCH. 1-2.4 FDD | TDLA30-10 | 1x2 Low | 1 | 6.4 |
| 2 | 8 | R.PDCCH. 1-2.7 FDD |

##### 5.3.2.1.4 2Rx FDD FR1 PDCCH performance for RedCap

5.3.2.1.4.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 1 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.2.1.4.3-1. The downlink physical setup is in accordance with Annex C.2.1.

5.3.2.1.4.2 Test applicability

This test case applies to all types of NR UE release 17 and forward that support NR RedCap.

5.3.2.1.4.3 Minimum conformance requirements

For the parameters specified in Table 5.3.2.1-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.1.4.3-1. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.2.1.4.3-1: Minimum performance for PDCCH with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 10 | 48 | 2 | 4 | R.PDCCH. 1-2.4 FDD | TDLA30-10 | 1x2 Low | 1 | 5.5 |
| 2 | 10 | 48 | 1 | 8 | R.PDCCH. 1-1.3 FDD | TDLA30-10 | 2x2 Low | 1 | -0.2 |

The normative reference for this requirement is TS 38.101-4 [2] clause 5.3.2.1.4.

5.3.2.1.4.4 Test description

5.3.2.1.4.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A in Figure A.3.1.7.1 for TE diagram and clause A.3.2.3 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.3-1 and Table 5.3.2.1.4.5-1 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, *Connected without Release On, Test Mode* On according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.2.1.4.4.3.

5.3.2.1.4.4.2 Test procedure

1. SS transmits PDCCH with DCI format as specified in PDCCH Reference Channel for C\_RNTI to transmit the DL RMC according to Table 5.3.2.1.4.5-1. The details of PDCCH are specified in Table 5.3.1, Table 5.3.2.1-1, Table 5.3.2.1.4.5-1 respectively. The details of PDSCH are specified in Table A.3.3.1.1-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.2.1.4.5-1 as appropriate.

3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.2.1.4.5-1, pass the UE. Otherwise fail the UE.

5.3.2.1.4.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2 with the following exceptions:

Table 5.3.2.1.4.4.3-1: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| frequencyDomainResources | 11111111 00000000 00000000 00000000 00000000 00000 | CORESET to use the least significant 48 RBs of the BWP |  |
| Duration | 2 | SearchSpace duration of 2 symbols  Test 1 |  |
|  | 1 | SearchSpace duration of 1 symbol  Test 2 |  |
| } |  |  |  |

Table 5.3.2.1.4.4.3-2: PDCCH *Search Space*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 with condition USS | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel4 | n1 | AL4 | Test 1 |
| aggregationLevel8 | n1 | AL8 | Test 2 |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| common SEQUENCE { |  |  | CSS, SISS |
| ue-Specific SEQUENCE { |  |  | USS |
| dci-Formats | formats0-1-And-1-1 | DCI Format 1\_1 | Long\_DCI |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.1.4.4.3-3: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| resourceAllocation | resourceAllocationType0 |  |  |
| } |  |  |  |

5.3.2.1.4.5 Test requirement

Table 5.3.2.1.4.5-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.1.4.5-1.

Table 5.3.2.1.4.5-1: Test Requirement for PDCCH with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 10 | 48 | 2 | 4 | R.PDCCH. 1-2.4 FDD | TDLA30-10 | 1x2 Low | 1 | 6.4 |
| 2 | 10 | 48 | 1 | 8 | R.PDCCH. 1-1.3 FDD | TDLA30-10 | 2x2 Low | 1 | 0.8 |

##### 5.3.2.1.5 2RX FDD Minimum requirements for PDCCH with intra-slot repetition

5.3.2.1.5.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 2 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.2.1.5.3-2. The downlink physical setup is in accordance with Annex C.2.1.

5.3.2.1.5.2 Test applicability

This test applies to all types of NR UE release 17 and forward.

This test also applies to all types of EUTRA UE release 17 and forward supporting EN-DC.

5.3.2.1.5.3 Minimum conformance requirements

Table 5.3.2.1.5.3-1: Test Parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | |
| TRxP #1(Note 1) | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | |  | TRxP #1 | |
| PDCCH configuration | | TCI state | |  | TCI State #1 | TCI State #2 |
| CORESETPoolIndex | |  | 0,1 | |
| Repetition transmission schemes | |  | FDM | |
| CCE to REG mapping type | |  | nonInterleaved | |
| REG bundle size | |  | 6 | |
| Time offset/Frequency offset of the second TxRP from the first TxRP | |  | timing offset = -0.5us, frequency offset = 200Hz | |
| Frequency domain resource allocation for CORSET | |  | Frequency non-overlapping | |
| CSI-RS for tracking | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | |
| Density | |  | 3 | |
| CSI-RS periodicity | | Slots | 20 | |
| CSI-RS offset | | Slots | 10 for CSI-RS resources 1 and 2  11 for CSI-RS resources 3 and 4 | 10 for CSI-RS resources 5 and 6  11 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | |
| TCI State #1 | Type 1 QCL information | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | N/A |
| QCL Type |  | Type A | N/A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| TCI State #2 | Type 1 QCL information | | CSI-RS resource |  | N/A | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | Type A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| Note: PDCCH is transmitted from both TRxP #1 and TRxP #2 | | | | | | |

For the parameters specified in Table 5.3.2.1.5.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.1.5.3-2. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.2.1.5.3-2: Minimum performance for PDCCH with 15kHz SCS (Note 2)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Bandwidth(MHz) | CORESET RB (Note 4) | CORESET duration | Aggregation level | Reference Channel | Propagation Condition (Note 1) | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg  (%) | SNR (dB) (Note 3) |
| 1 | 10 | 24 | 2 | 2 | R.PDCCH. 1-2.1 FDD | TDLA30-10 | 2x2, ULA Low | 1 | 2.7 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Bandwidth, CORESET parameters, reference channel, Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2  Note 4: CORESETs from TRxP #1 and TRxP #2 should not be overlapped | | | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [2] clause 5.3.2.1.5.

5.3.2.1.5.4 Test description

5.3.2.1.5.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.2.1-1 and Table 5.3.2.1.5.3-1 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.2.1.5.4.3.

5.3.2.1.5.4.2 Test procedure

1. SS transmits PDCCH with DCI format as specified in PDCCH Reference Channel for C\_RNTI to transmit the DL RMC according to Table 5.3.2.1.5.3-1. The details of PDCCH are specified in Table 5.3.1, Table 5.3.2.1-1, Table 5.3.2.1.5.3-1 respectively. The details of PDSCH are specified in Table A.3.3.1.1-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.2.1.5.3-1 as appropriate.

3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.2.1.5.4.4-1, pass the UE. Otherwise fail the UE.

5.3.2.1.5.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.3.2.1.5.4.3.1 Message exceptions for SA

Table 5.3.2.1.5.4.3.1-1: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| frequencyDomainResources | 11110000 00000000 00000000 00000000 00000000 00000 | CORESET to use the least significant 24 RBs of the BWP |  |
| Duration | 1 | SearchSpace duration of 1 symbol |  |
| } |  |  |  |

Table 5.3.2.1.5.4.3.1-2: PDCCH *Search Space*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel2 | n0 |  |  |
| } |  |  |  |

Table 5.3.2.1.5.4.3.1-3: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| resourceAllocation | resourceAllocationType1 |  |  |
| } |  |  |  |

Table 5.3.2.1.5.4.3.1-4: *CSI-ResourcePeriodicityAndOffset* for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots40 | 10 | For CSI-RS resources 1,2,5,6 |  |
| Slots40 | 11 | For CSI-RS resources 3,4,7,8 |  |
| } |  |  |  |

5.3.2.1.5.4.3.2 Message exceptions for NSA

Same as 5.3.2.1.5.4.3.1

5.3.2.1.5.4.4 Test requirement

Table 5.3.2.1.5.4.4-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.1.5.4.4-1.

Table 5.3.2.1.5.4.4-1: Test Requirements for PDCCH with 15kHz SCS (Note 2)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Bandwidth(MHz) | CORESET RB (Note 4) | CORESET duration | Aggregation level | Reference Channel | Propagation Condition (Note 1) | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg  (%) | SNR (dB) (Note 3) |
| 1 | 10 | 24 | 2 | 2 | R.PDCCH. 1-2.1 FDD | TDLA30-10 | 2x2, ULA Low | 1 | 3.6 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Bandwidth, CORESET parameters, reference channel, Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2  Note 4: CORESETs from TRxP #1 and TRxP #2 should not be overlapped | | | | | | | | | |

#### 5.3.2.2 TDD

The parameters specified in Table 5.3.2.2-1 are valid for all TDD tests unless otherwise stated.

Table 5.3.2.2-1: Test Parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | 1 Tx Antenna | | | 2 Tx Antenna |
| TDD UL-DL pattern |  | FR1.30-1 | | | |
| CCE to REG mapping type |  | Test 3: non-interleaved  Other tests: interleaved | | interleaved | |
| Interleaver size |  | 3 | | | |
| REG bundle size |  | Test 3: 6  Other tests: 2 | Test 1 in Table 5.3.2.2.2.3-1: 6  Other tests: 2 | | |
| Shift Index |  | 0 | | | |

##### 5.3.2.2.1 2Rx TDD FR1 PDCCH 1 Tx antenna performance for both SA and NSA

5.3.2.2.1.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 2 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.2.2.1.3-1. The downlink physical setup is in accordance with Annex C.2.1.

5.3.2.2.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC.

5.3.2.2.1.3 Minimum conformance requirements

For the parameters specified in Table 5.3.2.2-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.2.1.3-1. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.2.2.1.3-1: Minimum performance for PDCCH with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 40 | 102 | 1 | 2 | R.PDCCH.2-1.1 TDD | TDLA30-10 | 1x2 Low | 1 | 7.0 |
| 2 | 40 | 102 | 1 | 4 | R.PDCCH.2-1.2 TDD | TDLC300- 100 | 1x2 Low | 1 | 3.0 |
| 3 | 40 | 48 | 2 | 16 | R.PDCCH.2-2.1 TDD | TDLC300- 100 | 1x2 Low | 1 | -3.8 |

The normative reference for this requirement is TS 38.101-4 [5] clause 5.3.2.2.

5.3.2.2.1.4 Test description

5.3.2.2.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-2 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.2 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.2.2-1 and Table 5.3.2.2.1.3-1 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.2.2.1.4.3.

5.3.2.2.1.4.2 Test procedure

1. SS transmits PDSCH via PDCCH with DCI format as specified in PDCCH Reference Channel for C\_RNTI to transmit the DL RMC according to Table 5.3.2.2.1.3-1. The details of PDCCH are specified in Table 5.3-1, Table 5.3.2.2-1 and Table 5.3.2.2.1.3-1 respectively. The details of PDSCH are specified in Table A.3.3.2.2-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.2.2.1.5-1 as appropriate.

3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.2.2.1.5-1, pass the UE. Otherwise fail the UE.

4. Repeat steps from 1 to 3 for each subtest in Table 5.3.2.2.1.5-1 as appropriate.

5.3.2.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 4.6.1 and 5.4.2.

5.3.2.2.1.4.3.1 Message exceptions for SA

Table 5.3.2.2.1.4.3.1-1: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| frequencyDomainResources | 11111111 00000000 00000000 00000000 00000000 00000 | CORESET to use the least significant 48 RBs of the BWP  Test 3 |  |
| 11111111 11111111 10000000 00000000 00000000 00000 | CORESET to use the least significant 102 RBs of the BWP  Test 1, 2 |  |
| Duration | 2 | SearchSpace duration of 2 symbols  Test 3 |  |
| 1 | SearchSpace duration of 1 symbol  Test 1, 2 |  |
| cce-REG-MappingType CHOICE { |  |  |  |
| Interleaved SEQUENCE { | Null |  | Test 1,  Test 2 |
| reg-BundleSize | n2 |  | 1 Tx |
| interleaverSize | n3 |  | TDD |
| } |  |  |  |
| nonInterleaved | null |  | Test 3 |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.2.1.4.3.1-2: PDCCH *Search Space*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 with condition USS | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel2 | n1 | AL2 | Test 1 |
| aggregationLevel4 | n1 | AL4 | Test 2 |
| aggregationLevel16 | n1 | AL16 | Test 3 |
| } |  |  |  |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| common SEQUENCE { |  |  | CSS, SISS |
| ue-Specific SEQUENCE { |  |  | USS |
| dci-Formats | formats0-1-And-1-1 | DCI Format 1\_1 for test 2 | Long\_DCI |
| formats0-0-And-1-0 | DCI Format 1\_0 for tests 1 and 3 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.2.1.4.3.1-3: Void

Table 5.3.2.2.1.4.3.1-3A: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| resourceAllocation | resourceAllocationType1 |  | Test 1,  Test 3 |
| } |  |  |  |

5.3.2.2.1.4.3.2 Message exceptions for NSA

Same as 5.3.2.2.1.4.3.1.

5.3.2.2.1.5 Test requirement

Table 5.3.2.2.1.5-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.2.1.5-1.

Table 5.3.2.2.1.5-1: Test Requirement for 1Tx PDCCH with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 40 | 102 | 1 | 2 | R.PDCCH.2-1.1 TDD | TDLA30-10 | 1x2 Low | 1 | 7.9 |
| 2 | 40 | 102 | 1 | 4 | R.PDCCH.2-1.2 TDD | TDLC300- 100 | 1x2 Low | 1 | 3.9 |
| 3 | 40 | 48 | 2 | 16 | R.PDCCH.2-2.1 TDD | TDLC300- 100 | 1x2 Low | 1 | -2.9 |

##### 5.3.2.2.2 2Rx TDD FR1 PDCCH 2 Tx antenna performance for both SA and NSA

5.3.2.2.2.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 2 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.2.2.2.3-1. The downlink physical setup is in accordance with Annex C.2.1.

5.3.2.2.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC.

5.3.2.2.2.3 Minimum conformance requirements

For the parameters specified in Table 5.3.2.2-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.2.2.3-1. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.2.2.2.3-1: Minimum performance for PDCCH with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 40 | 90 | 1 | 8 | R.PDCCH.2-1.3 TDD | TDLC300-100 | 2x2 Low | 1 | -1.2 |

The normative reference for this requirement is TS 38.101-4 [5] clause 5.3.2.2.

5.3.2.2.2.4 Test description

5.3.2.2.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-2 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.2.2-1 and Table 5.3.2.2.2.3-1 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.2.2.2.4.3.

5.3.2.2.2.4.2 Test procedure

1. SS transmits PDSCH via PDCCH with DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.3.2.2.2.3-1. The details of PDCCH are specified in Table 5.3-1, Table 5.3.2.2-1 and Table 5.3.2.2.2.3-1 respectively. The details of PDSCH are specified in Table A.3.3.2.2-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.2.2.2.5-1 as appropriate.

3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.2.2.2.5-1, pass the UE. Otherwise fail the UE.

5.3.2.2.2.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.3.2.2.2.4.3.1 Message exceptions for SA

Table 5.3.2.2.2.4.3.1-1: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| frequencyDomainResources | 11111111 11111110 00000000 00000000 00000000 00000 | CORESET to use the least significant 90 RBs of the BWP  Test 1 |  |
| Duration | 1 | SearchSpace duration of 1 symbols  Test 1 |  |
| cce-REG-MappingType CHOICE { |  |  |  |
| Interleaved SEQUENCE { | Null |  |  |
| reg-BundleSize | n6 |  | 2 Tx |
| interleaverSize | n3 |  | TDD |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.2.2.4.3.1-2: PDCCH *Search Space*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 with condition USS | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel8 | n1 | AL8 | Test 1 |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.2.2.4.3.1-3: Void

5.3.2.2.2.4.3.2 Message exceptions for NSA

Same as 5.3.2.2.2.4.3.1.

5.3.2.2.2.5 Test requirement

Table 5.3.2.2.2.5-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.2.2.5-1.

Table 5.3.2.2.2.5-1: Test Requirement for 2Tx PDCCH with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 40 | 90 | 1 | 8 | R.PDCCH.2-1.3 TDD | TDLC300-100 | 2x2 Low | 1 | -0.2 |

##### 5.3.2.2.3 2Rx TDD FR1 PDCCH 1 Tx antenna performance for power saving

5.3.2.2.3.1 Test Purpose

This test verifies the demodulation performance of *DCI format 2\_6* PDCCH under 2 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.2.2.3.3-2 after receipt wake-up indication in the *DCI format 2\_6* PDCCH in DRX off state. The downlink physical setup is in accordance with Annex C.2.1.

5.3.2.2.3.2 Test applicability

This test applies to all types of NR UE release 16 and forward supporting Long DRX Cycle and DRX adaptation.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and Long DRX Cycle and DRX adaptation.

5.3.2.2.3.3 Minimum conformance requirements

During the test the UE shall monitor the *DCI format 2\_6* PDCCH in DRX off state and decide whether to receive the following PDCCH in DRX on period.

The parameters specified in Table 5.3.2.2.3.3-1 are valid for all TDD tests for power saving unless otherwise stated.

Table 5.3.2.2.3.3-1: Test Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | 1 Tx Antenna |
| TDD UL-DL pattern | |  | FR1.30-1 |
| CCE to REG mapping type | |  | interleaved |
| Interleaver size | |  | 3 |
| REG bundle size | |  | 2 |
| Shift Index | |  | 0 |
| DRX cycle | | ms | 10 |
| ps-WakeUp-r16 | |  | absent |
| Wake-up indication bit in DCI format 2\_6 | |  | 1 |
| PDCCH DCI format 2\_6 configuration | PS-offset |  | (TminimumTimeGap+1)//0.125 |
| Number of PDCCH candidates |  | 1 |
| Frequency domain resource allocation for CORESET |  | Start from RB = 0 with contiguous RB allocation |
| TCI state |  | TCI state #1 |
| PDCCH configuration | Slots for PDCCH monitoring |  | Each slot during DRX-on period |
| |  | | --- | | Note: TminimumTimeGap­ is signalled as a part of *drx-Adaptation-r16*UE capability. | | | | |

For the parameters specified in Table 5.3.2.2.3.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) observed on PDCCH during DRX on shall be below the specified value in Table 5.3.2.2.3.3-2. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.2.2.3.3-2: Minimum performance for PDCCH with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 40 | 102 | 1 | 4 | R.PDCCH. 2-1.2 TDD | TDLC300- 100 | 1x2 Low | 1 | 3.0 |
| 8 | R.PDCCH. 2-1.4 TDD |

The normative reference for this requirement is TS 38.101-4 [5] clause 5.3.2.2.

5.3.2.2.3.4 Test description

5.3.2.2.3.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-2 of 38.521-1 [7].

Configurations of DRX, DCP, PDSCH and PDCCH before measurement are specified in 5.3.2.2.3.4.3.1and Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.2 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.2.2-1 and Table 5.3.2.2.3.3-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.2.2.3.4.3.

5.3.2.2.3.4.2 Test procedure

1. SS transmits PDCCH with DCI format2\_6 as specified in PDCCH Reference Channel for PS\_RNTI within DRX off state. The Wake-up indication bit in PDCCH is set to 1.

2. SS transmits PDSCH via PDCCH with DCI format1\_1 as specified in PDCCH Reference Channel for C\_RNTI to transmit the DL RMC according to Table 5.3.2.2.3.3-2 in DRX on period. The details of PDCCH are specified in Table 5.3-1, Table 5.3.2.2-1 and Table 5.3.2.2.3.3-2 respectively. The details of PDSCH are specified in Table A.3.3.2.2-3. The SS sends downlink MAC padding bits on the DL RMC.

3. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.2.2.3.5-1 as appropriate.

4. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.2.2.3.5-1, pass the UE. Otherwise fail the UE.

5. Repeat steps from 2 to 4 for each subtest in Table 5.3.2.2.3.3-2 as appropriate.

5.3.2.2.3.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 4.6.1 and 5.4.2.

5.3.2.2.3.4.3.1 Message exceptions for SA

Table 5.3.2.2.3.4.3.1-1: DRX-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6],Table 4.6.3-56 | | | |
| Information Element | Value/remark | Comment | Condition |
| DRX-Config ::= SEQUENCE { |  |  |  |
| drx-onDurationTimer CHOICE { |  |  |  |
| milliSeconds | ms5 |  |  |
| } |  |  |  |
| drx-InactivityTimer | ms0 |  |  |
| drx-HARQ-RTT-TimerDL | 0 |  |  |
| drx-HARQ-RTT-TimerUL | 0 |  |  |
| drx-RetransmissionTimerDL | sl1 |  |  |
| drx-RetransmissionTimerUL | sl1 |  |  |
| drx-LongCycleStartOffset CHOICE { |  |  |  |
| ms10 | 0 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.2.3.4.3.1-2: DCP-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-106 | | | |
| Information Element | Value/remark | Comment | Condition |
| dcp-Config-r16 CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| ps-Offset-r16 | 28 |  | Scs-30kHz-r16 = sl6 |
| sizeDCI-2-6-r16 | 2 |  |  |
| ps-PositionDCI-2-6-r16 | 0 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.2.3.4.3.1-3: PDCCH-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6],Table 4.6.3-95 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-Config::= SEQUENCE { |  |  |  |
| controlResourceSetToAddModList SEQUENCE(SEQUENCE(SIZE (1..3)) OF ControlResourceSet ::= SEQUENCE { | 1 entry |  |  |
| ControlResourceSet[1] | ControlResourceSet |  |  |
| } |  |  |  |
| searchSpacesToAddModList  SEQUENCE(SIZE (1..10)) OF SearchSpace ::= SEQUENCE { | 2 entries |  |  |
| SearchSpace[1] | SearchSpace1 |  |  |
| SearchSpace[2] | SearchSpace2 |  |  |
| } |  |  |  |
| searchSpacesToAddModListExt-r16 SEQUENCE(SIZE (1..10)) OF SearchSpace { | 2 entries |  |  |
| searchSpaceExt-r16[1] | SearchSpaceExt1 |  |  |
| searchSpaceExt-r16[2] | SearchSpaceExt2 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.2.3.4.3.1-4: PDCCH-ControlResourceSet1

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 1 |  |  |
| frequencyDomainResources | 11111111 11111111 10000000 00000000 00000000 00000 | CORESET to use the least significant 102 RBs of the BWP |  |
| Duration | 1 | SearchSpace duration of 1 symbol |  |
| cce-REG-MappingType CHOICE { |  |  |  |
| Interleaved SEQUENCE { |  |  |  |
| reg-BundleSize | n2 |  | 1 Tx |
| interleaverSize | n3 |  | TDD |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.2.3.4.3.1-5: Void

Table 5.3.2.2.3.4.3.1-6: PDCCH *Search Space1*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| searchSpaceId | 2 | SearchSpaceId with condition USS | USS |
| controlResourceSetId | 1 | ControlResourceSetId |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel4 | n1 | Test AL4 |  |
| aggregationLevel8 | n1 | Test AL8 |  |
| } |  |  |  |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| ue-Specific SEQUENCE { |  |  | USS |
| dci-Formats | formats0-1-And-1-1 | DCI Format 1\_1 | Long\_DCI |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.2.3.4.3.1-6A: PDCCH *Search Space2*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| searchSpaceId | 4 |  |  |
| controlResourceSetId | 1 | ControlResourceSetId |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel4 | n1 | Test AL4 |  |
| aggregationLevel8 | n1 | Test AL8 |  |
| } |  |  |  |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| common SEQUENCE { |  |  | CSS, SISS |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.2.3.4.3.1-7: PDCCH *Search Space Ext1*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7a | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpaceExt-r16 ::= SEQUENCE { |  |  |  |
| controlResourceSetId-r16 | 1 |  |  |
| } |  |  |  |

Table 5.3.2.2.3.4.3.1-7A: PDCCH *Search Space Ext2*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7a | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpaceExt-r16 ::= SEQUENCE { |  |  |  |
| controlResourceSetId-r16 | 1 |  |  |
| searchSpaceType-r16 SEQUENCE { |  |  |  |
| common SEQUENCE { |  |  |  |
| dci-Format2-6-r16 SEQUENCE { | NULL |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.2.3.4.3.1-8: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| TCI-State[1] | TCI-StateId 0 |  |  |
| qcl-type1 { |  | Type 1 QCL information |  |
| Cell | ServCellIndex |  |  |
| Bwp-id | 1 | BWP ID |  |
| referenceSignal | Ssb : 0 | SSB # 0 |  |
| Qcl-Type | Type C |  |  |
| } |  |  |  |
| qcl-type2 { |  | Type 2 QCL information |  |
| Cell | ServCellIndex |  |  |
| Bwp-id | 1 | BWP ID |  |
| referenceSignal | Ssb : 0 | SSB # 0 |  |
| Qcl-Type | Type D |  |  |
| } |  |  |  |
| TCI-State[2] | TCI-StateId 1 | Type 1 QCL information |  |
| qcl-type1 { |  |  |  |
| Cell | ServCellIndex |  |  |
| Bwp-id | 1 | BWP ID |  |
| referenceSignal | csi-rs : 0 | CSI-RS # 0 |  |
| Qcl-Type | Type A |  |  |
| } |  |  |  |
| qcl-type2 { |  | Type 2 QCL information |  |
| Cell | ServCellIndex |  |  |
| Bwp-id | 1 | BWP ID |  |
| referenceSignal | csi-rs : 0 | SSB # 0 |  |
| Qcl-Type | Type D |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.3.2.2.3.4.3.2 Message exceptions for NSA

Same as 5.3.2.2.3.4.3.1.

5.3.2.2.3.5 Test requirement

Table 5.3.2.2.3.5-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.2.3.5-1.

Table 5.3.2.2.3.5-1: Test Requirements for PDCCH with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 40 | 102 | 1 | 4 | R.PDCCH. 2-1.2 TDD | TDLC300- 100 | 1x2 Low | 1 | 3.9 |
| 8 | R.PDCCH. 2-1.4 TDD |

##### 5.3.2.2.4 2Rx TDD FR1 PDCCH performance for RedCap

5.3.2.2.4.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 1 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.2.2.4.3-1. The downlink physical setup is in accordance with Annex C.2.1.

5.3.2.2.4.2 Test applicability

This test case applies to all types of NR UE release 17 and forward that support NR RedCap.

5.3.2.2.4.3 Minimum conformance requirements

For the parameters specified in Table 5.3.2.2-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.2.4.3-1. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.2.2.4.3-1: Minimum performance for PDCCH with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 20 | 48 | 1 | 4 | R.PDCCH.2-1.5 TDD | TDLC300-100 | 1x2 Low | 1 | 3.6 |
| 2 | 20 | 48 | 1 | 8 | R.PDCCH.2-1.6 TDD | TDLC300-100 | 2x2 Low | 1 | 0.0 |

The normative reference for this requirement is TS 38.101-4 [2] clause 5.3.2.2.4.

5.3.2.2.4.4 Test description

5.3.2.2.4.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A in Figure A.3.1.7.1 for TE diagram and clause A.3.2.3 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.3-1 and Table 5.3.2.2.4.5-1 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, *Connected without Release On, Test Mode* On according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.2.2.4.4.3

5.3.2.2.4.4.2 Test procedure

1. SS transmits PDCCH with DCI format as specified in PDCCH Reference Channel for C\_RNTI to transmit the DL RMC according to Table 5.3.2.2.4.5-1. The details of PDCCH are specified in Table 5.3.1, Table 5.3.1.1-1, Table 5.3.2.2.4.5-1 respectively. The details of PDSCH are specified in Table A.3.3.2.2-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.2.2.4.5-1 as appropriate.

3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.2.2.4.5-1, pass the UE. Otherwise fail the UE.

5.3.2.2.4.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2 with the following exceptions:

Table 5.3.2.2.4.4.3-1: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| frequencyDomainResources | 11111111 00000000 00000000 00000000 00000000 00000 | CORESET to use the least significant 48 RBs of the BWP |  |
| Duration | 1 | SearchSpace duration of 1 symbol |  |
| cce-REG-MappingType CHOICE { |  |  |  |
| interleaved ::= SEQUENCE { |  |  |  |
| reg-BundleSize | n2 |  | 1 Tx, 2 Tx |
| interleaverSize | n3 |  | TDD |
| shiftIndex | 0 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.2.4.4.3-2: PDCCH *Search Space*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 with condition USS | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel4 | n1 | AL4 | Test 1 |
| aggregationLevel8 | n1 | AL8 | Test 2 |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| ue-Specific SEQUENCE { |  |  | USS |
| dci-Formats | formats0-1-And-1-1 | DCI Format 1\_1 | Long\_DCI |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.2.4.4.3-3: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| resourceAllocation | resourceAllocationType0 |  |  |
| } |  |  |  |

5.3.2.2.4.5 Test requirement

Table 5.3.2.2.4.5-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.2.4.5-1.

Table 5.3.2.2.4.5-1: Test Requirement for PDCCH with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 20 | 48 | 1 | 4 | R.PDCCH.2-1.5 TDD | TDLC300-100 | 1x2 Low | 1 | 4.4 |
| 2 | 20 | 48 | 1 | 8 | R.PDCCH.2-1.6 TDD | TDLC300-100 | 2x2 Low | 1 | 0.9 |

##### 5.3.2.2.5 2RX TDD Minimum requirements for PDCCH with intra-slot repetition

5.3.2.2.5.1 Test Purpose

This test verifies the demodulation performance of PDCCH 2RX TDD Minimum requirements for PDCCH with intra-slot repetition under 2 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.2.2.5.3-1. The downlink physical setup is in accordance with Annex C.2.1.

5.3.2.2.5.2 Test applicability

This test applies to all types of NR UE release 17 and forward.

This test also applies to all types of EUTRA UE release 17 and forward supporting EN-DC.

5.3.2.2.5.3 Minimum conformance requirements

For the parameters specified in Table 5.3.2.2-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.2.5.3-1. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.2.2.5.3-1: Tests parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | |
| TRxP #1(Note 1) | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | |  | TRxP #1 | |
| PDCCH configuration | | TCI state | |  | TCI State #1 | TCI State #2 |
| CORESETPoolIndex | |  | 0,1 | |
| Repetition transmission schemes | |  | FDM | |
| CCE to REG mapping type | |  | nonInterleaved | |
| REG bundle size | |  | 6 | |
| Time offset/Frequency offset of the second TxRP from the first TxRP | |  | timing offset = -0.25us, frequency offset = 300Hz | |
| Frequency domain resource allocation for CORSET | |  | Frequency non-overlapping | |
| CSI-RS for tracking | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | |
| Density | |  | 3 | |
| CSI-RS periodicity | | Slots | 40 | |
| CSI-RS offset | | Slots | 20 for CSI-RS resources 1 and 2  21 for CSI-RS resources 3 and 4 | 20 for CSI-RS resources 5 and 6  21 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | |
| TCI State #1 | Type 1 QCL information | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | N/A |
| QCL Type |  | Type A | N/A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| TCI State #2 | Type 1 QCL information | | CSI-RS resource |  | N/A | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | Type A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| Note: PDCCH is transmitted from both TRxP #1 and TRxP #2 | | | | | | |

Table 5.3.2.2.5.3-2: Minimum performance for PDCCH with 30kHz SCS (Note 2)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Bandwidth(MHz) | CORESET RB (Note 4) | CORESET duration | Aggregation level | Reference Channel | Propagation Condition (Note 1) | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg  (%) | SNR (dB) (Note 3) |
| 1 | 40 | 48 | 2 | 2 | R.PDCCH. 2-2.2 TDD | TDLA30-10 | 2x2, ULA Low | 1 | 3.5 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Bandwidth, CORESET parameters, reference channel, Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2  Note 4: CORESETs from TRxP #1 and TRxP #2 should not be overlapped | | | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5] clause 5.3.2.2.

5.3.2.2.5.4 Test description

5.3.2.2.5.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-2 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.2.2-1 and Table 5.3.2.2.5.3-1 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.2.2.5.4.3.

5.3.2.2.5.4.2 Test procedure

1. SS transmits PDSCH via PDCCH with DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 5.3.2.2.5.3-1. The details of PDCCH are specified in Table 5.3-1, Table 5.3.2.2-1 and Table 5.3.2.2.5.3-1 respectively. The details of PDSCH are specified in Table A.3.3.2.2-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.2.2.5.3-1 as appropriate.

3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.2.2.5.5-1, pass the UE. Otherwise fail the UE.

5.3.2.2.5.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.3.2.2.5.4.3.1 Message exceptions for SA

Table 5.3.2.2.5.4.3.1-1: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| frequencyDomainResources | 11111111 11111110 00000000 00000000 00000000 00000 | CORESET to use the least significant 48 RBs of the BWP |  |
| Duration | 1 | SearchSpace duration of 1 symbol |  |
| cce-REG-MappingType CHOICE { |  |  |  |
| Interleaved SEQUENCE { | Null |  |  |
| reg-BundleSize | n2 |  | 2 Tx |
| interleaverSize | n3 |  | TDD |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.2.5.4.3.1-2: PDCCH *Search Space*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 with condition USS | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel2 | n1 | AL2 |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.2.5.4.3.1-3: *CSI-ResourcePeriodicityAndOffset* for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots40 | 10 | For CSI-RS resources 1,2,5,6 |  |
| Slots40 | 11 | For CSI-RS resources 3,4,7,8 |  |
| } |  |  |  |

5.3.2.2.5.4.3.2 Message exceptions for NSA

Same as 5.3.2.2.5.4.3.1.

5.3.2.2.5.4.4 Test requirement

Table 5.3.2.2.5.4.4-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.2.2.5.4.4-1.

Table 5.3.2.2.5.4.4-1: Minimum performance for PDCCH with 30kHz SCS (Note 2)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Bandwidth(MHz) | CORESET RB (Note 4) | CORESET duration | Aggregation level | Reference Channel | Propagation Condition (Note 1) | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg  (%) | SNR (dB) (Note 3) |
| 1 | 40 | 48 | 2 | 2 | R.PDCCH. 2-2.2 TDD | TDLA30-10 | 2x2, ULA Low | 1 | 4.4 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Bandwidth, CORESET parameters, reference channel, Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2  Note 4: CORESETs from TRxP #1 and TRxP #2 should not be overlapped | | | | | | | | | |

### 5.3.3 4RX requirements

#### 5.3.3.1 FDD

The parameters specified in Table 5.3.3.1-1 are valid for all FDD tests unless otherwise stated.

Table 5.3.3.1-1: Test Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | 1 Tx Antenna | 2 Tx Antenna |
| CCE to REG mapping type |  | nonInterleaved | |
| REG bundle size |  | 6 | |
| Shift index |  | 0 | |

##### 5.3.3.1.1 4Rx FDD FR1 PDCCH 1 Tx antenna performance for both SA and NSA

5.3.3.1.1.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 4 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.3.1.1.3-1. The downlink physical setup is in accordance with Annex C.2.1.

5.3.3.1.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports.

5.3.3.1.1.3 Minimum conformance requirements

For the parameters specified in Table 5.3.3.1-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.1.1.3-1. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.3.1.1.3-1: Minimum performance for PDCCH with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 10 | 24 | 2 | 2 | R.PDCCH. 1-2.1 FDD | TDLA30-10 | 1x4 Low | 1 | 2.2 |
| 2 | 10 | 24 | 2 | 2 | R.PDCCH. 1-2.3 FDD | TDLC300- 100 | 1x4 Low | 1 | 2.7 |
| 3 | 10 | 48 | 2 | 4 | R.PDCCH. 1-2.4 FDD | TDLA30-10 | 1x4 Low | 1 | 0.2 |
| 4 | 10 | 48 | 1 | 4 | R.PDCCH.1-1.1 FDD | TDLA30-10 | 1x4 Low | 1 | -0.4 |
| 5 | 10 | 48 | 2 | 16 | R.PDCCH. 1-2.6 FDD | TDLA30-10 | 1x4 Medium A | 1 | -3.2 |

The normative reference for this requirement is TS 38.101-4 [5] clause 5.3.3.1.

5.3.3.1.1.4 Test description

5.3.3.1.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.3 for TE diagram and section A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.3.1-1 and Table 5.3.3.1.1.3-1 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.3.1.1.4.3.

5.3.3.1.1.4.2 Test procedure

1. SS transmits PDCCH with DCI format as specified in PDCCH Reference Channel for C\_RNTI to transmit the DL RMC according to Table 5.3.3.1.1.3-1. The details of PDCCH are specified in Table 5.3-1, Table 5.3.3.1-1 and Table 5.3.3.1.1.3-1 respectively. The details of PDSCH are specified in Table A.3.3.1.1-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.3.1.1.5-1 as appropriate.

3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.3.1.1.5-1, pass the UE. Otherwise fail the UE.

4. Repeat steps from 1 to 3 for each subtest in Table 5.3.3.1.1.5-1 as appropriate.

5.3.3.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.3.3.1.1.4.3.1 Message exceptions for SA

Table 5.3.3.1.1.4.3.1-1: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| frequencyDomainResources | 11111111 00000000 00000000 00000000 00000000 00000 | CORESET to use the least significant 48 RBs of the BWP  Test 3, 4, 5 |  |
| 11110000 00000000 00000000 00000000 00000000 00000 | CORESET to use the least significant 24 RBs of the BWP  Test 1, 2 |  |
| Duration | 2 | SearchSpace duration of 2 symbols  Test 1, 2, 3, 5 |  |
| 1 | SearchSpace duration of 1 symbol  Test 4 |  |
| } |  |  |  |

Table 5.3.3.1.1.4.3.1-2: PDCCH *Search Space*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 with condition USS | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel2 | n1 | AL2 | Test 1, Test 2 |
| aggregationLevel4 | n1 | AL4 | Test 3, Test 4 |
| aggregationLevel16 | n1 | AL16 | Test 5 |
| } |  |  |  |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| common SEQUENCE { |  |  | CSS, SISS |
| ue-Specific SEQUENCE { |  |  | USS |
| dci-Formats | formats0-1-And-1-1 | DCI Format 1\_1 for tests 2 and 3 | Long\_DCI |
| formats0-0-And-1-0 | DCI Format 1\_0 for tests 1, 4, 5 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.3.1.1.4.3.1-3: Void

Table 5.3.3.1.1.4.3.1-3A: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| resourceAllocation | resourceAllocationType1 |  | Test 1,  Test 4,  Test 5 |
| } |  |  |  |

5.3.3.1.1.4.3.2 Message exceptions for NSA

Same as 5.3.3.1.1.4.3.1.

5.3.3.1.1.5 Test requirement

Table 5.3.3.1.1.5-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.1.1.5-1.

Table 5.3.3.1.1.5-1: Test Requirement for 1Tx PDCCH with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 10 | 24 | 2 | 2 | R.PDCCH. 1-2.1 FDD | TDLA30-10 | 1x4 Low | 1 | 3.1 |
| 2 | 10 | 24 | 2 | 2 | R.PDCCH. 1-2.3 FDD | TDLC300- 100 | 1x4 Low | 1 | 3.6 |
| 3 | 10 | 48 | 2 | 4 | R.PDCCH. 1-2.4 FDD | TDLA30-10 | 1x4 Low | 1 | 1.1 |
| 4 | 10 | 48 | 1 | 4 | R.PDCCH.1-1.1 FDD | TDLA30-10 | 1x4 Low | 1 | 0.5 |
| 5 | 10 | 48 | 2 | 16 | R.PDCCH. 1-2.6 FDD | TDLA30-10 | 1x4 Medium A | 1 | -2.3 |

##### 5.3.3.1.2 4Rx FDD FR1 PDCCH 2 Tx antenna performance for both SA and NSA

5.3.3.1.2.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 4 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.3.1.2.3-1. The downlink physical setup is in accordance with Annex C.2.1.

5.3.3.1.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports.

5.3.3.1.2.3 Minimum conformance requirements

For the parameters specified in Table 5.3.3.1-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.1.2.3-1. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.3.1.2.3-1: Minimum performance for PDCCH with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 10 | 24 | 2 | 4 | R.PDCCH. 1-2.2 FDD | TDLC300-100 | 2x4 Low | 1 | -1.9 |
| 2 | 10 | 48 | 2 | 8 | R.PDCCH. 1-2.5 FDD | TDLC300-100 | 2x4 Low | 1 | -4.5 |
| 3 | 10 | 48 | 1 | 4 | R.PDCCH.1-1.2 FDD | TDLA30-10 | 2x4 Low | 1 | -1.0 |

The normative reference for this requirement is TS 38.101-4 [5] clause 5.3.3.1.

5.3.3.1.2.4 Test description

5.3.3.1.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and section A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.3.1-1 and Table 5.3.3.1.2.3-1 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode* On*)* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.3.1.2.4.3.

5.3.3.1.2.4.2 Test procedure

1. SS transmits PDCCH with DCI format as specified in PDCCH Reference Channel for C\_RNTI to transmit the DL RMC according to Table 5.3.3.1.2.3-1. The details of PDCCH are specified in Table 5.3-1, Table 5.3.3.1-1 and Table 5.3.3.1.2.3-1 respectively. The details of PDSCH are specified in Table A.3.3.1.1-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.3.1.2.5-1 as appropriate.

3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.3.1.2.5-1, pass the UE. Otherwise fail the UE.

4. Repeat steps from 1 to 3 for each subtest in Table 5.3.3.1.2.5-1 as appropriate.

5.3.3.1.2.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.3.3.1.2.4.3.1 Message exceptions for SA

Table 5.3.3.1.2.4.3.1-1: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| frequencyDomainResources | 11111111 00000000 00000000 00000000 00000000 00000 | CORESET to use the least significant 48 RBs of the BWP  Test 2, 3 |  |
| 11110000 00000000 00000000 00000000 00000000 00000 | CORESET to use the least significant 24 RBs of the BWP  Test 1 |  |
| Duration | 2 | SearchSpace duration of 2 symbols  Test 1, 2 |  |
| 1 | SearchSpace duration of 1 symbol  Test3 |  |
| } |  |  |  |

Table 5.3.3.1.2.4.3.1-2: PDCCH *Search Space*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 with condition USS | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel4 | n1 | AL4 | Test 1, Test 3 |
| aggregationLevel8 | n1 | AL8 | Test 2 |
| } |  |  |  |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| common SEQUENCE { |  |  | CSS, SISS |
| ue-Specific SEQUENCE { |  |  | USS |
| dci-Formats | formats0-1-And-1-1 | DCI Format 1\_1 for tests 2 and 3 | Long\_DCI |
| formats0-0-And-1-0 | DCI Format 1\_0 for test 1 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.3.1.2.4.3.1-3: Void

Table 5.3.3.1.2.4.3.1-3A: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| resourceAllocation | resourceAllocationType1 |  | Test 1 |
| } |  |  |  |

5.3.3.1.2.4.3.2 Message exceptions for NSA

Same as 5.3.3.1.2.4.3.1.

5.3.3.1.2.5 Test requirement

Table 5.3.3.1.2.5-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.1.2.5-1.

Table 5.3.3.1.2.5-1: Test Requirement for 2Tx PDCCH with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 10 | 24 | 2 | 4 | R.PDCCH. 1-2.2 FDD | TDLC300-100 | 2x4 Low | 1 | -0.9 |
| 2 | 10 | 48 | 2 | 8 | R.PDCCH. 1-2.5 FDD | TDLC300-100 | 2x4 Low | 1 | -3.5 |
| 3 | 10 | 48 | 1 | 4 | R.PDCCH.1-1.2 FDD | TDLA30-10 | 2x4 Low | 1 | 0 |

##### 5.3.3.1.3 4Rx FDD FR1 PDCCH 1 Tx antenna performance for power saving

5.3.3.1.3.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 4 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.3.1.3.3-2. The downlink physical setup is in accordance with Annex C.2.1.

5.3.3.1.3.2 Test applicability

This test applies to all types of NR UE release 16 and forward that supporting 4 Rx antenna ports and DRX adaptation.

This test also applies to all types of EUTRA UE release 16 and forward that supporting EN-DC, 4 Rx antenna ports, Long DRX and DRX adaptation.

5.3.3.1.3.3 Minimum conformance requirements

The parameters specified in Table 5.3.3.1.3.3-1 are valid for FDD test unless otherwise stated.

Table 5.3.3.1.3.3-1: Test Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | 1 Tx Antenna |
| CCE to REG mapping type | |  | nonInterleaved |
| REG bundle size | |  | 6 |
| Shift Index | |  | 0 |
| DRX cycle | | ms | 10 |
| ps-WakeUp-r16 | |  | absent |
| Wake-up indication bit in DCI format 2\_6 | |  | 1 |
| PDCCH DCI format 2\_6 configuration | PS-offset |  |  |
| Number of PDCCH candidates |  | 1 |
| Frequency domain resource allocation for CORESET |  | Start from RB = 0 with contiguous RB allocation |
| TCI state |  | TCI state #1 |
| Slots for PDCCH monitoring | |  | Each slot during DRX-on period |
| Note: TminimumTimeGap­ is signalled as a part of *drx-Adaptation-r16*UE capability. | | | |

For the parameters specified in Table 5.3.3.1.3.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.1.3.3-2. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.3.1.3.3-2: Minimum performance for PDCCH with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 10 | 48 | 2 | 4 | R.PDCCH. 1-2.4 FDD | TDLA30-10 | 1x4 Low | 1 | 0.2 |
| 2 | 8 | R.PDCCH. 1-2.7 FDD |

The normative reference for this requirement is TS 38.101-4 [2] clause 5.3.3.1.3.

5.3.3.1.3.4 Test description

5.3.3.1.3.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.3.1-1, Table 5.3.3.1.3.3-1 and Table 5.3.3.1.3.3-2 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.3.1.3.4.3.

5.3.3.1.3.4.2 Test procedure

1. SS transmits PDCCH with DCI format2\_6 as specified in PDCCH Reference Channel for PS\_RNTI within DRX off state. The Wake-up indication bit in PDCCH is set to 1.

2. SS transmits PDSCH with PDCCH with DCI format 1\_1 as specified in PDCCH Reference Channel for C\_RNTI to transmit the DL RMC according to Table 5.3.3.1.3.3-2 in DRX on period. The details of PDCCH are specified in Table 5.3.1, Table 5.3.3.1-1, Table 5.3.3.1.3.3-1 and Table 5.3.3.1.3.3-2 respectively. The details of PDSCH are specified in Table A.3.3.1.1-3. The SS sends downlink MAC padding bits on the DL RMC. During the test the UE shall monitor the DCI format 2\_6 PDCCH in DRX off state and decide whether to receive the following PDCCH in DRX on period.

3. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.3.1.3.4.4-1 as appropriate.

4. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.3.1.3.4.4-1, pass the UE. Otherwise fail the UE.

5. Repeat steps from 2 to 4 for each subtest in Table 5.3.3.1.3.3-2 as appropriate.

5.3.3.1.3..3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.3.3.1.3.4.3.1 Message exceptions for SA

Table 5.3.3.1.3.4.3.1-1: DRX-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4],Table 4.6.3-56 | | | |
| Information Element | Value/remark | Comment | Condition |
| DRX-Config ::= SEQUENCE { |  |  |  |
| drx-onDurationTimer CHOICE { |  |  |  |
| milliSeconds | ms5 |  |  |
| } |  |  |  |
| drx-InactivityTimer | ms0 |  |  |
| drx-HARQ-RTT-TimerDL | 0 |  |  |
| drx-HARQ-RTT-TimerUL | 0 |  |  |
| drx-RetransmissionTimerDL | sl1 |  |  |
| drx-RetransmissionTimerUL | sl1 |  |  |
| drx-LongCycleStartOffset CHOICE { |  |  |  |
| ms10 | 0 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.3.1.3.4.3.1-2: DCP-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-106 | | | |
| Information Element | Value/remark | Comment | Condition |
| dcp-Config-r16 CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| ps-Offset-r16 | 32 |  | Scs-15kHz-r16 = sl3 |
| sizeDCI-2-6-r16 | 2 |  |  |
| ps-PositionDCI-2-6-r16 | 0 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.3.1.3.4.3.1-3: PDCCH-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6],Table 4.6.3-95 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-Config::= SEQUENCE { |  |  |  |
| controlResourceSetToAddModList SEQUENCE(SEQUENCE(SIZE (1..3)) OF ControlResourceSet ::= SEQUENCE { | 1 entry |  |  |
| ControlResourceSet[1] | ControlResourceSet |  |  |
| } |  |  |  |
| searchSpacesToAddModList  SEQUENCE(SIZE (1..10)) OF SearchSpace ::= SEQUENCE { | 2 entries |  |  |
| SearchSpace[1] | SearchSpace1 |  |  |
| SearchSpace[2] | SearchSpace2 |  |  |
| } |  |  |  |
| searchSpacesToAddModListExt-r16 SEQUENCE(SIZE (1..10)) OF SearchSpace { | 2 entries |  |  |
| searchSpaceExt-r16[1] | SearchSpaceExt1 |  |  |
| searchSpaceExt-r16[2] | SearchSpaceExt2 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.1.3.4.3.1-4: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 1 |  |  |
| frequencyDomainResources | 11111111 00000000 00000000 00000000 00000000 00000 | CORESET to use the least significant 48 RBs of the BWP |  |
| Duration | 2 | SearchSpace duration of 2 symbol |  |
| cce-REG-MappingType CHOICE { |  |  |  |
| nonInterleaved SEQUENCE |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.2.1.3.4.3.1-5: Void

Table 5.3.3.1.3.4.3.1-6: PDCCH *Search Space1*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| searchSpaceId | 2 | SearchSpaceId with condition USS |  |
| controlResourceSetId | 1 | ControlResourceSetId |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel4 | n1 | Test AL4 |  |
| aggregationLevel8 | n1 | Test AL8 |  |
| } |  |  |  |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| common SEQUENCE { |  |  |  |
| ue-Specific SEQUENCE { |  |  |  |
| dci-Formats | formats0-1-And-1-1 | DCI Format 1\_1 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.3.1.3.4.3.1-6A: PDCCH *Search Space2*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| searchSpaceId | 4 |  |  |
| controlResourceSetId | 1 | ControlResourceSetId |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel4 | n1 | Test AL4 |  |
| aggregationLevel8 | n1 | Test AL8 |  |
| } |  |  |  |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| common SEQUENCE { |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.3.1.3.4.3.1-7: PDCCH *Search Space Ext1*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7a | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpaceExt-r16 ::= SEQUENCE { |  |  |  |
| controlResourceSetId-r16 | 1 |  |  |
| } |  |  |  |

Table 5.3.3.1.3.4.3.1-7A: PDCCH *Search Space Ext2*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7a | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpaceExt-r16 ::= SEQUENCE { |  |  |  |
| controlResourceSetId-r16 | 1 |  |  |
| searchSpaceType-r16 SEQUENCE { |  |  |  |
| common SEQUENCE { |  |  |  |
| dci-Format2-6-r16 SEQUENCE { | NULL |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.3.1.3.4.3.1-8: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| TCI-State[1] | TCI-StateId 0 |  |  |
| qcl-type1 { |  | Type 1 QCL information |  |
| Cell | ServCellIndex |  |  |
| Bwp-id | 1 | BWP ID |  |
| referenceSignal | Ssb : 0 | SSB # 0 |  |
| Qcl-Type | Type C |  |  |
| } |  |  |  |
| qcl-type2 { |  | Type 2 QCL information |  |
| Cell | ServCellIndex |  |  |
| Bwp-id | 1 | BWP ID |  |
| referenceSignal | Ssb : 0 | SSB # 0 |  |
| Qcl-Type | Type D |  |  |
| } |  |  |  |
| TCI-State[2] | TCI-StateId 1 | Type 1 QCL information |  |
| qcl-type1 { |  |  |  |
| Cell | ServCellIndex |  |  |
| Bwp-id | 1 | BWP ID |  |
| referenceSignal | csi-rs : 0 | CSI-RS # 0 |  |
| Qcl-Type | Type A |  |  |
| } |  |  |  |
| qcl-type2 { |  | Type 2 QCL information |  |
| Cell | ServCellIndex |  |  |
| Bwp-id | 1 | BWP ID |  |
| referenceSignal | csi-rs : 0 | SSB # 0 |  |
| Qcl-Type | Type D |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.3.3.1.3.4.3.2 Message exceptions for NSA

Same as 5.3.3.1.3.4.3.1

5.3.3.1.3.4.4 Test requirement

Table 5.3.3.1.3.4.4-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.1.3.4.4-1.

Table 5.3.3.1.3.4.4-1: Test Requirements for PDCCH with 15 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 10 | 48 | 2 | 4 | R.PDCCH. 1-2.4 FDD | TDLA30-10 | 1x4 Low | 1 | 1.1 |
| 2 | 8 | R.PDCCH. 1-2.7 FDD |

##### 5.3.3.1.4 4RX FDD Minimum requirements for PDCCH with intra-slot repetition

5.3.3.1.4.1 Test Purpose

This test verifies the demodulation performance of PDCCH with intra-slot repetition under 4 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.3.1.4.3-2. The downlink physical setup is in accordance with Annex C.2.1.

5.3.3.1.4.2 Test applicability

This test applies to all types of NR UE release 17 and forward.

This test also applies to all types of EUTRA UE release 17 and forward supporting EN-DC.

5.3.3.1.4.3 Minimum conformance requirements

Table 5.3.3.1.4.3-1: Test Parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | |
| TRxP #1(Note 1) | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | |  | TRxP #1 | |
| PDCCH configuration | | TCI state | |  | TCI State #1 | TCI State #2 |
| CORESETPoolIndex | |  | 0,1 | |
| Repetition transmission schemes | |  | FDM | |
| CCE to REG mapping type | |  | nonInterleaved | |
| REG bundle size | |  | 6 | |
| Time offset/Frequency offset of the second TxRP from the first TxRP | |  | timing offset = -0.5us, frequency offset = 200Hz | |
| Frequency domain resource allocation for CORSET | |  | Frequency non-overlapping | |
| CSI-RS for tracking | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | |
| Density | |  | 3 | |
| CSI-RS periodicity | | Slots | 20 | |
| CSI-RS offset | | Slots | 10 for CSI-RS resources 1 and 2  11 for CSI-RS resources 3 and 4 | 10 for CSI-RS resources 5 and 6  11 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | |
| TCI State #1 | Type 1 QCL information | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | N/A |
| QCL Type |  | Type A | N/A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| TCI State #2 | Type 1 QCL information | | CSI-RS resource |  | N/A | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | Type A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| Note: PDCCH is transmitted from both TRxP #1 and TRxP #2 | | | | | | |

For the parameters specified in Table 5.3.3.1.3.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.1.3.3-2. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.3.1.4.3-2: Minimum performance for PDCCH with 15kHz SCS (Note 2)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Bandwidth(MHz) | CORESET RB (Note 4) | CORESET duration | Aggregation level | Reference Channel | Propagation Condition (Note 1) | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg  (%) | SNR (dB) (Note 3) |
| 1 | 10 | 24 | 2 | 2 | R.PDCCH. 1-2.1 FDD | TDLA30-10 | 2x4, ULA Low | 1 | -1.2 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Bandwidth, CORESET parameters, reference channel, Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2  Note 4: CORESETs from TRxP #1 and TRxP #2 should not be overlapped | | | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [2] clause 5.3.3.1.4.

5.3.3.1.4.4 Test description

5.3.3.1.4.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.3.1-1 and Table 5.3.3.1.4.3-1 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.3.1.4.4.3.

5.3.3.1.4.4.2 Test procedure

1. SS transmits PDCCH with DCI format as specified in PDCCH Reference Channel for C\_RNTI to transmit the DL RMC according to Table 5.3.3.1.4.3-1. The details of PDCCH are specified in Table 5.3.1, Table 5.3.3.1-1, Table 5.3.3.1.4.3-1 respectively. The details of PDSCH are specified in Table A.3.3.1.1-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.3.1.4.3-1 as appropriate.

3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.3.1.4.4.4-1, pass the UE. Otherwise fail the UE.

5.3.3.1.4.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.3.3.1.4.4.3.1 Message exceptions for SA

Table 5.3.3.1.4.4.3.1-1: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| frequencyDomainResources | 11110000 00000000 00000000 00000000 00000000 00000 | CORESET to use the least significant 24 RBs of the BWP |  |
| Duration | 1 | SearchSpace duration of 1 symbol |  |
|  |  |  |
| } |  |  |  |

Table 5.3.3.1.4.4.3.1-2: PDCCH *Search Space*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel2 | n1 |  |  |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| common SEQUENCE { |  |  | CSS, SISS |
| ue-Specific SEQUENCE { |  |  | USS |
| dci-Formats | formats0-0-And-1-0 | DCI Format 1\_0 for tests 1 | Long\_DCI |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.3.1.4.4.3.1-3: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| resourceAllocation | resourceAllocationType1 |  |  |
| } |  |  |  |

Table 5.3.3.1.4.4.3.1-4: *CSI-ResourcePeriodicityAndOffset* for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots40 | 10 | For CSI-RS resources 1,2,5,6 |  |
| Slots40 | 11 | For CSI-RS resources 3,4,7,8 |  |
| } |  |  |  |

5.3.3.1.4.4.3.2 Message exceptions for NSA

Same as 5.3.3.1.4.4.3.1

5.3.3.1.4.4.4 Test requirement

Table 5.3.3.1.4.4.4-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.1.4.4.4-1.

Table 5.3.3.1.4.4.4-1: Test Requirements for PDCCH with 15kHz SCS (Note 2)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Bandwidth(MHz) | CORESET RB (Note 4) | CORESET duration | Aggregation level | Reference Channel | Propagation Condition (Note 1) | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg  (%) | SNR (dB) (Note 3) |
| 1 | 10 | 24 | 2 | 2 | R.PDCCH. 1-2.1 FDD | TDLA30-10 | 2x4, ULA Low | 1 | -0.3 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Bandwidth, CORESET parameters, reference channel, Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2  Note 4: CORESETs from TRxP #1 and TRxP #2 should not be overlapped | | | | | | | | | |

#### 5.3.3.2 TDD

The parameters specified in Table 5.3.3.2-1 are valid for all TDD tests unless otherwise stated.

Table 5.3.3.2-1: Common Test Parameters

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Unit | 1 Tx Antenna | | | 2 Tx Antenna |
| TDD UL-DL pattern |  | FR1.30-1 | | | |
| CCE to REG mapping type |  | Test 3: Non-interleaved  Other tests: interleaved | interleaved | | |
| Interleaver size |  | 3 | | | |
| REG bundle size |  | Test 3: 6  Other tests: 2 | | 6 | |
| Shift Index |  | 0 | | | |

##### 5.3.3.2.1 4Rx TDD FR1 PDCCH 1 Tx antenna performance for both SA and NSA

5.3.3.2.1.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 4 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.3.2.1.3-1. The downlink physical setup is in accordance with Annex C.2.1.

5.3.3.2.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports.

5.3.3.2.1.3 Minimum conformance requirements

For the parameters specified in Table 5.3.3.2-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.2.1.3-1. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.3.2.1.3-1: Minimum performance for PDCCH with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 40 | 102 | 1 | 2 | R.PDCCH.2-1.1 TDD | TDLA30-10 | 1x4 Low | 1 | 2.1 |
| 2 | 40 | 102 | 1 | 4 | R.PDCCH.2-1.2 TDD | TDLC300-100 | 1x4 Low | 1 | -0.9 |
| 3 | 40 | 48 | 2 | 16 | R.PDCCH.2-2.1 TDD | TDLA30-10 | 1x4 Medium A | 1 | -3.6 |

The normative reference for this requirement is TS 38.101-4 [5] clause 5.3.3.2.

5.3.3.2.1.4 Test description

5.3.3.2.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-2 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.3 for TE diagram and section A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.3.2-1 and Table 5.3.3.2.1.3-1 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode* On*)* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.3.2.1.4.3.

5.3.3.2.1.4.2 Test procedure

1. SS transmits PDSCH via PDCCH with DCI format as specified in PDCCH Reference Channel for C\_RNTI to transmit the DL RMC according to Table 5.3.3.2.1.3-1. The details of PDCCH are specified in Table 5.3-1, Table 5.3.3.2-1 and Table 5.3.3.2.1.3-1 respectively. The details of PDSCH are specified in Table A.3.3.2.2-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.3.2.1.5-1 as appropriate.

3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.3.2.1.5-1, pass the UE. Otherwise fail the UE.

4. Repeat steps from 1 to 3 for each subtest in Table 5.3.3.2.1.5-1 as appropriate.

5.3.3.2.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.3.3.2.1.4.3.1 Message exceptions for SA

Table 5.3.3.2.1.4.3.1-1: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| frequencyDomainResources | 11111111 00000000 00000000 00000000 00000000 00000 | CORESET to use the least significant 48 RBs of the BWP  Test 3 |  |
| 11111111 11111111 10000000 00000000 00000000 00000 | CORESET to use the least significant 102 RBs of the BWP  Test 1, 2 |  |
| Duration | 2 | SearchSpace duration of 2 symbols  Test 3 |  |
| 1 | SearchSpace duration of 1 symbol  Test 1, 2 |  |
| cce-REG-MappingType CHOICE { |  |  |  |
| Interleaved SEQUENCE { | Null |  | Test 1,  Test 2 |
| reg-BundleSize | n2 |  | 1 Tx |
| interleaverSize | n3 |  | TDD |
| } |  |  |  |
| nonInterleaved | null |  | Test 3 |
| } |  |  |  |
| } |  |  |  |

Table 5.3.3.2.1.4.3.1-2: PDCCH *Search Space*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 with condition USS | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel2 | n1 | AL2 | Test 1 |
| aggregationLevel4 | n1 | AL4 | Test 2 |
| aggregationLevel16 | n1 | AL16 | Test 3 |
| } |  |  |  |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| common SEQUENCE { |  |  | CSS, SISS |
| ue-Specific SEQUENCE { |  |  | USS |
| dci-Formats | formats0-1-And-1-1 | DCI Format 1\_1 for test 2 | Long\_DCI |
| formats0-0-And-1-0 | DCI Format 1\_0 for test 1 and 3 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.3.2.1.4.3.1-3: Void

Table 5.3.3.2.1.4.3.1-3A: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.2-3 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| resourceAllocation | resourceAllocationType1 |  | Test 1,  Test 3 |
| } |  |  |  |

5.3.3.2.1.4.3.2 Message exceptions for NSA

Same as 5.3.3.2.1.4.3.1.

5.3.3.2.1.5 Test requirement

Table 5.3.3.2.1.5-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.2.1.5-1.

Table 5.3.3.2.1.5-1: Test Requirement for 1Tx PDCCH with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 40 | 102 | 1 | 2 | R.PDCCH.2-1.1 TDD | TDLA30-10 | 1x4 Low | 1 | 3 |
| 2 | 40 | 102 | 1 | 4 | R.PDCCH.2-1.2 TDD | TDLC300-100 | 1x4 Low | 1 | 0 |
| 3 | 40 | 48 | 2 | 16 | R.PDCCH.2-2.1 TDD | TDLA30-10 | 1x4 Medium A | 1 | -2.7 |

##### 5.3.3.2.2 4Rx TDD FR1 PDCCH 2 Tx antenna performance for both SA and NSA

5.3.3.2.2.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 4 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.3.2.2.3-1. The downlink physical setup is in accordance with Annex C.2.1.

5.3.3.2.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports.

5.3.3.2.2.3 Minimum conformance requirements

For the parameters specified in Table 5.3.3.2-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.2.2.3-1. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.3.2.2.3-1: Minimum performance for PDCCH with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 40 | 90 | 1 | 8 | R.PDCCH.2-1.3 | TDLC300-100 | 2x4 Low | 1 | -4.3 |

The normative reference for this requirement is TS 38.101-4 [5] clause 5.3.3.2.

5.3.3.2.2.4 Test description

5.3.3.2.2.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-2 of 38.521-1 [7].

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and section A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.3.2-1 and Table 5.3.3.2.2.3-1 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.3.2.2.4.3.

5.3.3.2.2.4.2 Test procedure

1. SS transmits PDSCH via PDCCH with DCI format as specified in PDCCH Reference Channel for C\_RNTI to transmit the DL RMC according to Table 5.3.3.2.2.3-1. The details of PDCCH are specified in Table 5.3-1, Table 5.3.3.2-1 and Table 5.3.3.2.2.3-1. The details of PDSCH are specified in Table A.3.3.2.2-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.3.2.2.5-1 as appropriate.

3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.3.2.2.5-1, pass the UE. Otherwise fail the UE.

4. Repeat steps from 1 to 3 for each subtest in Table 5.3.3.2.2.5-1 as appropriate.

5.3.3.2.2.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 4.6.1 and 5.4.2.

5.3.3.2.2.4.3.1 Message exceptions for SA

Table 5.3.3.2.2.4.3.1-1: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| frequencyDomainResources | 11111111 11111110 00000000 00000000 00000000 00000 | CORESET to use the least significant 90 RBs of the BWP  Test 1 |  |
| Duration | 1 | SearchSpace duration of 1 symbols  Test 1 |  |
| cce-REG-MappingType CHOICE { |  |  |  |
| Interleaved SEQUENCE { | Null |  |  |
| reg-BundleSize | n6 |  | 2 Tx |
| interleaverSize | n3 |  | TDD |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.3.2.2.4.3.1-2: PDCCH *Search Space*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 with condition USS | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel8 | n1 | AL8 | Test 1 |
| } |  |  |  |
| } |  |  |  |

Table 5.3.3.2.2.4.3.1-3: Void

5.3.3.2.2.4.3.2 Message exceptions for NSA

FFS

5.3.3.2.2.5 Test requirement

Table 5.3.3.2.2.5-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.2.2.5-1.

Table 5.3.3.2.2.5-1: Test Requirement for 2Tx PDCCH with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 40 | 90 | 1 | 8 | R.PDCCH.2-1.3 | TDLC300-100 | 2x4 Low | 1 | -3.3 |

##### 5.3.3.2.3 4Rx TDD FR1 PDCCH 1 Tx antenna performance for power saving

5.3.3.2.3.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 4 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.3.2.3.3-2 after receipt wake-up indication in the *DCI format 2\_6* PDCCH in DRX off state. The downlink physical setup is in accordance with Annex C.2.1.

5.3.3.2.3.2 Test applicability

This test applies to all types of NR UE release 16 and forward supporting 4 Rx antenna ports and Long DRX Cycle and DRX adaptation.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and 4 Rx antenna ports and Long DRX Cycle and DRX adaptation.

5.3.3.2.3.3 Minimum conformance requirements

During the test the UE shall monitor the *DCI format 2\_6* PDCCH in DRX off state and decide whether to receive the following PDCCH in DRX on period.

For the parameters specified in Table 5.3.3.2.3.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) observed on PDCCH during DRX on shall be below the specified value in Table 5.3.3.2.3.3-2. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.3.2.3.3-1: Test Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | 1 Tx Antenna |
| TDD UL-DL pattern | |  | FR1.30-1 |
| CCE to REG mapping type | |  | interleaved |
| Interleaver size | |  | 3 |
| REG bundle size | |  | 2 |
| Shift Index | |  | 0 |
| DRX cycle | | ms | 10 |
| ps-WakeUp-r16 | |  | absent |
| Wake-up indication bit in DCI format 2\_6 | |  | 1 |
| PDCCH DCI format 2\_6 configuration | PS-offset |  | (TminimumTimeGap+1)//0.125 |
| Number of PDCCH candidates |  | 1 |
| Frequency domain resource allocation for CORESET |  | Start from RB = 0 with contiguous RB allocation |
| TCI state |  | TCI state #1 |
| Slots for PDCCH monitoring | |  | Each slot during DRX-on period |
| Note: TminimumTimeGap­ is signalled as a part of *drx-Adaptation-r16*UE capability. | | | |

Table 5.3.3.2.3.3-2: Minimum performance for PDCCH with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 40 | 102 | 1 | 4 | R.PDCCH. 2-1.2 TDD | TDLC300- 100 | 1x4 Low | 1 | -0.9 |
| 8 | R.PDCCH. 2-1.4 TDD |

The normative reference for this requirement is TS 38.101-4 [5] clause 5.3.3.2.

5.3.3.2.3.4 Test description

5.3.3.2.3.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-2 of 38.521-1 [7].

Configurations of DRX, DCP, PDSCH and PDCCH before measurement are specified in 5.3.3.2.3.4.3.1 and Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D.

1. Connect the SS, the faders and AWGN noise sources to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.3 for TE diagram and section A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.3.2-1 and Table 5.3.3.2.1.3-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode* On*)* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.3.2.1.4.3.

5.3.3.2.3.4.2 Test procedure

1. SS transmits PDCCH with DCI format2\_6 as specified in PDCCH Reference Channel for PS\_RNTI within DRX off state. The Wake-up indication bit in PDCCH is set to 1.

2. SS transmits PDSCH via PDCCH with DCI format1\_1 as specified in PDCCH Reference Channel for C\_RNTI to transmit the DL RMC according to Table 5.3.3.2.3.3-2 in DRX on period. The details of PDCCH are specified in Table 5.3-1, Table 5.3.3.2-1 and Table 5.3.3.2.3.3-2 respectively. The details of PDSCH are specified in Table A.3.3.2.2-3. The SS sends downlink MAC padding bits on the DL RMC.

3. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.3.2.3.5-1as appropriate.

4. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.3.2.3.5-1, pass the UE. Otherwise fail the UE.

5. Repeat steps from 2 to 4 for each subtest in Table 5.3.3.2.3.3-2 as appropriate.

5.3.3.2.3.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 4.6.1 and 5.4.2.

5.3.3.2.3.4.3.1 Message exceptions for SA

Table 5.3.3.2.3.4.3.1-1: DRX-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4],Table 4.6.3-56 | | | |
| Information Element | Value/remark | Comment | Condition |
| DRX-Config ::= SEQUENCE { |  |  |  |
| drx-onDurationTimer CHOICE { |  |  |  |
| milliSeconds | ms5 |  |  |
| } |  |  |  |
| drx-InactivityTimer | ms0 |  |  |
| drx-HARQ-RTT-TimerDL | 0 |  |  |
| drx-HARQ-RTT-TimerUL | 0 |  |  |
| drx-RetransmissionTimerDL | sl1 |  |  |
| drx-RetransmissionTimerUL | sl1 |  |  |
| drx-LongCycleStartOffset CHOICE { |  |  |  |
| ms10 | 0 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.3.2.3.4.3.1-2: DCP-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-106 | | | |
| Information Element | Value/remark | Comment | Condition |
| dcp-Config-r16 CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| ps-Offset-r16 | 28 |  | Scs-30kHz-r16 = sl6 |
| sizeDCI-2-6-r16 | 2 |  |  |
| ps-PositionDCI-2-6-r16 | 0 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.3.2.3.4.3.1-3: PDCCH-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6],Table 4.6.3-95 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-Config::= SEQUENCE { |  |  |  |
| controlResourceSetToAddModList SEQUENCE(SEQUENCE(SIZE (1..3)) OF ControlResourceSet ::= SEQUENCE { | 1 entry |  |  |
| ControlResourceSet[1] | ControlResourceSet |  |  |
| } |  |  |  |
| searchSpacesToAddModList  SEQUENCE(SIZE (1..10)) OF SearchSpace ::= SEQUENCE { | 2 entries |  |  |
| SearchSpace[1] | SearchSpace1 |  |  |
| SearchSpace[2] | SearchSpace2 |  |  |
| } |  |  |  |
| searchSpacesToAddModListExt-r16 SEQUENCE(SIZE (1..10)) OF SearchSpace { | 2 entries |  |  |
| searchSpaceExt-r16[1] | SearchSpaceExt1 |  |  |
| searchSpaceExt-r16[2] | SearchSpaceExt2 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.3.2.3.4.3.1-4: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| controlResourceSetId | 1 |  |  |
| frequencyDomainResources | 11111111 11111111 10000000 00000000 00000000 00000 | CORESET to use the least significant 102 RBs of the BWP |  |
| Duration | 1 | SearchSpace duration of 1 symbol |  |
| cce-REG-MappingType CHOICE { |  |  |  |
| Interleaved SEQUENCE { | Null |  |  |
| reg-BundleSize | n2 |  | 1 Tx |
| interleaverSize | n3 |  | TDD |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.3.2.3.4.3.1-5: Void

Table 5.3.3.2.3.4.3.1-6: PDCCH *Search Space1*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| searchSpaceId | 2 | SearchSpaceId with condition USS | USS |
| controlResourceSetId | 1 | ControlResourceSetId |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel4 | n1 | Test AL4 |  |
| aggregationLevel8 | n1 | Test AL8 |  |
| } |  |  |  |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| common SEQUENCE { |  |  | CSS, SISS |
| ue-Specific SEQUENCE { |  |  | USS |
| dci-Formats | formats0-1-And-1-1 | DCI Format 1\_1 | Long\_DCI |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.3.2.3.4.3.1-6A: PDCCH *Search Space2*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| searchSpaceId | 4 |  |  |
| controlResourceSetId | 1 | ControlResourceSetId |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel4 | n1 | Test AL4 |  |
| aggregationLevel8 | N1 | Test AL8 |  |
| } |  |  |  |
| } |  |  |  |
| searchSpaceType CHOICE { |  |  |  |
| common SEQUENCE { |  |  | CSS, SISS |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.3.2.3.4.3.1-7: PDCCH *Search Space Ext1*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7a | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpaceExt-r16 ::= SEQUENCE { |  |  |  |
| controlResourceSetId-r16 | 1 |  |  |
| } |  |  |  |

Table 5.3.3.2.3.4.3.1-7A: PDCCH *Search Space Ext2*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7a | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpaceExt-r16 ::= SEQUENCE { |  |  |  |
| controlResourceSetId-r16 | 1 |  |  |
| searchSpaceType-r16 SEQUENCE { |  |  |  |
| common SEQUENCE { |  |  |  |
| dci-Format2-6-r16 SEQUENCE { | NULL |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.3.2.3.4.3.1-8: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| TCI-State[1] | TCI-StateId 0 |  |  |
| qcl-type1 { |  | Type 1 QCL information |  |
| Cell | ServCellIndex |  |  |
| Bwp-id | 1 | BWP ID |  |
| referenceSignal | Ssb : 0 | SSB # 0 |  |
| Qcl-Type | Type C |  |  |
| } |  |  |  |
| qcl-type2 { |  | Type 2 QCL information |  |
| Cell | ServCellIndex |  |  |
| Bwp-id | 1 | BWP ID |  |
| referenceSignal | Ssb : 0 | SSB # 0 |  |
| Qcl-Type | Type D |  |  |
| } |  |  |  |
| TCI-State[2] | TCI-StateId 1 | Type 1 QCL information |  |
| qcl-type1 { |  |  |  |
| Cell | ServCellIndex |  |  |
| Bwp-id | 1 | BWP ID |  |
| referenceSignal | csi-rs : 0 | CSI-RS # 0 |  |
| Qcl-Type | Type A |  |  |
| } |  |  |  |
| qcl-type2 { |  | Type 2 QCL information |  |
| Cell | ServCellIndex |  |  |
| Bwp-id | 1 | BWP ID |  |
| referenceSignal | csi-rs : 0 | SSB # 0 |  |
| Qcl-Type | Type D |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

5.3.3.2.3.4.3.2 Message exceptions for NSA

Same as 5.3.3.2.3.4.3.1.

5.3.3.2.3.5 Test requirement

Table 5.3.3.2.3.5-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.2.3.5-1.

Table 5.3.3.2.3.5-1: Test Requirements for PDCCH with 30 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNR (dB) |
| 1 | 40 | 102 | 1 | 4 | R.PDCCH. 2-1.2 TDD | TDLC300- 100 | 1x4 Low | 1 | 0 |
| 8 | R.PDCCH. 2-1.4 TDD |

##### 5.3.3.2.4 4RX TDD Minimum requirements for PDCCH with intra-slot repetition

5.3.3.2.4.1 Test Purpose

This test verifies the demodulation performance of PDCCH with intra-slot repetition under 4 receive antenna TDD conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 5.3.3.2.4.3-2. The downlink physical setup is in accordance with Annex C.2.1.

5.3.3. 2.4.2 Test applicability

This test applies to all types of NR UE release 17 and forward.

This test also applies to all types of EUTRA UE release 17 and forward supporting EN-DC.

5.3.3.2.4.3 Minimum conformance requirements

Table 5.3.3.2.4.3-1: Test Parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | Value | |
| TRxP #1(Note 1) | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | |  | TRxP #1 | |
| PDCCH configuration | | TCI state | |  | TCI State #1 | TCI State #2 |
| CORESETPoolIndex | |  | 0,1 | |
| Repetition transmission schemes | |  | FDM | |
| CCE to REG mapping type | |  | nonInterleaved | |
| REG bundle size | |  | 6 | |
| Time offset/Frequency offset of the second TxRP from the first TxRP | |  | timing offset = -0.25us, frequency offset = 300Hz | |
| Frequency domain resource allocation for CORSET | |  | Frequency non-overlapping | |
| CSI-RS for tracking | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | |
| Density | |  | 3 | |
| CSI-RS periodicity | | Slots | 40 | |
| CSI-RS offset | | Slots | 20 for CSI-RS resources 1 and 2  21 for CSI-RS resources 3 and 4 | 20 for CSI-RS resources 5 and 6  21 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | |
| TCI State #1 | Type 1 QCL information | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | N/A |
| QCL Type |  | Type A | N/A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| TCI State #2 | Type 1 QCL information | | CSI-RS resource |  | N/A | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | Type A |
| Type 2 QCL information | | CSI-RS resource |  | N/A | N/A |
| QCL Type |  | N/A | N/A |
| Note: PDCCH is transmitted from both TRxP #1 and TRxP #2 | | | | | | |

For the parameters specified in Table 5.3.3.2.3.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.2.3.3-2. The downlink physical setup is in accordance with Annex C.2.1.

Table 5.3.3.2.4.3-2: Minimum performance for PDCCH with 15kHz SCS (Note 2)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Bandwidth(MHz) | CORESET RB (Note 4) | CORESET duration | Aggregation level | Reference Channel | Propagation Condition (Note 1) | Antenna configuration and correlation Matrix (Note 2) | Reference value | |
| Pm-dsg  (%) | SNR (dB) (Note 3) |
| 1 | 40 | 48 | 2 | 2 | R.PDCCH. 2-2.2 TDD | TDLA30-10 | 2x4, ULA Low | 1 | -1.0 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Bandwidth, CORESET parameters, reference channel, Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2  Note 4: CORESETs from TRxP #1 and TRxP #2 should not be overlapped | | | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [2] clause 5.3.3.2.4.

5.3.3.2.4.4 Test description

5.3.3.2.4.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 and Table 5.3.6-1 of 38.521-1 [7].

Configurations of PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

For EN-DC within FR1 operation, setup the LTE link according to Annex D

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and clause A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 5.3-1, Table 5.3.2.1-1 and Table 5.3.3.2.4.3-1 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without Release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode* On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.3.3.2.4.4.3.

5.3.3.2.4.4.2 Test procedure

1. SS transmits PDCCH with DCI format as specified in PDCCH Reference Channel for C\_RNTI to transmit the DL RMC according to Table 5.3.3.2.4.3-1. The details of PDCCH are specified in Table 5.3.3, Table 5.3.3.2-1, Table 5.3.3.2.4.3-1 respectively. The details of PDSCH are specified in Table A.3.3.1.1-3. The SS sends downlink MAC padding bits on the DL RMC.

2. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 5.3.3.2.4.3-1 as appropriate.

3. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 5.3.3.2.4.4.4-1, pass the UE. Otherwise fail the UE.

5.3.3.2.4.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clauses 4.6.1 and 5.4.2.

5.3.3.2.4.4.3.1 Message exceptions for SA

Table 5.3.3.2.4.4.3.1-1: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| frequencyDomainResources | 11111111 11111110 00000000 00000000 00000000 00000 | CORESET to use the least significant 48 RBs of the BWP |  |
| Duration | 1 | SearchSpace duration of 1 symbols |  |
| cce-REG-MappingType CHOICE { |  |  |  |
| Interleaved SEQUENCE { | Null |  |  |
| reg-BundleSize | n6 |  | 2 Tx |
| interleaverSize | n3 |  | TDD |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 5.3.3.2.4.4.3.1-2: PDCCH *Search Space*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel2 | n1 |  |  |
| } |  |  |  |

Table 5.3.3.2.4.4.3.1-3: *CSI-ResourcePeriodicityAndOffset* for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots40 | 10 | For CSI-RS resources 1,2,5,6 |  |
| Slots40 | 11 | For CSI-RS resources 3,4,7,8 |  |
| } |  |  |  |

5.3.3.2.4.4.3.2 Message exceptions for NSA

Same as 5.3.3.2.4.4.3.1

5.3.3.2.4.4.4 Test requirement

Table 5.3.3.2.4.4.4-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 5.3.3.2.4.4.4-1.

Table 5.3.3.2.4.4.4-1: Test Requirements for PDCCH with 30kHz SCS (Note 2)

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Bandwidth(MHz) | CORESET RB (Note 4) | CORESET duration | Aggregation level | Reference Channel | Propagation Condition (Note 1) | Antenna configuration and correlation Matrix (Note 2) | Reference value | |
| Pm-dsg  (%) | SNR (dB) (Note 3) |
| 1 | 40 | 48 | 2 | 2 | R.PDCCH. 2-2.2 TDD | TDLA30-10 | 2x4, ULA Low | 1 | -0.1 |
| Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.  Note 2: Bandwidth, CORESET parameters, reference channel, Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.  Note 3: SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2  Note 4: CORESETs from TRxP #1 and TRxP #2 should not be overlapped | | | | | | | | | |

## 5.4 PBCH demodulation requirements

TS 38.101-4 shall specify the PBCH performance requirements and has recommended that these requirements do not need to be tested.

## 5.5 Sustained downlink data rate provided by lower layers

### 5.5.1 FR1 Sustained downlink data rate performance for single carrier

5.5.1.1 Test Purpose

The purpose of the test is to verify that the Layer 1 and Layer 2 correctly process in a sustained manner the received packets corresponding to the maximum data rate indicated by UE capabilities*.* The sustained downlink data rate shall be verified in terms of the success rate of delivered PDCP SDU(s) by Layer 2. The test case below specifies the RF conditions and the required success rate of delivered TB by Layer 1 to meet the sustained data rate requirement

5.5.1.2 Test Applicability

This test applies to all types of NR UE release 15 and forward.

5.5.1.3 Minimum conformance requirements

The requirements in this clause are applicable to the FR1 single carrier case.

The TB success rate shall be higher than 85% when PDSCH is scheduled with MCS defined for the channel bandwidth with the downlink physical channel setup according to Annex C.3.1.

The TB success rate is defined as 100%\*NDL\_correct\_rx/ (NDL\_newtx + NDL\_retx), where NDL\_newtx is the number of newly transmitted DL transport blocks, NDL\_retx is the number of retransmitted DL transport blocks, and NDL\_correct\_rx is the number of correctly received DL transport blocks.

The common test parameters are specified in Table 5.5.1.3-1. The parameters specified in Table 5.5.1.3-2 are applicable for tests on FDD bands and parameters specified in Table 5.5.1.3-3 are applicable for tests on TDD bands.

Unless otherwise stated, no user data is scheduled on slot #0, 10 and 11 within 20 ms for SCS 15 kHz.

Unless otherwise stated, no user data is scheduled on slot #0, 20 and 21 within 20 ms for SCS 30 kHz.

Table 5.5.1.3-1: Common test parameters for FDD and TDD bands

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Value |
| PDSCH transmission scheme | | |  | Transmission scheme 1 |
| EPRE ratio of PTRS to PDSCH | | | dB | N/A |
| Channel bandwidth | | | MHz | Select channel bandwidth as per test parameter selection clause 5.5.1.3.1 |
| Common serving cell parameters | Physical Cell ID | |  | 0 |
| SSB position in burst | |  | First SSB in Slot #0 |
| SSB periodicity | | ms | 20 |
| First DMRS position for Type A PDSCH mapping | |  | 2 |
| Cross carrier scheduling | | |  | Not configured |
| Active DL BWP index | | |  | 1 |
| Actual carrier configuration | Offset between Point A and the lowest usable subcarrier on this carrier (Note 2) | | RBs | 0 |
| Subcarrier spacing | | kHz | 15 or 30 |
| DL BWP configuration #1 | RB offset | | RBs | 0 |
| Number of contiguous PRB | |  | Maximum transmission bandwidth configuration as specified in clause 5.3.2 of TS 38.101-1 [2] for tested channel bandwidth and subcarrier spacing |
| Subcarrier spacing | | kHz | 15 or 30 |
| Cyclic prefix | |  | Normal |
| PDCCH configuration | Slots for PDCCH monitoring | |  | Each slot |
| Symbols with PDCCH | |  | Symbols #0 |
| Number of PRBs in CORESET | |  | Table 5.5.1.3-4 |
| Number of PDCCH candidates and aggregation levels | |  | 2/AL2 for 15 kHz / 5 MHz and 30 kHz / 15 MHz  2/AL4 for 15 kHz / 10 MHz, 30 kHz / 10 MHz and 30 kHz / 20 MHz  2/AL8 for other greater combinations |
| CCE-to-REG mapping type | |  | Non-interleaved |
| DCI format | |  | 1\_1 |
| TCI State | |  | TCI state #1 |
| PDCCH & PDCCH DMRS Precoding configuration | |  | For number of Tx=1: No precoding;For number of Tx=2:  Single Panel Type I, Randomized precoder selection for every REG bundle and updated per slot with equal probability of precoder indices 0 and 2  For number of Tx=4:  Single Panel Type I, Randomized precoder selection for every REG bundle and updated per slot with equal probability of i\_1,1 in {1,2,3,5,6,7} and i\_2 in {0,2} |
| PDSCH configuration | Mapping type | |  | Type A |
| k0 | |  | 0 |
| PDSCH aggregation factor | |  | 1 |
| PRB bundling type | |  | Static |
| PRB bundling size | |  | WB |
| Resource allocation type | |  | Type 0 |
| VRB-to-PRB mapping type | |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size | |  | N/A |
| PDSCH DMRS configuration | DMRS Type | |  | Type 1 |
| Number of additional DMRS | |  | 1 |
| Length | |  | 1 |
| Antenna ports indexes | |  | {1000} for 1 Layer CCs {1000, 1001} for 2 Layers CCs  {1000 – 1003} for 4 Layers CCs |
| Number of PDSCH DMRS CDM group(s) without data | |  | 1 for 1 layer and 2 layers CCs  2 for 4 Layers CCs |
| PTRS configuration | | |  | PTRS is not configured |
| CSI-RS for tracking | Subcarrier indexes in the PRB used for CSI-RS | |  | k0 = 3 for CSI-RS resource 1,2,3,4 |
| OFDM symbols in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resource 1 and 3  l0 = 10 for CSI-RS resource 2 and 4 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 |
| CDM Type | |  | 'No CDM' for CSI-RS resource 1,2,3,4 |
| Density (ρ) | |  | 3 for CSI-RS resource 1,2,3,4 |
| CSI-RS periodicity | | Slots | 15 kHz SCS: 20 for CSI-RS resource 1,2,3,4  30 kHz SCS: 40 for CSI-RS resource 1,2,3,4 |
| CSI-RS offset | | Slots | 15 kHz SCS:  10 for CSI-RS resource 1 and 2  11 for CSI-RS resource 3 and 4  30 kHz SCS:  20 for CSI-RS resource 1 and 2  21 for CSI-RS resource 3 and 4 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = BWP size |
| QCL info | |  | TCI state #0 |
| NZP CSI-RS for CSI acquisition | Subcarrier indexes in the PRB used for CSI-RS | |  | k0 = 4 |
| OFDM symbols in the PRB used for CSI-RS | |  | l0 = 12 |
| Number of CSI-RS ports (X) | |  | Same as number of transmit antenna |
| CDM Type | |  | For number of Tx=1: ‘No CDM’  For number of Tx>1: 'FD-CDM2' |
| Density (ρ) | |  | 1 |
| CSI-RS periodicity | |  | 15 kHz SCS: 20  30 kHz SCS: 40 |
| CSI-RS offset | |  | 0 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = BWP size |
| QCL info | |  | TCI state #1 |
| ZP CSI-RS for CSI acquisition | Subcarrier indexes in the PRB used for CSI-RS | |  | k0 = 0 |
| OFDM symbols in the PRB used for CSI-RS | |  | l0 = 12 |
| Number of CSI-RS ports (X) | |  | 4 |
| CDM Type | |  | 'FD-CDM2' |
| Density (ρ) | |  | 1 |
| CSI-RS periodicity | |  | 15 kHz SCS: 20  30 kHz SCS: 40 |
| CSI-RS offset | |  | 0 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = BWP size |
| TCI state #0 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| Maximum number of code block groups for ACK/NACK feedback | | |  | 1 |
| Maximum number of HARQ transmission | | |  | 4 |
| HARQ ACK/NACK bundling | | |  | Multiplexed |
| Redundancy version coding sequence | | |  | {0,2,3,1} |
| PDSCH & PDSCH DMRS Precoding configuration | | |  | For number of Tx=1: No precoding;  For number of Tx>1: Single Panel Type I, Randomized precoder selection for every PRB bundle and updated per slot with equal probability of each applicable i1, i2 combination |
| Symbols for all unused REs | | |  | OCNG Annex A.5 |
| Propagation condition | | |  | Static propagation condition  No external noise sources are applied |
| Antenna configuration | 1 layer CCs | |  | 1x2 or 1x4 |
| 2 layers CCs | |  | 2x2 or 2x4 |
| 4 layers CCs | |  | 4x4 |
| Physical signals, channels mapping and precoding | | |  | As specified in Annex B.4.1 |
| Es | | | dBm/kHz | -112 for MCS indexes in Table 5.5.1.3-5:  -110.5 For 1024QAM MCS indexes in Table 5.5.2.3-1: |
| Note 1: UE assumes that the TCI state for the PDSCH is identical to the TCI state applied for the PDCCH transmission  Note 2: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-1 [2] for tested channel bandwidth and subcarrier spacing | | | | |

Table 5.5.1.3-2: Additional test parameters for FDD band

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| PDSCH configuration | Starting symbol (S) |  | 1 |
| Length (L) |  | 13 |
| Number of HARQ Processes | |  | 4 |
| K1 value | |  | 2 |

Table 5.5.1.3-3: Additional test parameters for TDD band

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| PDSCH configuration | Starting symbol (S) |  | 1 |
| Length (L) |  | 13 |
| Number of HARQ Processes | |  | 8 |
| K1 value | |  | Specific to each UL-DL pattern |
| TDD UL-DL pattern | |  | 15 kHz SCS: FR1.15-1  30 kHz SCS: FR1.30-1 |
| Note 1: PDSCH is scheduled only on full DL slots | | | |

Table 5.5.1.3-4: Number of PRBs in CORESET

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SCS (kHz) | 5MHz | 10MHz | 15MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50MHz | 60 MHz | 80 MHz | 100 MHz |
| 15 | 24 | 48 | 78 | 102 | 132 | 156 | 216 | 270 | N/A | N/A | N/A |
| 30 | 6 | 24 | 36 | 48 | 60 | 78 | 102 | 132 | 162 | 216 | 270 |

Table 5.5.1.3-5: MCS indexes for indicated UE capabilities

|  |  |  |  |
| --- | --- | --- | --- |
| Maximum number of PDSCH MIMO layers | Maximum modulation format | Scaling factor | MCS |
| 1 | 8 | 1 | 26 |
| 1 | 8 | 0.8 | 21 |
| 1 | 8 | 0.75 | 20 |
| 1 | 8 | 0.4 | 11 |
| 1 | 6 | 1 | 27 |
| 1 | 6 | 0.8 | 23 |
| 1 | 6 | 0.75 | 22 |
| 1 | 6 | 0.4 | 14 |
| 1 | 4 | 1 | 16 |
| 1 | 4 | 0.8 | 16 |
| 1 | 4 | 0.75 | 16 |
| 1 | 4 | 0.4 | 10 |
| 1 | 2 | 1 | 9 |
| 1 | 2 | 0.8 | 9 |
| 1 | 2 | 0.75 | 9 |
| 1 | 2 | 0.4 | 4 |
| 2 | 8 | 1 | 26 |
| 2 | 8 | 0.8 | 21 |
| 2 | 8 | 0.75 | 20 |
| 2 | 8 | 0.4 | 11 |
| 2 | 6 | 1 | 27 |
| 2 | 6 | 0.8 | 23 |
| 2 | 6 | 0.75 | 22 |
| 2 | 6 | 0.4 | 14 |
| 2 | 4 | 1 | 16 |
| 2 | 4 | 0.8 | 16 |
| 2 | 4 | 0.75 | 16 |
| 2 | 4 | 0.4 | 10 |
| 2 | 2 | 1 | 9 |
| 2 | 2 | 0.8 | 9 |
| 2 | 2 | 0.75 | 9 |
| 2 | 2 | 0.4 | 4 |
| 4 | 8 | 1 | 26 |
| 4 | 8 | 0.8 | 23 |
| 4 | 8 | 0.75 | 22 |
| 4 | 8 | 0.4 | 12 |
| 4 | 6 | 1 | 27 |
| 4 | 6 | 0.8 | 24 |
| 4 | 6 | 0.75 | 23 |
| 4 | 6 | 0.4 | 14 |
| 4 | 4 | 1 | 16 |
| 4 | 4 | 0.8 | 16 |
| 4 | 4 | 0.75 | 16 |
| 4 | 4 | 0.4 | 11 |
| 4 | 2 | 1 | 9 |
| 4 | 2 | 0.8 | 9 |
| 4 | 2 | 0.75 | 9 |
| 4 | 2 | 0.4 | 5 |
| Note 1: MCS Index for maximum modulation format 2,4 and 6 is based on MCS index table 1 defined in clause 5.1.3.1 of TS 38.214 [12]  Note 2: MCS Index for maximum modulation format 8 is based on MCS index table 2 defined in clause 5.1.3.1 of TS 38.214 [12] | | | |

5.5.1.3.1 Procedure for test parameter selection

Below test parameter selection procedure is from 38.101-4 [5] by replacing CA configuration with operating band, and bandwidth instead of bandwidth combination.

The test parameters are determined by the following procedure:

- Select one operating band among all supported operating bands and set of per band UE capabilities among all supported UE capabilities that provides the largest data rate TS 38.306 [14], Section 4.1.2.

- Set of per band UE capabilities includes channel bandwidth, subcarrier spacing, number of PDSCH MIMO layers, modulation format and scaling factor TS 38.306 [14], Section 4.1.2.

- When there are multiple sets of bandwidths and UE capabilities (channel bandwidth, subcarrier spacing, number of MIMO layer, modulation format, scaling factor) with same largest data rate, select one among sets with the smallest channel bandwidth.

- For each operating band, use Table 5.5.1.3-5 to determine MCS based on test parameters and indicated UE capabilities

Pasting relevant portion of max data rate equation from TS 38.306 [14] section 4.1

For NR, the approximate data rate for a given number of aggregated carriers in a band or band combination is computed as follows.



wherein

J is the number of aggregated component carriers in a band or band combination

Rmax = 948/1024

For the j-th CC,

 is the maximum number of supported layers given by higher layer parameter *maxNumberMIMO-LayersPDSCH* for downlink and maximum of higher layer parameters *maxNumberMIMO-LayersCB-PUSCH* and *maxNumberMIMO-LayersNonCB-PUSCH* for uplink.

 is the maximum supported modulation order given by higher layer parameter *supportedModulationOrderDL* for downlink and higher layer parameter *supportedModulationOrderUL* for uplink.

is the scaling factor given by higher layer parameter *scalingFactor* and can take the values 1, 0.8, 0.75, and 0.4.

 is the numerology (as defined in TS 38.211 [6])

 is the average OFDM symbol duration in a subframe for numerology , i.e. . Note that normal cyclic prefix is assumed.

 is the maximum RB allocation in bandwidth  with numerology , as defined in 5.3 TS 38.101-1 [2] and 5.3 TS 38.101-2 [3], where  is the UE supported maximum bandwidth in the given band or band combination.

is the overhead and takes the following values

0.14, for frequency range FR1 for DL

0.18, for frequency range FR2 for DL

0.08, for frequency range FR1 for UL

0.10, for frequency range FR2 for UL

NOTE: Only one of the UL or SUL carriers (the one with the higher data rate) is counted for a cell operating SUL.

The approximate maximum data rate can be computed as the maximum of the approximate data rates computed using the above formula for each of the supported band or band combinations.

The normative reference for this requirement is TS 38.101-4 [5], clause 5.5.1.

5.5.1.4 Test description

5.5.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 of TS 38.521-1.

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 4.1.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 5.2.2.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1, A.3.1.7.4 and A.3.1.7.5 for TE diagram (without fader and AWGN) for 2Rx and 4Rx respectively and clause A.3.2.2 for UE diagram.

2. The parameter settings for the NR cell are initially set up according to Table 5.5.1.3-1 as appropriate.

3. Downlink signals for the NR cell are initially set up according to Annexes C.0, C.1, C.2, C.3.1, and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions for the NR cell are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR with *Connected without release On, Test Loop Function On with UE Test Loop Mode A with UL\_PDCP\_SDU\_SIZE = 0* according to TS 38.508-1 [6] clause 4.5.4. Message content are defined in clause 5.5.1.4.3.

6. SS shall transmit UECapabilityEnquiry message.

7. The UE shall transmit UECapabilityInformation message.

8. Using the UE capabilities advertised in the *UE-CapabilityRAT-Container* of the type *UE-NR-Capability,* and the procedure outlined in 5.5.1.3.1 determine one set of parameters that would provide the largest data rate.

9. Setup up the NR cell using these parameters for the test.

10. Configure the TBsize, DL RMC, UL RMC, PDCP size from Annex A.3.2\_1 and Annex A.2.2 for UL as appropriate.

5.5.1.4.2 Test procedure

1. SS configures T-reordering timer to be infinity.

2. SS sends a PDCP reestablishment via RRC Reconfiguration message requesting for PDCP Status Report.

3. SS sets the counters NDL\_newtx NDL\_retx to 0.

4. For each new DL HARQ transmission the SS generates sufficient PDCP SDUs (max PDCP SDU size and minimum number of consecutive PDCP SDUs) to fill up the TB in accordance with Annex A.3.2\_1. The SS ciphers the PDCP SDUs, concatenates the resultant PDCP PDUs to form an RLC PDU and then a MAC PDU. The SS transmits the MAC PDU. The SS increments then NDL\_newtx by one

5. If PHY requests a DL HARQ retransmission, the SS performs a HARQ retransmission and increments NDL\_retx by one.

6. Steps 4 to 5 are repeated at every TTI for at least 300 frames and the SS waits for 300ms to let any HARQ retransmissions and RLC retransmissions to finish.

7. SS sends a PDCP reestablishment via RRC Reconfiguration message requesting for PDCP Status Report.

8. The SS calculates the TB success rate as A = 100%\* NDL\_correct\_rx / (NDL\_newtx + NDL\_retx).

10. SS computes the PDCP SDU loss by looking into the FMC and Bitmap field in the PDCP Status Report. PDCP SDU loss B = COUNT reported in the Bitmap field of PDCP Stata Report.

11. The UE passes the test if A ≥ 85% TB success rates and B = 0.

Note 1: In case of RLC PDU retransmission, the number of new required PDCP SDUs is as many as to fill the rest of TB.

5.5.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2 with the following exceptions

Table 5.5.1.4.3-0: CLOSE UE TEST LOOP (in the preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.509 clause 6.3.1 | | | |
| Information Element | | Value/remark | Comment | Condition |
| Protocol discriminator | | 1 1 1 1 |  |  |
| Skip indicator | | 0 0 0 0 |  |  |
| Message type | | 1 0 0 0 0 0 0 0 |  |  |
| UE test loop mode | | 0 0 0 0 0 0 0 0 | UE test loop mode A |  |
| UE test loop mode A LB setup | |  |  |
| Length of UE test loop mode A LB setup list in bytes | | 0 0 0 0 0 0 1 1 | Length of one LB setup DRB (3 bytes) |
| LB setup DRB | | 0 0 0 0 0 0 0 0,  0 0 0 0 0 0 0 0,  0 0 Q5 Q4 Q3 Q2 Q1 Q0 | UL PDCP SDU size = 0  Q5 = 1 (for NR Data Radio Bearers)  Q4..Q0 = Data Radio Bearer identity number -1 for the radio bearer. See 38.509 clause 6.3.1 |
| UE test loop mode B LB setup | | Not present |  |

Table 5.5.1.4.3-1 to -6: Void

Table 5.5.1.4.3-7: RadioBearerConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3-132 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF SEQUENCE { | 1 entry |  | DRB1 |
| cnAssociation CHOICE { |  |  |  |
| sdap-Config | SDAP-Config |  |  |
| } |  |  |  |
| drb-Identity | DRB-Identity using condition DRB1 |  |  |
| reestablishPDCP | true |  | DRB1 AND Re-establish\_PDCP |
| pdcp-Config | PDCP-Config |  |  |
| } |  |  |  |

Table 5.5.1.4.3-8: *PDCP-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-99 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCP-Config ::= SEQUENCE { |  |  |  |
| drb SEQUENCE { |  |  |  |
| discardTimer | infinity |  |  |
| pdcp-SN-Size-UL | len18bits |  |  |
| pdcp-SN-Size-DL | len18bits |  |  |
| headerCompression CHOICE { |  |  |  |
| notUsed | Null |  |  |
| } |  |  |  |
| integrityProtection | Not present |  |  |
| statusReportRequired | true |  |  |
| outOfOrderDelivery | Not present |  |  |
| } |  |  |  |
| t-Reordering | Not present |  |  |
| } |  |  |  |

5.5.1.5 Test requirement

The PDCP SDU success rate of greater than 85% shall be sustained during at least 300 frames.

### 5.5.2 FR1 Sustained downlink data rate performance for single carrier with DL1024QAM

Note: This test case requires DL EVM to be better than 2.5%

5.5.2.1 Test Purpose

The purpose of the test is to verify that the Layer 1 and Layer 2 correctly process in a sustained manner the received packets corresponding to the maximum data rate indicated by UE’s that support DL1024QAM capability*.* The sustained downlink data rate shall be verified in terms of the success rate of delivered PDCP SDU(s) by Layer 2. The test case below specifies the RF conditions and the required success rate of delivered TB by Layer 1 to meet the sustained data rate requirement.

5.5.2.2 Test Applicability

This test applies to all types of NR UE release 17 and forward that support DL1024QAM.

5.5.2.3 Minimum conformance requirements

Same as in Clause 5.5.1.3 with the addition of Table 5.5.2.3-1 for DL1024QAM.

Table 5.5.2.3-1: 1024QAM MCS indexes for indicated UE capabilities

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Supported RX  antenna ports | Maximum number of PDSCH MIMO layers | Maximum modulation format | Scaling factor | MCS |
| 2RX | 1 | 10 | 1 | 23 |
|  | 1 | 10 | 0.8 | 21 |
|  | 1 | 10 | 0.75 | 19 |
|  | 1 | 10 | 0.4 | 9 |
| 4RX | 1 | 10 | 1 | 24 |
|  | 1 | 10 | 0.8 | 21 |
|  | 1 | 10 | 0.75 | 19 |
|  | 1 | 10 | 0.4 | 9 |
|  | 2 | 10 | 1 | 23 |
|  | 2 | 10 | 0.8 | 21 |
|  | 2 | 10 | 0.75 | 19 |
|  | 2 | 10 | 0.4 | 9 |
| Note 1: MCS Index for maximum modulation format 10 is based on MCS index Table 4 defined in clause 5.1.3.1 of TS 38.214 [12]  Note 2: For the band(s) on which UE supporting “Maximum modulation format” of 10, with 2 RX and 2 MIMO layers, the MCS index is derived from the rows with “Maximum modulation format” of 8 in Table 5.5.1.3-5 | | | | |

5.5.2.3.1 Procedure for test parameter selection

Below test parameter selection procedure is from 38.101-4 [5] by replacing CA configuration with operating band, and bandwidth instead of bandwidth combination.

The test parameters are determined by the following procedure:

- Select one operating band among all supported operating bands and set of per band UE capabilities supporting 1024QAM (*pdsch-1024QAM-FR1*) among all supported UE capabilities that provides the largest data rate [TS 38.306 [14, Section 4.1.2]].

- Set of per band UE capabilities includes channel bandwidth, subcarrier spacing, number of PDSCH MIMO layers, modulation format and scaling factor [TS 38.306 [14, Section 4.1.2]].

- When there are multiple sets of bandwidths and UE capabilities (channel bandwidth, subcarrier spacing, number of MIMO layer, modulation format, scaling factor) with same largest data rate, select one among sets with the smallest channel bandwidth.

- For a UE capable of 1024QAM (*pdsch-1024QAM-FR1*), for each operating band, use Table 5.5.2.3-1 to determine MCS based on test parameters and indicated UE capabilities if the maximum modulation format is 10.

5.5.2.4 Test description

5.5.2.4.1 Initial conditions

Same as in Clause 5.5.1.4.1.

5.5.2.4.2 Test procedure

Same as in Clause 5.5.1.4.2.

5.5.2.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2 with the following exceptions:

Table 5.5.2.4.3-1: PDSCH-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 Table 5.4.2.0-26 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| mcs-Table-r17 | qam1024 |  |  |
| } |  |  |  |

5.5.2.5 Test requirement

Same as in Clause 5.5.1.5.

### 5.5.3 FR1 Sustained downlink data rate performance for RedCap

5.5.3.1 Test Purpose

The purpose of the test is to verify that the Layer 1 and Layer 2 correctly process in a sustained manner the received packets corresponding to the maximum data rate indicated by UE capabilities*.* The sustained downlink data rate shall be verified in terms of the success rate of delivered PDCP SDU(s) by Layer 2. The test case below specifies the RF conditions and the required success rate of delivered TB by Layer 1 to meet the sustained data rate requirement.

5.5.3.2 Test Applicability

This test applies to all types of NR UE release 17 and forward that support NR RedCap.

5.5.3.3 Minimum conformance requirements

Same as in Clause 5.5.1.3 except that the MIMO layers are configured to 2 for UE supporting 2 MIMO layers and 1 for UE supporting 1 MIMO layers for all operating bands. Antenna configuration is 1x1 for UE supporting 1 layer and 2x2 for UE supporting 2 layers.

For RedCap UE with HD-FDD mode, the additional test parameters are specified in Table 5.5.3.3-1.

Table 5.5.3.3-1: Additional test parameters for HD-FDD single carrier

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Value** |
| Duplex mode | |  | HD-FDD |
| PDSCH configuration | Starting symbol (S) |  | 1 |
| Length (L) |  | 13 |
| Number of HARQ Processes | |  | 4 |
| Full DL slots (Note 1, Note 2) | |  | For slots i, if mod(i, 5) = {0,1,2} |
| K1 value (Note 2) | |  | 4 if mod(i, 5) = 0  3 if mod(i, 5) = 1  2 if mod(i, 5) = 2 |
| Note 1: PDSCH is scheduled only on full DL slots.  Note 2: i is the slot index per frame; i = {1, 2, …, 19}. | | | |

5.5.3.3.1 Procedure for test parameter selection

Same as in Clause 5.5.1.3.1.

5.5.3.4 Test description

5.5.3.4.1 Initial conditions

Same as in Clause 5.5.1.4.1.

5.5.3.4.2 Test procedure

Same as in Clause 5.5.1.4.2.

5.5.3.4.3 Message contents

Same as in Clause 5.5.1.4.3.

5.5.3.5 Test requirement

Same as in Clause 5.5.1.5.

### 5.5A.1 FR1 Sustained downlink data rate performance for carrier aggregation

##### 5.5A.1.1 FR1 SDR performance for CA (2DL CA)

5.5A.1.1.1 Test Purpose

The purpose of the test is to verify that the Layer 1 and Layer 2 correctly process in a sustained manner the received packets corresponding to the maximum data rate indicated by UE capabilities*.* The sustained downlink data rate shall be verified in terms of the success rate of delivered PDCP SDU(s) by Layer 2. The test case below specifies the RF conditions and the required success rate of delivered TB by Layer 1 to meet the sustained data rate requirement.

5.5A.1.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 2DL CA

5.5A.1.1.3 Minimum conformance requirements

The Sustained Data Rate (SDR) requirements in this clause are applicable to the FR1 CA.

The TB success rate shall be higher than 85% when PDSCH is scheduled with MCS defined for the selected CA bandwidth combination and with the downlink physical channel setup according to Annex C.2.1.

The TB success rate is defined as 100%\*NDL\_correct\_rx/ (NDL\_newtx + NDL\_retx), where NDL\_newtx is the number of newly transmitted DL transport blocks, NDL\_retx is the number of retransmitted DL transport blocks, and NDL\_correct\_rx is the number of correctly received DL transport blocks.

The common test parameters are specified in Table 5.5A.1.1.3-1. The parameters specified in Table 5.5A.1.1.3-2 are applicable for tests on FDD CCs and parameters specified in Table 5.5A.1.1.3-3 are applicable for tests on TDD CCs.

Unless otherwise stated, no user data is scheduled on slot #0, 10 and 11 within 20 ms for SCS 15 kHz.

Unless otherwise stated, no user data is scheduled on slot #0, 20 and 21 within 20 ms for SCS 30 kHz.

Table 5.5A.1.1.3-1: Common test parameters for FDD and TDD component carriers

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Value |
| PDSCH transmission scheme | | |  | Transmission scheme 1 |
| EPRE ratio of PTRS to PDSCH | | | dB | N/A |
| Channel bandwidth | | | MHz | Channel bandwidth from selected CA bandwidth combination |
| Common serving cell parameters | Physical Cell ID | |  | 0 |
| SSB position in burst | |  | First SSB in Slot #0 |
| SSB periodicity | | ms | 20 |
| First DMRS position for Type A PDSCH mapping | |  | 2 |
| Cross carrier scheduling | | |  | Not configured |
| Active DL BWP index | | |  | 1 |
| Actual carrier configuration | Offset between Point A and the lowest usable subcarrier on this carrier (Note 2) | | RBs | 0 |
| Subcarrier spacing | | kHz | 15 or 30 |
| DL BWP configuration #1 | RB offset | | RBs | 0 |
| Number of contiguous PRB | |  | Maximum transmission bandwidth configuration as specified in clause 5.3.2 of TS 38.101-1 [2] for tested channel bandwidth and subcarrier spacing |
| Subcarrier spacing | | kHz | 15 or 30 |
| Cyclic prefix | |  | Normal |
| PDCCH configuration | Slots for PDCCH monitoring | |  | Each slot |
| Symbols with PDCCH | |  | Symbols #0 |
| Number of PRBs in CORESET | |  | Table 5.5A.1.1.3-4 |
| Number of PDCCH candidates and aggregation levels | |  | 2/AL2 for 15 kHz / 5 MHz and 30 kHz / 15 MHz  2/AL4 for 15 kHz / 10 MHz, 30 kHz / 10 MHz and 30 kHz / 20 MHz  2/AL8 for other greater combinations |
| CCE-to-REG mapping type | |  | Non-interleaved |
| DCI format | |  | 1\_1 |
| TCI State | |  | TCI state #1 |
| PDCCH & PDCCH DMRS Precoding configuration | |  | For number of Tx=1: No precoding;For number of Tx=2:  Single Panel Type I, Randomized precoder selection for every REG bundle and updated per slot with equal probability of precoder indices 0 and 2  For number of Tx=4:  Single Panel Type I, Randomized precoder selection for every REG bundle and updated per slot with equal probability of i\_1,1 in {1,2,3,5,6,7} and i\_2 in {0,2} |
| PDSCH configuration | Mapping type | |  | Type A |
| k0 | |  | 0 |
| PDSCH aggregation factor | |  | 1 |
| PRB bundling type | |  | Static |
| PRB bundling size | |  | wideband |
| Resource allocation type | |  | Type 0 |
| VRB-to-PRB mapping type | |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size | |  | N/A |
| PDSCH DMRS configuration | DMRS Type | |  | Type 1 |
| Number of additional DMRS | |  | 1 |
| Length | |  | 1 |
| Antenna ports indexes | |  | {1000} for 1 Layer CCs {1000, 1001} for 2 Layers CCs  {1000 – 1003} for 4 Layers CCs |
| Number of PDSCH DMRS CDM group(s) without data | |  | 1 for 1 layer and 2 layers CCs  2 for 4 Layers CCs |
| PTRS configuration | | |  | PTRS is not configured |
| CSI-RS for tracking | Subcarrier indexes in the PRB used for CSI-RS | |  | k0 = 3 for CSI-RS resource 1,2,3,4 |
| OFDM symbols in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resource 1 and 3  l0 = 10 for CSI-RS resource 2 and 4 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 |
| CDM Type | |  | 'No CDM' for CSI-RS resource 1,2,3,4 |
| Density (ρ) | |  | 3 for CSI-RS resource 1,2,3,4 |
| CSI-RS periodicity | | Slots | 15 kHz SCS: 20 for CSI-RS resource 1,2,3,4  30 kHz SCS: 40 for CSI-RS resource 1,2,3,4 |
| CSI-RS offset | | Slots | 15 kHz SCS:  10 for CSI-RS resource 1 and 2  11 for CSI-RS resource 3 and 4  30 kHz SCS:  20 for CSI-RS resource 1 and 2  21 for CSI-RS resource 3 and 4 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = ceil(BWP size /4)\*4 |
| QCL info | |  | TCI state #0 |
| NZP CSI-RS for CSI acquisition | Subcarrier indexes in the PRB used for CSI-RS | |  | k0 = 4 |
| OFDM symbols in the PRB used for CSI-RS | |  | l0 = 12 |
| Number of CSI-RS ports (X) | |  | Same as number of transmit antenna |
| CDM Type | |  | For number of Tx=1: ‘No CDM’  For number of Tx>1: 'FD-CDM2' |
| Density (ρ) | |  | 1 |
| CSI-RS periodicity | |  | 15 kHz SCS: 20  30 kHz SCS: 40 |
| CSI-RS offset | |  | 0 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = ceil(BWP size /4)\*4 |
| QCL info | |  | TCI state #1 |
| ZP CSI-RS for CSI acquisition | Subcarrier indexes in the PRB used for CSI-RS | |  | k0 = 0 |
| OFDM symbols in the PRB used for CSI-RS | |  | l0 = 12 |
| Number of CSI-RS ports (X) | |  | 4 |
| CDM Type | |  | 'FD-CDM2' |
| Density (ρ) | |  | 1 |
| CSI-RS periodicity | |  | 15 kHz SCS: 20  30 kHz SCS: 40 |
| CSI-RS offset | |  | 0 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = ceil(BWP size/4)\*4 |
| TCI state #0 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| Maximum number of code block groups for ACK/NACK feedback | | |  | 1 |
| Maximum number of HARQ transmission | | |  | 4 |
| HARQ ACK/NACK bundling | | |  | Multiplexed |
| Redundancy version coding sequence | | |  | {0,2,3,1} |
| PDSCH & PDSCH DMRS Precoding configuration | | |  | For number of Tx=1: No precoding;  For number of Tx>1: Single Panel Type I, Randomized precoder selection for every PRB bundle and updated per slot with equal probability of each applicable i1/i2 combination or codebook  index, chosen from section 5.2.2.2.1 of TS 38.214 [12] |
| Symbols for all unused REs | | |  | OP.1 FDD as defined in Annex A.5.1.1  OP.1 TDD as defined in Annex A.5.2.1 |
| Propagation condition | | |  | Static propagation condition  No external noise sources are applied |
| Antenna configuration | 1 layer CCs | |  | 1x2 or 1x4 |
| 2 layers CCs | |  | 2x2 or 2x4 |
| 4 layers CCs | |  | 4x4 |
| Physical signals, channels mapping and precoding | | |  | As specified in Annex B.4.1 |
| Note 1: UE assumes that the TCI state for the PDSCH is identical to the TCI state applied for the PDCCH transmission  Note 2: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-1 [2] for tested channel bandwidth and subcarrier spacing | | | | |

Table 5.5A.1.1.3-2: Additional test parameters for FDD CC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | FDD |
| PDSCH configuration | Starting symbol (S) |  | 1 |
| Length (L) |  | 13 |
| Number of HARQ Processes | |  | 4 |
| K1 value | |  | 2 |

Table 5.5A.1.1.3-3: Additional test parameters for TDD CC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| PDSCH configuration | Starting symbol (S) |  | 1 |
| Length (L) |  | 13 |
| Number of HARQ Processes | |  | 8 |
| K1 value | |  | Specific to each UL-DL pattern |
| TDD UL-DL pattern | |  | 15 kHz SCS: FR1.15-1  30 kHz SCS: FR1.30-1 |
| Note 1: PDSCH is scheduled only on full DL slots | | | |

Table 5.5A.1.1.3-4: Number of PRBs in CORESET

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| SCS (kHz) | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 35 MHz | 40 MHz | 45 MHz | 50 MHz | 60 MHz | 80 MHz | 100 MHz |
| 15 | 24 | 48 | 78 | 102 | 132 | 156 | 186 | 216 | 240 | 270 | N/A | N/A | N/A |
| 30 | 6 | 24 | 36 | 48 | 60 | 78 | 90 | 102 | 114 | 132 | 162 | 216 | 270 |

Table 5.5A.1.1.3-5: MCS indexes for indicated UE capabilities

|  |  |  |  |
| --- | --- | --- | --- |
| Maximum number of PDSCH MIMO layers | Maximum modulation format | Scaling factor | MCS |
| 1 | 8 | 1 | 26 |
| 1 | 8 | 0.8 | 21 |
| 1 | 8 | 0.75 | 20 |
| 1 | 8 | 0.4 | 11 |
| 1 | 6 | 1 | 27 |
| 1 | 6 | 0.8 | 23 |
| 1 | 6 | 0.75 | 22 |
| 1 | 6 | 0.4 | 14 |
| 1 | 4 | 1 | 16 |
| 1 | 4 | 0.8 | 16 |
| 1 | 4 | 0.75 | 16 |
| 1 | 4 | 0.4 | 10 |
| 1 | 2 | 1 | 9 |
| 1 | 2 | 0.8 | 9 |
| 1 | 2 | 0.75 | 9 |
| 1 | 2 | 0.4 | 4 |
| 2 | 8 | 1 | 26 |
| 2 | 8 | 0.8 | 21 |
| 2 | 8 | 0.75 | 20 |
| 2 | 8 | 0.4 | 11 |
| 2 | 6 | 1 | 27 |
| 2 | 6 | 0.8 | 23 |
| 2 | 6 | 0.75 | 22 |
| 2 | 6 | 0.4 | 14 |
| 2 | 4 | 1 | 16 |
| 2 | 4 | 0.8 | 16 |
| 2 | 4 | 0.75 | 16 |
| 2 | 4 | 0.4 | 10 |
| 2 | 2 | 1 | 9 |
| 2 | 2 | 0.8 | 9 |
| 2 | 2 | 0.75 | 9 |
| 2 | 2 | 0.4 | 4 |
| 4 | 8 | 1 | 26 |
| 4 | 8 | 0.8 | 23 |
| 4 | 8 | 0.75 | 22 |
| 4 | 8 | 0.4 | 12 |
| 4 | 6 | 1 | 27 |
| 4 | 6 | 0.8 | 24 |
| 4 | 6 | 0.75 | 23 |
| 4 | 6 | 0.4 | 14 |
| 4 | 4 | 1 | 16 |
| 4 | 4 | 0.8 | 16 |
| 4 | 4 | 0.75 | 16 |
| 4 | 4 | 0.4 | 11 |
| 4 | 2 | 1 | 9 |
| 4 | 2 | 0.8 | 9 |
| 4 | 2 | 0.75 | 9 |
| 4 | 2 | 0.4 | 5 |
| Note 1: MCS Index for maximum modulation format 2,4 and 6 is based on MCS index Table 1 defined in clause 5.1.3.1 of TS 38.214 [12]  Note 2: MCS Index for maximum modulation format 8 is based on MCS index Table 2 defined in clause 5.1.3.1 of TS 38.214 [12] | | | |

5.5A.1.1.3.1 Procedure for test parameter selection

The test parameters are determined by the following procedure:

- Select one CA bandwidth combination among all supported CA configurations and set of per component carrier (CC) UE capabilities among all supported UE capabilities that provides the largest data rate in accordance with clause 4.1.2 of TS 38.306 [14].

- Set of per CC UE capabilities includes channel bandwidth, subcarrier spacing, number of PDSCH MIMO layers, modulation format and scaling factor in accordance with clause 4.1.2 of TS 38.306 [14].

- When there are multiple sets of CA bandwidth combinations and UE capabilities (channel bandwidth, subcarrier spacing, number of MIMO layer, modulation format, scaling factor) with same largest data rate, select one among sets with the smallest aggregated channel bandwidth.

- For each CC in CA bandwidth combination, use Table 5.5A.1.1.3-5 to determine MCS based on test parameters and indicated UE capabilities.

The normative reference for this requirement is TS 38.101-4 [5], clause 5.5A.1.

5.5A.1.1.4 Test description

5.5A.1.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state.

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 of TS 38.521-1.

Configurations of PDSCH and PDCCH before measurement are specified in Annex C.

Test Environment: Normal, as defined in TS 38.508-1 [6] clause 5.2.2.

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 4.3.1.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.2A, A.3.1.7.6, and A.3.1.7.7 for TE diagram (without fader and AWGN) for 2Rx and 4Rx CC(s) respectively and clause A.3.2.6 for UE diagram.

2. The parameter settings for the NR cell are initially set up according to Table 5.5.1.3-1 as appropriate.

3. Downlink signals for the NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions for the NR cell are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR with *Connected without release On, Test Loop Function On with UE Test Loop Mode A with UL\_PDCP\_SDU\_SIZE = 0* according to TS 38.508-1 [6] clause 4.5.4. Message content are defined in clause 5.5 A.1.1.4.3.

6. Configure SCC(s) as applicable according to Annex C.0, C.1 and C.2 for all downlink physical channels.

7. The SS shall configure SCC (s) as applicable as per TS 38.508-1 [6] clause 5.5.1.

8. SS activates SCC(s) as applicable by sending the activation MAC-CE (Refer TS 38.321 [24], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[25], clause9.3).

9. SS shall transmit UECapabilityEnquiry message.

10. The UE shall transmit UECapabilityInformation message.

11. Using the UE capabilities advertised in the *UE-CapabilityRAT-Container* of the type *UE-NR-Capability,* and the procedure outlined in 5.5A.1.1.3.1 determine one set of parameters that would provide the largest data rate.

12. Setup up the NR cells using these parameters for the test.

13. Configure the TBsize, DL RMC, UL RMC, PDCP size from Annex A.3.2\_1 and Annex A.2.2 for UL as appropriate.

5.5A.1.1.4.2 Test procedure

1. SS configures T-reordering timer to be infinity.

2. SS sends a PDCP reestablishment via RRC Reconfiguration message requesting for PDCP Status Report.

3. SS sets the counters NDL\_newtx NDL\_retx to 0.

4. For each new DL HARQ transmission the SS generates sufficient PDCP SDUs (max PDCP SDU size and minimum number of consecutive PDCP SDUs) to fill up the TB on both PCC and SCC(s) as applicable in accordance with Annex A.3.2\_1. The SS ciphers the PDCP SDUs, concatenates the resultant PDCP PDUs to form an RLC PDU and then a MAC PDU. The SS transmits the MAC PDU. The SS increments then NDL\_newtx by one

5. If PHY requests a DL HARQ retransmission, the SS performs a HARQ retransmission and increments NDL\_retx by one.

6. Steps 4 to 5 are repeated at every TTI for at least 300 frames and the SS waits for 300ms to let any HARQ retransmissions and RLC retransmissions to finish.

7. SS sends a PDCP reestablishment via RRC Reconfiguration message requesting for PDCP Status Report.

8. The SS calculates the TB success rate as A = 100%\* NDL\_correct\_rx / (NDL\_newtx + NDL\_retx).

9. SS computes the PDCP SDU loss by looking into the FMC and Bitmap field in the PDCP Status Report. PDCP SDU loss B = COUNT reported in the Bitmap field of PDCP Stata Report.

10. The UE passes the test if A ≥ 85% TB success rate on both PCC and SCC and B = 0.

Note 1: In case of RLC PDU retransmission, the number of new required PDCP SDUs is as many as to fill the rest of TB.

5.5A.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2 with the following exceptions:

Table 5.5A.1.1.4.3-1: CLOSE UE TEST LOOP (in the preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.509 [9] clause 6.3.1 | | | |
| Information Element | | Value/remark | Comment | Condition |
| Protocol discriminator | | 1 1 1 1 |  |  |
| Skip indicator | | 0 0 0 0 |  |  |
| Message type | | 1 0 0 0 0 0 0 0 |  |  |
| UE test loop mode | | 0 0 0 0 0 0 0 0 | UE test loop mode A |  |
| UE test loop mode A LB setup | |  |  |
| Length of UE test loop mode A LB setup list in bytes | | 0 0 0 0 0 0 1 1 | Length of one LB setup DRB (3 bytes) |
| LB setup DRB | | 0 0 0 0 0 0 0 0,  0 0 0 0 0 0 0 0,  0 0 Q5 Q4 Q3 Q2 Q1 Q0 | UL PDCP SDU size = 0  Q5 = 1 (for NR Data Radio Bearers)  Q4..Q0 = Data Radio Bearer identity number -1 for the radio bearer. See 38.509 clause 6.3.1 |
| UE test loop mode B LB setup | | Not present |  |

Table 5.5A.1.1.4.3-2: RadioBearerConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3-132 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF SEQUENCE { | 1 entry |  | DRB1 |
| cnAssociation CHOICE { |  |  |  |
| sdap-Config | SDAP-Config |  |  |
| } |  |  |  |
| drb-Identity | DRB-Identity using condition DRB1 |  |  |
| reestablishPDCP | true |  | DRB1 AND Re-establish\_PDCP |
| pdcp-Config | PDCP-Config |  |  |
| } |  |  |  |

Table 5.5A.1.1.4.3-3: *PDCP-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-99 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCP-Config ::= SEQUENCE { |  |  |  |
| drb SEQUENCE { |  |  |  |
| discardTimer | infinity |  |  |
| pdcp-SN-Size-UL | len18bits |  |  |
| pdcp-SN-Size-DL | len18bits |  |  |
| headerCompression CHOICE { |  |  |  |
| notUsed | Null |  |  |
| } |  |  |  |
| integrityProtection | Not present |  |  |
| statusReportRequired | true |  |  |
| outOfOrderDelivery | Not present |  |  |
| } |  |  |  |
| t-Reordering | Not present |  |  |
| } |  |  |  |

Table 5.5A.1.1.4.3-4: Physical layer parameters for DCI format 1\_1

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-1 | | | |
| Parameter | Value | Value in binary | Condition |
| PDSCH-to-HARQ\_feedback timing indicator | corresponding to K1 slots as per Table 9.2.3-1 in TS 38.213 [22] and dl-DataToUL-ACK in Table 4.6.3-112  For FDD 15kHz SCell:  K1 = 7 if mod(i,5) = 0  K1 = 5 if mod(i,5) = 1  K1 = 4 if mod(i,5) = 2  K1 = 11 if mod(i,5) = 3  K1 = 9 if mod(i,5) = 4  where i is slot index per frame; i = {0,…,19} | - | (For FDD CC if configured as SCell with TDD PCell) |
| corresponding to K1 slots as per Table 9.2.3-1 in TS 38.213 [22] and dl-DataToUL-ACK in Table 4.6.3-112  For TDD30kHz SCell:  K1 = 3 |  | (For TDD CC if configured as SCell with FDD PCell) |

Table 5.5A.1.1.4.3-5: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | Not present | n8 | (For FDD CC if configured as SCell with TDD PCell) |
| } |  |  |  |

5.5A.1.1.5 Test requirement

The TB success rate of greater than 85% with no PDCP SDU loss shall be sustained during at least 300 frames on each CC.

#### 5.5A.1.2 FR1 SDR performance for CA (3DL CA)

##### 5.5A.1.2.1 Test Purpose

Same as in clause 5.5A.1.1.1

##### 5.5A.1.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 3DL CA

##### 5.5A.1.2.3 Minimum conformance requirements

Same as in clause 5.5A.1.1.3

5.5A.1.2.3.1 Procedure for test parameter selection

Same as in clause 5.5A.1.1.3.1

##### 5.5A.1.2.4 Test description

Same as in clause 5.5A.1.1.4

5.5A.1.2.4.3 Message contents

Same as in clause 5.5A.1.1.4.3

##### 5.5A.1.2.5 Test requirement

The TB success rate of greater than 85% with no PDCP SDU loss shall be sustained during at least 300 frames on each CC.

#### 5.5A.1.3 FR1 SDR performance for CA (4DL CA)

##### 5.5A.1.3.1 Test Purpose

Same as in clause 5.5A.1.1.1

##### 5.5A.1.3.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 4DL CA

##### 5.5A.1.3.3 Minimum conformance requirements

Same as in clause 5.5A.1.1.3

5.5A.1.3.3.1 Procedure for test parameter selection

Same as in clause 5.5A.1.1.3.1

##### 5.5A.1.3.4 Test description

Same as in clause 5.5A.1.1.4

5.5A.1.3.4.3 Message contents

Same as in clause 5.5A.1.1.4.3

##### 5.5A.1.3.5 Test requirement

The TB success rate of greater than 85% with no PDCP SDU loss shall be sustained during at least 300 frames on each CC.

#### 5.5A.1.4 FR1 SDR performance for CA (5DL CA)

##### 5.5A.1.4.1 Test Purpose

Same as in clause 5.5A.1.1.1

##### 5.5A.1.4.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 5DL CA

##### 5.5A.1.4.3 Minimum conformance requirements

Same as in clause 5.5A.1.1.3

5.5A.1.4.3.1 Procedure for test parameter selection

Same as in clause 5.5A.1.1.3.1

##### 5.5A.1.4.4 Test description

Same as in clause 5.5A.1.1.4

5.5A.1.4.4.3 Message contents

Same as in clause 5.5A.1.1.4.3

##### 5.5A.1.4.5 Test requirement

The TB success rate of greater than 85% with no PDCP SDU loss shall be sustained during at least 300 frames on each CC.