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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 of the 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.

In the present document, modal verbs have the following meanings:

shall indicates a mandatory requirement to do somethingshall not indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

should indicates a recommendation to do something

should not indicates a recommendation not to do something

may indicates permission to do something

need not indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

can indicates that something is possiblecannot indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

will indicates that something is certain or expected to happen as a result of action taken by an agency

the behaviour of which is outside the scope of the present document

will not indicates that something is certain or expected not to happen as a result of action taken by an

agency the behaviour of which is outside the scope of the present document

might indicates a likelihood that something will happen as a result of action taken by some agency the

behaviour of which is outside the scope of the present document

might not indicates a likelihood that something will not happen as a result of action taken by some agency

the behaviour of which is outside the scope of the present document

In addition:

is (or any other verb in the indicative mood) indicates a statement of fact

is not (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

1 Scope

The present document establishes the minimum performance requirements for NR User Equipment (UE).

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.
- 3GPP TR 21.905: "Vocabulary for 3GPP Specifications". [1] [2] 3GPP TS 38.521-4: "NR; User Equipment (UE) radio transmission and reception; Part 4: Performance requirements". Recommendation ITU-R M.1545: "Measurement uncertainty as it applies to test limits for the [3] terrestrial component of International Mobile Telecommunications-2000". [4] 3GPP TS 36.101: "Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception". 3GPP TR 38.901: "Study on channel model for frequencies from 0.5 to 100 GHz". [5] [6] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone". [7] 3GPP TS 38.101-2: "NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone". 3GPP TS 38.101-3: "NR; User Equipment (UE) radio transmission and reception; Part 3: Range 1 [8] and Range 2 Interworking operation with other radios".
- 3GPP TS 38.211: "NR; Physical channels and modulation". [9]
- 3GPP TS 38.212: "NR; Multiplexing and channel coding". [10]
- 3GPP TS 38.213: "NR; Physical layer procedures for control". [11]
- [12] 3GPP TS 38.214: "NR; Physical layer procedures for data".
- 3GPP TS 37.340: "Evolved Universal Terrestrial Radio Access (E-UTRA) and NR; Multi-[13] connectivity", Stage 2.
- 3GPP TS 38.306: "NR; User Equipment (UE) radio access capabilities". [14]
- 3GPP TS 36.211: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and [15] Modulation".
- [16] 3GPP TS38.521-4, "User Equipment (UE) conformance specification; Radio transmission and reception; Part 4: Performance"
- [17] 3GPP TS 38.331: "Radio Resource Control (RRC) protocol specification".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP 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 3GPP TR 21.905 [1].

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

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

Enhanced Receiver Type 1: SU-MIMO interference mitigation advanced receiver [14]

- R-ML (reduced complexity ML) receiver with enhanced inter-stream interference suppression for SU-MIMO transmissions with rank 2 with 2 RX antennas
- R-ML (reduced complexity ML) receiver with enhanced inter-stream interference suppression for SU-MIMO transmissions with rank 2, 3, and 4 with 4 RX antennas

FR1: Frequency range 1 as defined in clause 5.1 of TS 38.101-3 [8].

FR2: Frequency range 2 as defined in clause 5.1 of TS 38.101-3 [8].

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

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

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

 $N_{\rm oc}$ The power spectral density of a white noise source with average power per Hz as defined in Clause

4.4.3 for conducted requirements and Clause 4.5.3 for radiated requirements

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP 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 3GPP TR 21.905 [1].

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

DC 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

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

NR New Radio

NSA Non-Standalone Operation Mode 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

The present document is a Single-RAT and interwork specification for NR UE, covering minimum performance requirements of both conducted and radiated requirements. Conformance to the present specification is demonstrated by fulfilling the test requirements specified in the conformance specification TS 38.521-4 [2].

The Minimum Requirements given in this specification make no allowance for measurement uncertainty. The test specification TS 38.521-4 [2] defines test tolerances. These test tolerances are individually calculated for each test. The test tolerances are used to relax the minimum requirements in this specification to create test requirements.

The measurement results returned by the test system are compared – without any modification – against the test requirements as defined by the shared risk principle.

The shared risk principle is defined in Recommendation ITU-R M.1545 [3].

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

4.2 Applicability of minimum requirements

The conducted minimum requirements specified in this specification shall be met in all applicable scenarios for FR1. The radiated minimum requirements specified in this specification shall be met in all applicable scenarios for FR2. The minimum requirements for interworking specified in this specification shall be met in all applicable scenarios for NR interworking operation.

All minimum performance requirements defined in Clauses 5-8 are applicable to both SA and NSA unless otherwise explicitly stated in Clause 9 and 10.

All minimum performance requirements defined in Clauses 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 test system for certain test conditions is less than the defined SNR requirement for those tests, those requirements shall 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	
Α	Carrier Aggregation (CA)	
В	Dual-Connectivity (DC)	
С	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:

$$SNR = \frac{\sum_{j=1}^{N_{RX}} E_s^{(j)}}{\sum_{j=1}^{N_{RX}} N_{oc}^{(j)}}$$

Where

- N_{RX} 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:

 $Noc_{Band_X,\ SCS_Y,\ CBW_Z} = REFSENS_{Band_X,\ SCS_Y,\ CBW_Z} - 10*log10(12*SCS_Y*nPRB) + D - SNR_{REFSENS} + \Delta_{thermal} +$

where

- REFSENS_{Band_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 [6]
- 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 [6]
- D is diversity gain equal to 3 dB
- SNR_{REFSENS} = -1 dB is the SNR used for simulation of REFSENS
- Δ_{thermal} is the amount of dB that the wanted noise is set above UE thermal noise, giving a defined rise in total noise. $\Delta_{\text{thermal}} = 16$ dB, 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

where:

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:

 $Es_{Band_X,\ SCS_Y,\ CBW_Z} = REFSENS_{Band_X,\ SCS_Y,\ CBW_Z} - 10*log10(12*SCS_Y*nPRB) + D - SNR_{REFSENS} + dB_{EVM} + \Delta_{thermal} + \Delta_{t$

- REFSENS_{Band_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 [6]
- 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 [6]
- D is diversity gain equal to 3 dB
- SNR_{REFSENS} = -1 dB is the SNR used for simulation of REFSENS

- dB_{EVM} is the SNR of the applied signal due to EVM impairment on the wanted Es. An allowed EVM of 3% gives a dB_{EVM} of 30.5dB, derived as 20*log10(1/0.03).
- $\Delta_{thermal}$ 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. $\Delta_{thermal} = 7.6 dB$, giving a rise in total impairment of 0.7dB, regarded as acceptable.

The calculated Es value for the baseline of Band n12, 15kHz SCS, 15MHz CBW is -113.5 dBm/Hz.

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

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.

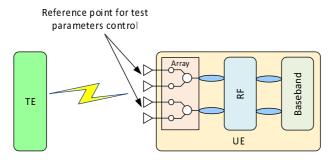


Figure 4.5.1-1: Reference point for radiated Demodulation and CSI requirements

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 SNR_{BB}. The SNR at the reference point is defined as

$$SNR = SNR_{BB} + \Delta_{BB}$$

where Δ_{BB} is specified in clause 4.5.3.

The reference point SNR is defined as:

$$SNR = \frac{\sum_{j=1}^{N_{RX}} E_s^{(j)}}{\sum_{j=1}^{N_{RX}} N_{oc}^{(j)}}$$

- N_{RX} 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 [7] by a defined amount, so that the impact of UE noise floor is limited to no greater than a value Δ_{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.

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 $\Delta_{BB} = 1 dB$.

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	
n257	-166.8	-161.3	-157.6	-166.3	
n258	-166.8	-161.3	-157.6	-166.3	
n259			-154.0		
n260	-163.8		-155.0	-164.3	
n261	-166.8	-161.3	-157.6	-166.3	
Note 1: Noc levels are specified in dBm/Hz					

For PC3 multi-band devices, the Noc power level (Noc_{MB}) shall increase by multi-band relaxation defined in Table 6.2.1.3-4 of TS 38.101-2 [7]:

$$Noc_{MB} = Noc_{SB} + \Delta MB_{P,n}$$

- Noc_{SB} is the Noc defined in Table 4.5.3.2-1
- $\Delta MB_{P,n}$ values are specified in TS 38.101-2 [7].

For CA case, the Noc power level (Noc_{CA}) shall increase by a relaxation factor defined in TS 38.101-2 [7] Table 7.3A.2.1-1:

$$Noc_{CA} = Noc_{SC} + \Delta R_{IB}$$

- Noc_{SC} is derived by assuming UE supports single carrier.
- ΔR_{IB} values are specified in TS 38.101-2 [7].

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 and on the UE Power class, and taking a baseline of UE Power class 3 in Band n260.

 $Noc = REFSENS_{PC3, \, n260, \, 50MHz} - 10Log_{10}(SCS_{REFSENS} \, x \, PRB_{REFSENS} \, x \, 12) - SNR_{REFSENS} + \Delta_{thermal} +$

where:

- REFSENS_{PC3, n260, 50MHz} is the REFSENS value in dBm specified for Power Class 3 UE in Band n260 for 50MHz Channel bandwidth in Table 7.3.2.3-1 of TS 38.101-2 [7].
- SCS_{REFSENS} is a subcarrier spacing associated with N_{RB} for 50MHz in Table 5.3.2-1 of TS 38.101-2 [7], chosen as 120 kHz.
- PRB_{REFSENS} is N_{RB} associated with subcarrier spacing 120 kHz for 50MHz in Table 5.3.2-1 of TS 38.101-2 [7] and is 32.
- 12 is the number of subcarriers in a PRB
- SNR_{REFSENS} = -1 dB is the SNR used for simulation of REFSENS
- $\Delta_{thermal}$ is the amount of dB that the wanted noise is set above UE thermal noise, giving a rise in total noise of Δ_{BB} . $\Delta_{thermal} = 6dB$, giving a rise in total noise of 1 dB.

The calculated Noc value for the baseline of UE Power class 3 in Band n260 is rounded to -155 dBm/Hz.

The following methodology to define the Noc level for UE power class X (PC_X) and operating band Y (Band_Y) is used for the single carrier case and single band devices:

Noc(PC_X, Band_Y) = -155 dBm/Hz + REFSENS_{PC_X}, Band_Y, 50MHz - REFSENS_{PC3}, n260, 50MHz

where REFSENS values are specified in TS 38.101-2 [7].

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 defined in TS 38.521-4 [16] and rank number in TS 38.521-4 [16] corresponding to the test cases
- Otherwise select one direction which satisfies the REFSENS defined in TS 38.101-2 [7], minimum isolation requirement defined in TS 38.521-4 [16] and rank number in TS 38.521-4 [16] 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

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[6].

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.

5.1.1.2 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 [6]. 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)	
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	FR1 FDD	PDSCH	Clause 5.2.2.1.1 (Test 3-1)	
advanced receiver			Clause 5.2.3.1.1 (Test 5-1)	
	FR1 TDD	PDSCH	Clause 5.2.2.2.1 (Test 3-1)	
			Clause F 2 2 2 4 /Test F 4)	
Alternative additional DMRS	FR1 FDD	PDSCH	Clause 5.2.3.2.1 (Test 5-1) Clause 5.2.2.1.4 (Test 1-2)	
position for co-existence with		. 200	, ,	
LTE CRS (additionalDMRS-DL-			Clause 5.2.3.1.4 (Test 1-2)	
Alt)	FR1 TDD	PDSCH	Clause 5.2.2.2.4 (Test 1-2)	
Basic DL NR-NR CA operation	NR CA	SDR	Clause 5.2.3.2.4 (Test 1-2) Clause 5.5A.1	1)Up to 16 DL
(supportedBandCombinationList)	INIC OA	ODIC	Olause S.SA. I	carriers
				2)Same numerology
				across carrier for data/control channel
				at a given time
Enhanced demodulation	FR1 FDD	PDSCH	Clause 5.2.2.1.9 (Test 1-1)	
processing for HST-SFN joint transmission scheme with			Clause 5.2.3.1.9 (Test 1-1)	
velocity up to 500km/h			, ,	
	FR1 TDD	PDSCH	Clause 5.2.2.2.9 (Test 1-1)	
			Clause 5.2.3.2.9 (Test 1-1)	
Alternative 64QAM MCS table	FR1 FDD	PDSCH	Clause 5.2.2.1.5	
for PDSCHNew 64QAM MCS			Clause 5.2.3.1.5	
table for PDSCH (dl-64QAM- MCS-TableAlt)			Clause 5.2.2.1.6 Clause 5.2.3.1.6	
in the state of th	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	FR1 FDD	PDSCH	Clause 5.2.3.1.5	
10^-5New CQI table (cqi-			Clause 5.2.3.1.5	
TableAlt)	FR1 TDD	PDSCH	Clause 5.2.2.2.5	_
	TRITOD	I DOCIT	Clause 5.2.3.2.5	
PDSCH repetitions over multiple	FR1 FDD	PDSCH	Clause 5.2.2.1.6	
slots (pdsch- RepetitionMultiSlots)			Clause 5.2.3.1.6	
Tropoundaminate of the state of	FR1 TDD	PDSCH	Clause 5.2.2.2.6	
LIE BROOM	ED4 EDD	DDOOLI	Clause 5.2.3.2.6	
UE PDSCH processing capability #2 (pdsch-	FR1 FDD	PDSCH	Clause 5.2.2.1.7 Clause 5.2.3.1.7	
ProcessingType2)]
	FR1 TDD	PDSCH	Clause 5.2.2.2.7	
Pre-emption indication for DL	FR1 FDD	PDSCH	Clause 5.2.3.2.7 Clause 5.2.2.1.8	
(pre-EmptIndication-DL)			Clause 5.2.3.1.8	
	FR1 TDD	PDSCH	Clause 5.2.2.2.8	
Single DCI based SDM	FR1 FDD	PDSCH	Clause 5.2.3.2.8 Clause 5.2.2.1.11	
transmission for multi-TRxP			Clause 5.2.3.1.11	
(singleDCI-SDM-scheme-r16)	FR1 TDD	PDSCH	Clause 5.2.2.2.11 Clause 5.2.3.2.11	
Multi DCI based multi-TRxP	FR1 FDD	PDSCH	Clause 5.2.3.2.11 Clause 5.2.2.1.12	
support (multiDCI-MultiTRP-r16)			Clause 5.2.3.1.12	
	FR1 TDD	PDSCH	Clause 5.2.2.2.12	
Single DCI based FDM Scheme-	FR1 FDD	PDSCH	Clause 5.2.3.2.12 Clause 5.2.2.1.13	
A for multi-TRxP(supportFDM-			Clause 5.2.3.1.13	
SchemeA-r16)	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-	FR1 FDD	PDSCH	Clause 5.2.2.1.14 Clause 5.2.3.1.14	
slotTDM-r16)	FR1 TDD	PDSCH	Clause 5.2.2.1.14	
310(11)(11)	TRITOD	I Doci i	Clause 5.2.3.2.14	
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.

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)	
230QAWFFN1)	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 (maxConfigNumberPortsAcros sNZP-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 (Test 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 Clause 5.2.3.1.10	For the value of "maxNumberActiveT CI-PerBWP" other than n1, 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 5.2.2.2.10 Clause 5.2.3.2.10	

5.1.1.5 Applicability of different requirements for HST

The applicability rules for different HST requirements in section 5 are specified in Table 5.1.1.5-1.

Table 5.1.1.5-1: Applicability of requirements for HST

	If UE has passed			UE can skip			
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)		

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 <u>smaller bandwidth</u> 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 CA requirements

5.1.1.7.1 Definition of CA capability

The definition with respect to CA capabilities is given as in Table 5.1.1.7.1-1.

Table 5.1.1.7.1-1: Definition of CA capability

CA	CA Capability Description				
Capability					
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 Clause 5.5A.1 of TS 38.101-1 [6].					
CA_N corresponds to NR CA configurations and bandwidth combination					
sets defined in Clause 5.5A.2 of TS 38.101-1 [6].					
	_AX corresponds to NR CA configurations and bandwidth combination				
set	s defined in Clause 5.5A.3 of TS 38.101-1 [6].				

5.1.1.7.2 Applicability and test rules for different CA configurations and bandwidth combination sets

The performance requirement for CA UE demodulation tests in Clause 5.2A are defined independent of CA configurations and bandwidth combination sets specified in Clause 5.5A of TS 38.101-1. For UEs supporting different CA configurations and bandwidth combination sets, the applicability and test rules are defined in Table 5.1.1.7.2-1 and Table 5.1.1.7.2-2. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set.

Table 5.1.1.7.2-1: 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 Clause 5.2A.2.1 and 5.2A.3.1	CA_C, CA_N, CA_AX	Table 5.1.1.7.2-2	Largest aggregated CA bandwidth combination	Any of CCs
Test 2 in Clause 5.2A.2.1 and 5.2A.3.1	CA_C, CA_N, CA_AX	Table 5.1.1.7.2-2	Largest aggregated CA bandwidth combination	Any of CCs
Test 3 in Clause 5.2A.2.1 and 5.2A.3.1	CA_AX	Table 5.1.1.7.2-2	Largest aggregated CA bandwidth combination	TDD CC if supported, otherwise FDD CC
Test 4 in Clause 5.2A.2.1 and 5.2A.3.1 (NOTE 2)	CA_AX	Table 5.1.1.7.2-2	Largest aggregated CA bandwidth combination	Any of CCs
Test 5 in Clause 5.2A.2.1 and 5.2A.3.1 (NOTE 3)	CA_AX	Table 5.1.1.7.2-2	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 5.1.1.7.2-2.

NOTE 2: These scenarios are only tested for UEs which are not verified with Test 3 in Clause 5.2A.2.1 and 5.2A.3.1. NOTE 3: These scenarios are only tested for UEs which are not verified with Test 2 in Clause 5.2A.2.1 and 5.2A.3.1.

Table 5.1.1.7.2-2: Selection of CA configurations

CA capability	Step 1	Step 2	Step 3	Step 4			
CA_C or CA_N	Select the CA	Select any one of CA	N/A	N/A			
	configurations with	configurations, which					
	the maximum number	contain CA bandwidth					
	of CCs, for which the	combination with the					
	supported maximum	largest aggregated					
	number of MIMO	channel bandwidth					
	layers is not lower	and supported					
	than 2.	maximum data rate is					
		not lower than the					
		tested date rate,					
		among all the					
		selected CA					
		configurations from					
		Step 1.					
CA_AX	Select the CA	Select any one of CA	Select the CA	Select any one of CA			
	configurations with	configurations, which	configurations with	configurations, which			
	the maximum number	contain CA bandwidth	the largest number of	contain CA bandwidth			
	of CCs, for which the	combination with the	bands and with the	combination with the			
	supported maximum	largest aggregated	maximum number of	largest aggregated			
	number of MIMO	channel bandwidth	CCs, for which the	channel bandwidth			
	layers is not lower	and supported	supported maximum	and supported			
	than 2.	maximum data rate is	number of MIMO	maximum data rate is			
		not lower than the	layers is not lower	not lower than the			
		tested date rate,	than 2.	tested date rate,			
		among all the		among all the			
		selected CA		selected CA			
		configurations from		configurations from			
NOTE 1. For CA	AV conchility if CA sout	Step 1.	A configuration with the La	Step 3.			
	_AX capability, if CA confi						
	ep 3 and Step 4 are skipp	ed. Otherwise, the two C/	A configurations selected	nom step z 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 $DataRate = 10^{-3} \sum_{j=1}^{J} TBS_j 2^{\mu_j}$

and FRCs used in the test.

5.1.1.7.3 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 Clause5.2A.3.1 are applied.

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

5.1.1.8 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			
Test t	type	Test list	Test	ype	Test list	notes	
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)		

5.2 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			Transmission scheme 1
Carrier	Offset between Point A and the lowest	RBs	0
configuration	usable subcarrier on this carrier (Note 2)		45 00
DL BWP	Subcarrier spacing Cyclic prefix	kHz	15 or 30 Normal
configuration #1	Cyclic prefix		Normai
John garation // 1	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 [6] for tested
			channel bandwidth and subcarrier spacing
Common serving	Physical Cell ID		0 0
cell parameters	1 Hydrodi Coll 12		· ·
	SSB position in burst		First SSB in Slot #0
	SSB periodicity	ms	20
PDCCH	Slots for PDCCH monitoring		Each slot
configuration	Symbolo with DDCCLI	Cymholo	0.1
	Symbols with PDCCH Number of PRBs in CORESET	Symbols	0, 1 Table 5.2-2 for tested channel
	Number of FRES III COREGET		bandwidth and subcarrier spacing
	Number of PDCCH candidates and		1/AL8
	aggregation levels		
	CCE-to-REG mapping type		Non-interleaved
	DCI format		1_1
	TCI state		TCI state #1
	PDCCH & PDCCH DMRS Precoding configuration		Single Panel Type I, Random per slot with equal probability of each
	Corniguration		applicable i ₁ , i ₂ combination, and with
			REG bundling granularity for number
			of Tx larger than 1
Cross carrier schedu			Not configured
CSI-RS for tracking	First subcarrier index in the PRB used for CSI-RS		k ₀ =0 for CSI-RS resource 1,2,3,4
	First OFDM symbol in the PRB used for		I ₀ = 6 for CSI-RS resource 1 and 3
	CSI-RS		$I_0 = 10$ 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
	OCL into		Number of PRB = BWP size
NZP CSI-RS for	QCL info First subcarrier index in the PRB used for		TCI state #0 k ₀ = 0
CSI acquisition	CSI-RS		KU = U
5 2 1 2 3 4 3 1 3 1 3 1	First OFDM symbol in the PRB used for		l ₀ = 12
	CSI-RS		
	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

	Fraguenov Occ	unation		Start PRB 0
	Frequency Occ	supation		Number of PRB = BWP size
	QCL info			TCI state #1
ZP CSI-RS for CSI acquisition	P CSI-RS for CSI First subcarrier index in the PRB used for			k ₀ = 4
aoquioinon		mbol in the PRB used for		I ₀ = 12
	Number of CSI	-RS ports (X)		4
	CDM Type	res ports (71)		'FD-CDM2'
	Density (ρ)			1
	CSI-RS periodi	citv	Slots	15 kHz SCS: 20
		- 9		30 kHz SCS: 40
	CSI-RS offset		Slots	0
	Frequency Occ	cupation		Start PRB 0
	' '			Number of PRB = BWP size
PDSCH DMRS	Antenna ports i	ndexes		{1000} for Rank 1 tests
configuration				{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		2
	mapping type A			
	Number of PDS	SCH DMRS CDM group(s)		1 for Rank 1 and Rank 2 tests
	without data	-		2 for Rank 3 and Rank 4 tests
TCI state #0	Type 1 QCL	SSB index		SSB #0
	information			
		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	CSI-RS resource		N/A
	information			
		QCL Type		N/A
PT-RS configuration				PT-RS is not configured
Maximum number of	code block group	os for ACK/NACK feedback		1
Maximum number of		sion		4
HARQ ACK/NACK b	undling			Multiplexed
Redundancy version	coding sequence	9		{0,2,3,1}
PDSCH & PDSCH D	MRS Precoding	configuration		Single Panel Type I, Random
				precoder selection updated per slot,
				with equal probability of each
				applicable i ₁ , i ₂ combination, and with
				PRB bundling granularity
Symbols for all unuse	ed REs			OP.1 FDD as defined in Annex
				A.5.1.1
				OP.1 TDD as defined in Annex
D				A.5.2.1
Physical signals, cha				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 [6] 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

5.2.1 1RX requirements

(Void)

5.2.2 2RX requirements

5.2.2.1 FDD

5.2.2.1.1 Minimum requirements for PDSCH Mapping Type A

The performance requirements are specified in Table 5.2.2.1.1-3 and Table 5.2.2.1.1-4, with the addition of test parameters in Table 5.2.2.1.1-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.1-1.

Table 5.2.2.1.1-1: 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, 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 5.2.2.1.1-2: 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		Test 1-2: Type 1 with start RB = 23, $L_{RBs} = 6$ 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
g	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.
	CSI-RS offset	Slots	Other tests: Table 5.2-1. 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 5.2.2.1.1-3: 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 v	alue
		, ,				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]

Table 5.2.2.1.1-4: Minimum performance for Rank 2

Test num.	Reference channel			h Modulation Propagation format and condition		Reference value	
num.	Chamer	Subcarrier spacing (kHz)	code rate	Condition	matrix and antenna configuration	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 5.2.2.1.1-5: 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 va	alue
						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

5.2.2.1.2 Minimum requirements for PDSCH Mapping Type A and CSI-RS overlapped with PDSCH

The performance requirements are specified in Table 5.2.2.1.2-3, with the addition of test parameters in table 5.2.2.1.2-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.2-1.

Table 5.2.2.1.2-1: 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 5.2.2.1.2-2: 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
NZP CSI-RS for CSI acquisition	OFDM symbols in the PRB used for CSI-RS		l ₀ = 13
	CSI-RS periodicity	Slots	5
ZP CSI-RS for CSI acquisition	Subcarrier index in the PRB used for CSI-RS		$(k_0, k_1, k_2, k_3)=(2, 4, 6, 8)$
•	Number of CSI-RS ports (X)		8
	CSI-RS periodicity	Slots	5
Number of HARQ Pr			4
The number of slots ACK information	between PDSCH and corresponding HARQ-		2

Table 5.2.2.1.2-3: Minimum performance for Rank 2

		Bandwidth			Correlation	Reference value	
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	matrix and antenna configuration	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

5.2.2.1.3 Minimum requirements for PDSCH Mapping Type B

The performance requirements are specified in Table 5.2.2.1.3-3, with the addition of test parameters in Table 5.2.2.1.3-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.3-1.

Table 5.2.2.1.3-1: Tests purpose

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

Table 5.2.2.1.3-2: Test parameters

	Parameter	Unit	Value
Duplex mode			FDD
Active DL BWP inde	ex		1
PDSCH configuration	Mapping type		Туре В
	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 P	Number of HARQ Processes		4
The number of slots ACK information	between PDSCH and corresponding HARQ-		2

Table 5.2.2.1.3-3: Minimum performance for Rank 1

		Bandwidth			Correlation	Reference value	
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	matrix and antenna configuration	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

5.2.2.1.4 Minimum requirements for PDSCH Mapping Type A and LTE-NR coexistence

The performance requirements are specified in Table 5.2.2.1.4-3, with the addition of test parameters in Table 5.2.2.1.4-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.4-1.

Table 5.2.2.1.4-1: Tests purpose

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

Table 5.2.2.1.4-2: 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	Symbole with DIYCCH		Symbol# 2
PDSCH configuration	Mapping type		Туре А
	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			4
The number of slots between PDSCH and corresponding HARQ-ACK information			2
Note 1: No MBSF	N is configured on LTE carrier		

Table 5.2.2.1.4-3: Minimum performance for Rank 1

		Bandwidth			Correlation	Reference v	alue
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	matrix and antenna configuration	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

5.2.2.1.5 Minimum requirements for PDSCH 0.001% BLER

The performance requirements are specified in Table 5.2.2.1.5-3, with the addition of test parameters in Table 5.2.2.1.5-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.5-1.

Table 5.2.2.1.5-1: Tests purpose

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

Table 5.2.2.1.5-2: Test parameters

	Parameter	Unit	Value
Duplex mode			FDD
Active DL BWP inde	X		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 ACK information	between PDSCH and corresponding HARQ-		2

Table 5.2.2.1.5-3: Minimum performance for Rank 1

Test	Deference	Bandwidth (MHz) /	Modulation	Dranagation	Correlation matrix and	Reference value	
num.	Reference channel	Subcarrier spacing (kHz)	format and code rate	Propagation condition	antenna configuration	Target BLER	SNR (dB)
1-1	R.PDSCH.1-1.4 FDD	10 / 15	QPSK, 0.59	AWGN	1x2, ULA Low	0.001%	2.7

5.2.2.1.6 Minimum requirements for PDSCH repetitions over multiple slots

The performance requirements are specified in Table 5.2.2.1.6-3, 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 5.2.2.1.6-1.

Table 5.2.2.1.6-1: Tests purpose

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

Table 5.2.2.1.6-2: Test parameters

	Parameter	Unit	Value
Duplex mode			FDD
Active DL BWP inde	X		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 Pr	ocesses		4
The number of slots corresponding HARO	between final repetition of PDSCH and Q-ACK information		2

Table 5.2.2.1.6-3: Minimum performance for Rank 1

Toot	Deference	Bandwidth (MHz) / Modulation Correlation	Reference value				
Test num.	Reference channel	Subcarrier spacing (kHz)	format and code rate	Propagation condition	matrix and antenna configuration	I A PARA PI LD I	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.

5.2.2.1.7 Minimum requirements for PDSCH Mapping Type B and UE processing capability 2

The performance requirements are specified in Table 5.2.2.1.7-3, with the addition of test parameters in Table 5.2.2.1.7-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.7-1.

Table 5.2.2.1.7-1: Tests purpose

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

Table 5.2.2.1.7-2: Test parameters

	Parameter	Unit	Value
Duplex mode			FDD
Active DL BWP index	X		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 ACK information	between PDSCH and corresponding HARQ-		0

Table 5.2.2.1.7-3: Minimum performance for Rank 1

		Bandwidth		Correlation	Reference value		
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	matrix and antenna configuration	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	[8.0]

5.2.2.1.8 Minimum requirements for PDSCH pre-emption

The performance requirements are specified in Table 5.2.2.1.8-3, with the addition of test parameters in Table 5.2.2.1.8-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.8-1.

Table 5.2.2.1.8-1: Tests purpose

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

Table 5.2.2.1.8-2: 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		Туре А
-	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
3	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 Pro	ocesses		4
ACK information	between PDSCH and corresponding HARQ-		2
Note 1: Void	co modellod as random data on pro ampted Pl	Ec	

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 5.2.2.1.8-3: Minimum performance for Rank 1

		Bandwidth (MHz) /	Madadatian		Correlation Reference value		alue
Test num.	Reference channel	Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	matrix and antenna configuration	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]

5.2.2.1.9 Minimum requirements for PDSCH HST-SFN

The performance requirements are specified in Table 5.2.2.1.9-3, with the addition of test parameters in Table 5.2.2.1.9-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.9-1.

Table 5.2.2.1.9-1: Tests purpose

Test index

Table 5.2.2.1.9-2: Test parameters

	Parameter	Unit	Value
Duplex mode			FDD
Active DL BWP index	(1
PDSCH	Mapping type		Type A
configuration			
	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		N/A
	size		
PDSCH DMRS	DMRS Type		Type 1
configuration			
	Number of additional DMRS		2
	Maximum number of OFDM symbols for		1
	DL front loaded DMRS		
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 Pro			4
	between PDSCH and corresponding HARQ-		2
ACK information			

Table 5.2.2.1.9-3: Minimum performance for Rank 2

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

5.2.2.1.10 Minimum requirements for HST DPS

The performance requirements are specified in Table 5.2.2.1.10-3, with the addition of test parameters in Table 5.2.2.1.10-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.10-1.

Table 5.2.2.1.10-1: Tests purpose

. 45.0 0.2.2.1.	
Purpose	Test index
Verify UE performance in the HST-DPS scenario define in B.3.3	d 1-1, 1-2

Table 5.2.2.1.10-2: Test parameters

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		Parameter		Unit	Value
Active DL BMP Index PDSCH configuration TC state Note 1	Duplex mode				FDD
Mapping type	Active DL BWP index				1
Mapping type	PDCCH configuration	TCI state			Note 1
Resource set #1 Resource set #2 Resource set #3 Resource set #4 Resource s					
Starting symbol (S)					
Length (L)		Starting symbol (S)		
POSCH aggregation factor 1 1 PRB bundling type Static PRB bundling size 2 2 Resource allocation type Type 0 RBG size Conflig2 VRB-to-PRB mapping type Non-interleaved VRB-to-PRB mapping interleaver bundle size Note 1 N/A TCI state Note 1 TOI state Note 1 Tol state			,		
PRB bundling type			on factor		1
PRB bundling size					Static
Resource allocation type					
RBG size VRB-to-PRB mapping type VRB-to-PRB mapping interleaver bundle size N/A					Type 0
VRB-to-PRB mapping type			71.		
VRB-to-PRB mapping interleaver bundle size		VRB-to-PRB mapp	ping type		
TC state Note 1 Type 1					N/A
DMRS Type					Note 1
Number of additional DMRS	PDSCH DMRS	DMRS Type			Type 1
Maximum number of OFDM symbols for DL front loaded DMRS	configuration	<u> </u>	1.0140.0		
Total table					
Resource set #1 First OFDM symbol in the PRB used for CSI-RS resource 1 and 3 to PRB used for CSI-RS resource 2 and 4					1
Resource set #1 the PRB used for CSI-RS		front loaded DMRS			1 54 001 50
RS	CCI DC for two obins	Danauman ant #4	1		
CSI-RS periodicity	COI-KO for tracking	Resource set #1			$I_0 = 9$ for CSI-RS resource 2 and 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 First OFDM symbol in the PRB used for CSI-RS resource 5 and 6 10 = 10 for CSI-RS resource 5 and 6 10 = 10 for CSI-RS resource 7 and 8 CSI-RS offset Slots CSI-RS resource 5 and 6 2 for CSI-RS resource 7 and 8 CSI-RS offset Slots CSI-RS periodicity Slots CSI-RS resource 7 and 8 CSI-RS periodicity Slots CSI-RS periodicity Slots CSI-RS offset Slots O O O O O O O O O			_	Cloto	10 for CSL DS recourse 4.9.9.4
CSI-RS offset 2 for CSI-RS resource 3 and 4 TCI state #2			CSI-KS periodicity		
Resource set #2 First OFDM symbol in the PRB used for CSI-RS 10 for CSI-RS resource 5 and 6 lo = 10 for CSI-RS resource 7 and 8 CSI-RS offset Slots 10 for CSI-RS resource 5 and 6 lo = 10 for CSI-RS for tracking Resource 5 and 6 lo = 10 for CSI-RS for tracking Resource 5 and 6 lo = 10 for CSI-RS for tracking Resource 5 and 6 lo = 10 for CSI-RS for tracking Resource 5 and 6 lo = 10 for CSI-RS for tracking Resource 5 and 6 lo = 10 for CSI-RS for tracking Resource 5 and 6 lo = 10 for CSI-RS for tracking Resource 5 and 6 lo = 10 for CSI-RS for tracking Resource 5 and 6 lo = 10 for CSI-RS for tracking Resource 5 and 6 lo = 10 for CSI-RS for tracking Resource 5 and 6 lo = 10 for CSI-RS for tracking Resource 5 and 6 lo = 10 for CSI-RS for tracking Resource 5 and 6 lo = 10 for CSI-RS for tracking Resource 5 and 6 lo = 10 for CSI-RS for tracking Resource 5 and 6 lo = 10 for CSI-RS for tracking for CSI-RS for tracking for CSI-RS for tracking for CSI-R			CSI-RS offset	Siots	
Resource set #2 First OFDM symbol in the PRB used for CSI-RS resource 5 and 6 lo = 10 for CSI-RS resource 5 and 6 lo = 10 for CSI-RS resource 7 and 8 lo = 10 for CSI-RS resource 7 and 8 lo = 10 for CSI-RS resource 7 and 8 lo = 10 for CSI-RS resource 5 and 6 lo = 10 for CSI-RS resource 7 and 8 lo = 10 for CSI-RS resource 5 and 6 lo = 10 for CSI-RS resource 7 and 8 lo = 10 for CSI-RS resource 5 and 6 lo = 10 for CSI-RS resource 7 and 8 lo = 10 for CSI-RS resource 5 and 6 lo = 10 for CSI-RS resource 7 and 8 lo = 10 for CSI-RS resource 5 and 6 lo = 10 for CSI-RS resource 5 and 6 lo = 10 for CSI-RS resource 5 and 6 lo = 10 for CSI-RS resource 5 and 6 lo = 10 for CSI-RS resource 5 and 6 lo = 10 for CSI-RS resource 5 and 6 lo = 10 for CSI-RS resource 5 and 6 lo = 10 for CSI-RS resource 5 and 6 lo = 10 for CSI-RS resource 5 and 6 lo = 10 for CSI-RS resource 5 and 6 lo = 10 for CSI-RS resource 5 and 6 lo = 10 for CSI-RS resource 5 and 6 lo = 10 for CSI-RS resource 5 and 6 lo = 10 for CSI-RS resource 5 and 6 lo = 10 for CSI-RS resource 5 and 6 lo = 10 for CSI-RS resource 5 and 6 lo = 10 for CSI-RS resource 5 lo CSI-RS resource 5 lo CSI-RS resource 5 lo CSI-RS resource 5 lo CSI-RS for tracking Resource set #1 configuration for tracking Resource 5 lo CSI-RS resource 5 lo CSI-RS resource 5 lo CSI-RS resource 5 lo CSI-RS for tracking Resource 5 lo CSI-RS resource 5 lo CSI-RS for tracking			QCL info		
Resource set #2 the PRB used for CSI- RS lo = 10 for CSI-RS resource 7 and 8 RS CSI-RS periodicity Slots 10 for CSI-RS resource 5,6,7,8.					
RS		Resource set #2			
CSI-RS periodicity					
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				Slots	10 for CSI-RS resource 5.6.7.8.
NZP CSI-RS for CSI acquisition Resource set #3 First OFDM symbol in the PRB used for CSI-RS periodicity Slots 20					
NZP CSI-RS for CSI acquisition			CSI-RS offset	0.0.0	
Resource set #3 the PRB used for CSI-RS CSI-RS for CSI-RS offset Slots QC CSI-RS offset Slots QC TCI state #0			QCL info		
Resource set #3 To provide the property of the provided provid	NZD CCL DC for CCL		First OFDM symbol in		I ₀ = 12
CSI-RS periodicity Slots 20		Resource set #3	the PRB used for CSI-		
CSI-RS offset QCL info TCl state #0	acquisition		RS		
Resource set #4 First OFDM symbol in the PRB used for CSI-RS Slots 20				Slots	20
Resource set #4 First OFDM symbol in the PRB used for CSI-RS CSI-RS periodicity Slots 20				Slots	,
Resource set #4			QCL info		TCI state #0
RS			First OFDM symbol in		$I_0 = 13$
CSI-RS periodicity Slots 20		Resource set #4			
CSI-RS offset Slots 0 TCI state #1					
Type 1 QCL info					
Type 1 QCL Information CSI-RS resource CSI-RS resource 1 from 'CSI-RS for tracking Resource set #1' configuration Type A				Slots	<u> </u>
Type 1 QCL Information CSI-RS resource CSI-RS resource CSI-RS resource CSI-RS resource Type A			QCL info		
Information		Type 1 OCI			
Configuration QCL Type Type A	TCI state #0		CSI-RS resource		
Type 2 QCL Information CSI-RS resource N/A					
Information CSI-RS resource N/A			QCL Type		
Total configuration Color configuration			CSI-RS resource		N/A
Type 1 QCL Information CSI-RS resource CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' Configuration Type 2 QCL Information CSI-RS resource Type A N/A Type 1 QCL Information CSI-RS resource Type A N/A Type 1 QCL Information SSB index SSB #0 Type 2 QCL SSB index Type C N/A Type 3 QCL Type Type C Type C Type C Type C Type 3 QCL Type Type C		ıntormation			N/*
TCI state #1 Type 1 QCL Information CSI-RS resource CSI-RS resource tracking Resource set #2' Configuration Type A			QCL Type		
Information CSI-RS resource CSI-RS resourc	TCI atota #4	Type 1 QCL	CCL DC reserves		
QCL Type Type A	TOT State #1		COI-KO resource		
Type 2 QCL Information CSI-RS resource N/A			OCL Type		
Information CSI-RS resource		Type 2 OCI			
Type 1 QCL SSB index SSB #0			CSI-RS resource		1.97.1
SSB Index SSB Index Type C Type 2 QCL SSB Index N/A SSB Index Type C N/A SSB Index Type C Type 2 QCL SSB Index Type C			QCL Type		
	TCI state #2		SSB index		SSB #0
Type 2 QCL SSR index N/A	. Of State #2	information			
		T	QCL Type		
Intermation			SSB index		N/A
		Intormation			

		QCL Type		N/A
TCI state #3	CI state #3 Type 1 QCL information			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, TCl state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy mod(i, 2n) = n. PDCCH and PDSCH associated with TCl # (k mod 2) is transmitted by kth RRH from slot# $max[(2k-1)n+1+T_{HARQ}+T_{MAC\,proc}+T_{firstTRS}+T_{TRS\,proc},0]$

to slot#

$$(2k+1)n + T_{HARQ} + T_{MAC proc}$$

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 mod(i, 2n) = n. PDCCH and PDSCH associated with TCI # (k mod 2) is transmitted by kth RRH from slot# $max[(2k-1)n + 1 + T_{HARO} + T_{MAC\ DTOC}, 0]$

to slot#

$$(2k + 1)n + T_{HARQ} + T_{MAC proc}$$

Where k=0, 1, 2... is the RRH number, n = 2520 is half of the number of slots between two RRH, T_{HARQ} = 2 is the number of slots between PDSCH and corresponding HARQ-ACK information, $T_{MAC\ proc}$ = 3 is the number of slots for MAC CE processing, $T_{firstTRS}$ = 6 is the number of slots to first TRS transmission occasion after MAC CE command is decoded by the UE, $T_{TRS\ proc}$ = 2 is the number of slots for TRS processing.

Table 5.2.2.1.10-3: Minimum performance for HST DPS

		Bandwidth			Number of	Correlation	Reference value	
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	active PDSCH TCI states	matrix and antenna configuration	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]

5.2.2.1.11 Minimum requirements for PDSCH Single-DCI based SDM scheme

The performance requirements are specified in Table 5.2.2.1.11-3, with the addition of test parameters in Table 5.2.2.1.11-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.11-1.

Table 5.2.2.1.11-1: Tests purpose

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

Table 5.2.2.1.11-2: Test parameters

	eter	Unit	Value				
				Oilit	TRxP #1(Note 1)	TRxP #2(Note 1)	
Transmit TRxP of SS					P #1		
PDCCH configuration		TCI state	TD a all a day		TCI St		
	(CORESETPoolIndex First subcarrier index in the			k0=0 for CSI-RS	k0=1 for CSI-RS	
			for CSI-RS		resources 1,2,3,4	resources 5,6,7,8	
	<u> -'</u>	ND useu	101 001-10		10 = 6 for CSI-RS	10 = 6 for CSI-RS	
	_				resources 1 and 3	resources 5 and 7	
			M symbol in the PRB		10 = 10 for CSI-	10 = 10 for CSI-	
		used for C	SI-RS		RS resources 2	RS resources 6	
					and 4	and 8	
		Number of	f CSI-RS ports (X)		1 for CSI-RS	1 for CSI-RS	
CSI-RS for tracking	<u>_</u> '	variibei o	T COT ITO POILS (71)		resource 1,2,3,4	resource 5,6,7,8	
Correction tracking		CDM Type	Э			SI-RS resource	
						,5,6,7,8	
		Density CSI-RS pe	priodicity	Slots		3.0	
	<u> </u>	COI-IXO PE	enodicity	31013	10 for CSI-RS	10 for CSI-RS	
					resources 1 and 2	resources 5 and 6	
	(CSI-RS of	fset	Slots	11 for CSI-RS	11 for CSI-RS	
						resources 7 and 8	
	(QCL info				ate #0	
Duplex mode					F	OD OC	
Active DL BWP index	(1	
	Mapping typ	type			Тур	e A	
	k0				0		
	Starting symbol (S)				2		
	Length (L)				12 Static		
PDSCH	PRB bundling type						
configuration	PRB bundling size Resource allocation type					2	
	RBG size				Тур		
	VRB-to-PRB mapping type				Config2 Non-interleaved		
		VRB-to-PRB mapping type VRB-to-PRB mapping interleaver bundle					
	size				N.	/A	
	Antenna port indexes				1000	1002	
	TCI state				TCI State #1	TCI State #2	
PDSCH DMRS	DMRS Type				Тур	pe 1	
configuration	Number of additional DMRS				,	1	
	Maximum number of OFDM symbols for				,	1	
	DL front loaded DMRS				CSI-RS resource		
					1 from 'CSI-RS		
	Type 1 QCL		CSI-RS resource		for tracking'	N/A	
TCI State #1	information				configuration		
			QCL Type		Type A	N/A	
	Type 2 QCL		CSI-RS resource		N/A	N/A	
	information		QCL Type		N/A	N/A	
						CSI-RS resource	
	Type 1 QCL		CSI-RS resource		N/A	5 from 'CSI-RS	
	information	•				for tracking'	
TCI State #2			00L T:		N1/A	configuration	
	Tyma 2 OCL		QCL Type		N/A N/A	Type A N/A	
	Type 2 QCL information		CSI-RS resource QCL Type	 	N/A N/A	N/A N/A	
Resource allocation	Resource allocation				Full-ove		
						test 1-1	
Timing offset of the s	econd IRXP fi	rom the fi	rst ikxp	us		est 1-2	
Frequency offset of the	he second TD	vD from +h	na firet TPvP	Hz		test 1-1	
		AT HUIHILI	IC III OL ITAK	1 12	0 for test 1-2		
Number of HARQ Pro				1	4	1	
The number of slots I	between PDS0	CH and co	orresponding HARQ-			2	
ACK information					1		

Precodin	g configuration	SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity		
Note 1:	Note 1: PDSCH transmission is done from both TRxPs (PDSCH Layer 0 is transmitted from TRxP #1 and PDSC layer 1 is transmitted from TRxP #2)			

Table 5.2.2.1.11-3: Minimum performance

		Bandwidt	Modulatio		Correlation matrix	Referenc	e value				
Test num	Reference channel	h (MHz) / Subcarrier spacing (kHz)	n format and code rate	Propagation condition(Not e 1)	and antenna configuration(Not e 2)	Fraction of maximum throughpu t (%)	SNR (dB)(Not e 3)				
1-1	R.PDSCH.1 -3.2 FDD	10 / 15	64QAM, 0.50	TDLA30-10	2x2, ULA Low	70	[19.4]				
1-2	R.PDSCH.1 -3.2 FDD	10 / 15	64QAM, 0.50	TDLA30-10	2x2, ULA Low	70	[19.1]				
Note 1	Note 1: The propagation conditions apply to each of TRYP #1 and TRYP #2 and are statistically independent										

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 Minimum requirements for PDSCH Multi-DCI based transmission scheme

The performance requirements are specified in Table 5.2.2.1.12-3, with the addition of test parameters in Table 5.2.2.1.12-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.12-1.

Table 5.2.2.1.12-1: Tests purpose

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

Table 5.2.2.1.12-2: Test parameters

Parameter					lue	
				TRxP #1(Note 1)	TRxP #2(Note 1)	
Transmit TRxP of SS	TCI	state		TCI State #1	P #1 TCI State #2	
PDCCH configuration		RESETPoolIndex			,1	
		t subcarrier index in the		k0=0 for CSI-RS	k0=1 for CSI-RS	
		B used for CSI-RS		resources 1,2,3,4	resources 5,6,7,8	
				I0 = 6 for CSI-RS	I0 = 6 for CSI-RS	
		+ OFDM as unabading the DDD		resources 1 and 3	resources 5 and 7	
	FIIS	t OFDM symbol in the PRB d for CSI-RS		I0 = 10 for CSI-	10 = 10 for CSI-	
	use	u 101 C31-K3		RS resources 2	RS resources 6	
				and 4	and 8	
	Nun	nber of CSI-RS ports (X)		1 for CSI-RS	1 for CSI-RS	
CSI-RS for tracking	11011	is a control parts (7.)		resource 1,2,3,4		
oor no for tracking	CDI	И Туре			SI-RS resource	
					,5,6,7,8	
	Den		Clata		3	
	CSI	-RS periodicity	Slots	10 for CSI-RS	20 10 for CSI-RS	
				resources 1 and 2	resources 5 and 6	
	CSI	-RS offset	Slots	11 for CSI-RS	11 for CSI-RS	
					resources 7 and 8	
	OCI	_ info			ate #0	
Duplex mode	50				DD	
Active DL BWP index	(1	
	Mapping type			Typ	e A	
	k0				0	
	Starting symbol	(S)			2	
	Length (L)			12		
PDSCH	PRB bundling ty			Static		
configuration	PRB bundling s			2		
comigaration	Resource alloca	ation type		Type 1		
	RBG size				nfig2	
	VRB-to-PRB ma			Non-inte	erleaved	
		apping interleaver bundle		N/A		
	size					
	Antenna port in	on indexes		{1000,1001}	{1002,1003} TCI State #2	
PDSCH DMRS	TCI state DMRS Type			TCI State #1		
configuration	Number of addi	tional DMPS		1 1/1	oe 1	
Comiguration		per of OFDM symbols for			I	
	DL front loaded			,	1	
	DE HOIR loaded			CSI-RS resource		
		201.70		1 from 'CSI-RS		
	Type 1 QCL	CSI-RS resource		for tracking'	N/A	
TCI State #1	information			configuration		
		QCL Type		Type A	N/A	
	Type 2 QCL	CSI-RS resource		N/A	N/A	
	information	QCL Type		N/A	N/A	
					CSI-RS resource	
	Type 1 QCL	CSI-RS resource		N/A	5 from 'CSI-RS	
TOLO: "2	information			,	for tracking'	
TCI State #2		OCL Time		N1/A	configuration	
	Type 2 OCI	QCL Type		N/A	Type A	
	Type 2 QCL information	CSI-RS resource QCL Type	1	N/A N/A	N/A N/A	
Resource allocation	inionnation	QOL TYPE			erlapping	
Timing offset of the s	econd TRyP from	the first TRvP	us		enapping).5	
Frequency offset of the s			Hz		00	
Number of HARQ Pr		TOTAL UTO IN OUT TAXA	112		4	
The number of slots between PDSCH and corresponding HARQ-					-	
ACK information					2	
2.1				SP Type I. indep	endent precoding	
Drocoding configurat	ion				ed for both TRxPs,	
Precoding configurat	IUII				vith PRB bundling	
				_	ularity	
						

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 5.2.2.1.12-3: Minimum performance

Tes t nu m.	t Reference channel nu n.		Bandwid th (MHz) / Subcarri er spacing (kHz)	Modulati on format and code rate	Propagation condition(N ote 1)	Correlation matrix and antenna configuration(N ote 2)	Reference Fraction of maximu m throughp ut (%)	SNR (dB)(No te 3)
	TRxP #1	TRxP #2						
1-1	R.PDSCH.	R.PDSCH.	10 / 15	64QAM,	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

5.2.2.1.13 Minimum requirements for PDSCH with single-DCI based FDM Scheme A

The performance requirements are specified in Table 5.2.2.1.13-3, with the addition of test parameters in Table 5.2.2.1.13-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.13-1.

Table 5.2.2.1.13-1: Tests purpose

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

Table 5.2.2.1.13-2: Test parameters

Transmit TRXP of SSB		Paran	neter		Unit		lue	
PDCCH configuration					-	TRxP #1 (Note 1) TRxP #2 (Note 1)		
CORESETPOOIIndex								
First subcarrier index in the PRB used for CSI-RS PRB used for CSI-RS PRB used for CSI-RS PRB used for CSI-RS First OFDM symbol in the PRB used for CSI-RS First OFDM symbol in the PRB used for CSI-RS First OFDM symbol in the PRB used for CSI-RS First OFDM symbol in the PRB used for CSI-RS First OFDM symbol in the PRB used for CSI-RS First OFDM symbol in the PRB used for CSI-RS First OFDM symbol in the PRB used for CSI-RS First OFDM symbol in the PRB used for CSI-RS First OFDM symbol in the PRB used for CSI-RS First OFDM symbol	PDCCH configuration	n 		TPoolIndex				
PRB used for CSI-RS								
First OFDM symbol in the PRB used for CSI-RS								
Prist Or Dispress Prist Or Dispress Security Se								
Used for CSI-RS Used for CSI-RS Used for CSI-RS RS resources 2 and 4			First OFD	M symbol in the PRB				
CSI-RS for tracking								
Number of CSI-RS ports (X)								
CDM Type		-	Number o	f CSI-RS ports (X)		1 for CSI-RS	1 for CSI-RS	
Density	CSI-RS for tracking	-	CDM Type	e		'No CDM' for C	SI-RS resource	
CSI-RS periodicity		-						
CSI-RS offset				eriodicity	Slots			
CSI-RS offset Slots resources 1 and 2 11 for CSI-RS resources 3 and 4 resources 5 and 6 11 for CSI-RS resources 3 and 4 resources 7 and 8 TCI state #0		-	ooi no p	criodicity	01013		_	
Duplex mode			CSI-RS of	ffset	Slots	resources 1 and 2	resources 5 and 6	
Duplex mode		_						
Mapping type			QCL info		ļ			
Mapping type		.,				F	טט	
FOR FOR	Active DL BVVP index	_	/DO			Tym	1 00 A	
Starting symbol (S)			/pe					
PDSCH Configuration		_					_	
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 Antenna port indexes 1000, 1001 1000, 1001 TCI state TCI State #1 TCI State #2 DMRS Type Type 1 TCI State #2 DMRS Type Type 1 Type 1 Number of additional DMRS 1 Type 1 Maximum number of OFDM symbols for DL front loaded DMRS 1 SCSI-RS resource Type 1 QCL information CSI-RS resource 1 from "CSI-RS" for tracking" configuration configuration N/A N/A TQP 2 QCL information CSI-RS resource N/A N/A N/A TVpp 1 QCL information CSI-RS resource N/A N/A N/A TCI State #2 Type 1 QCL information CSI-RS resource N/A N/A N/A TCI State #2 Type 1 QCL information CSI-RS resource N/A N/A								
PRB bundling size	DUSCH					Static		
Resource allocation type								
VRB-to-PRB mapping type	comigaration							
VRB-to-PRB mapping interleaver bundle size								
Size						Non-Interleaved		
TCI state						N/A		
DMRS Type		Antenna p	nna port indexes			1000, 1001	1000, 1001	
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 1 from 'CSI-RS for tracking' configuration N/A TVJpe 1 QCL information QCL Type Type A N/A Type 2 QCL information CSI-RS resource N/A N/A N/A Type 1 QCL information CSI-RS resource N/A N/A N/A Type 1 QCL information QCL Type N/A Type A Type 2 QCL information QCL Type N/A Type A Type 2 QCL information QCL Type N/A N/A Type 2 QCL information QCL Type N/A N/A Type A Type 2 QCL information QCL Type N/A N/A Type A Type 2 QCL information QCL Type N/A N/A Timing offset of the second TRXP from the first TRXP Use Type Information Use Type Information Number of HARQ Processes 4 The number of slots between PDSCH and corresponding HARQ-ACK information SP Type I, independent precoding generation is applied for both TRXPs, random per slot with PRB bundling granularity								
Maximum number of OFDM symbols for DL front loaded DMRS 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1						Тур	pe 1	
TCI State #1 Type 1 QCL information CSI-RS resource 1 from 'CSI-RS for tracking' configuration QCL Type Type A N/A N/A Type 2 QCL information CSI-RS resource N/A N/A Type 1 QCL Type N/A N/A Type 1 QCL Type N/A N/A Type 1 QCL Type N/A N/A CSI-RS resource N/A N/A Type 1 QCL Type N/A N/A Type 1 QCL CSI-RS resource N/A N/A Type 2 QCL information QCL Type N/A Type A Type 2 QCL CSI-RS resource N/A N/A Type 2 QCL CSI-RS resource N/A N/A Type 2 QCL Type N/A Type A Type 2 QCL CSI-RS resource N/A N/A Timing offset of the second TRxP from the first TRxP US Frequency offset of the second TRxP from the first TRxP Hz The number of HARQ Processes The number of slots between PDSCH and corresponding HARQ-ACK information Precoding configuration SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity.	configuration					,	1	
Type 1 QCL Information						•	1	
TCI State #1 Information						CSI-RS resource		
TCI State #1 Information		Type 1 OC	YI .	CSLRS resource			N/A	
TCI State #1 Configuration Type A N/A Type 2 QCL information QCL Type N/A N/A Type 1 QCL CSI-RS resource N/A N/A Type 1 QCL information QCL Type N/A N/A Type 2 QCL information QCL Type N/A Type A Type 2 QCL information QCL Type N/A N/A Type 2 QCL information QCL Type N/A N/A Type A N/A N/A Type A 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.				OOI-ING Tesource			IN/A	
Type 2 QCL information QCL Type N/A N/A Type 1 QCL information QCL Type N/A N/A Type 1 QCL information QCL Type N/A S for tracking' configuration QCL Type N/A Type A Type 2 QCL information QCL Type N/A Type A Type 2 QCL information QCL Type N/A N/A Type A Type 2 QCL information QCL Type N/A N/A Timing offset of the second TRxP from the first TRxP US Frequency offset of the second TRxP from the first TRxP Hz Number of HARQ Processes 4 The number of slots between PDSCH and corresponding HARQ-ACK information Precoding configuration SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity.	TCI State #1			OCL Turns			NI/A	
TCI State #2 TUPE 1 QCL information Type 1 QCL Type QCL Type Type 2 QCL QCL Type Type 2 QCL information QCL Type Type 2 QCL CSI-RS resource Information QCL Type Type 2 QCL CSI-RS resource Information QCL Type N/A Type A N/A Type A N/A N/A N/A N/A Type A N/A N/A N/A Timing offset of the second TRxP from the first TRxP Frequency offset of the second TRxP from the first TRxP Number of HARQ Processes The number of slots between PDSCH and corresponding HARQ-ACK information Precoding configuration Precoding configuration SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity.		Type 2 00	<u>۱</u>					
TCI State #2 Type 1 QCL information CSI-RS resource Information QCL Type N/A Type 2 QCL CSI-RS resource Information QCL Type N/A Type A N/A Type A N/A N/A N/A Type A N/A Timing offset of the second TRxP from the first TRxP US Frequency offset of the second TRxP from the first TRxP Number of HARQ Processes The number of slots between PDSCH and corresponding HARQ-ACK information Precoding configuration SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity.								
TCI State #2 Type 1 QCL information QCL Type Type 2 QCL information QCL Type Type 2 QCL information QCL Type Type 2 QCL information QCL Type N/A Type A N/A Type A N/A N/A N/A Timing offset of the second TRxP from the first TRxP Vus Frequency offset of the second TRxP from the first TRxP Number of HARQ Processes The number of slots between PDSCH and corresponding HARQ-ACK information Precoding configuration SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity.		1		JF-				
TCI State #2 Information QCL Type Type 2 QCL Information QCL Type Type 2 QCL Information QCL Type N/A Type A N/A N/A N/A Timing offset of the second TRxP from the first TRxP Frequency offset of the second TRxP from the first TRxP Number of HARQ Processes The number of slots between PDSCH and corresponding HARQ-ACK information Precoding configuration SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity.		Type 1 OC	YI	CSI-RS resource		N/A	5 from 'CSI-RS	
Configuration QCL Type N/A Type 2 QCL information QCL Type N/A N/A N/A Timing offset of the second TRxP from the first TRxP Value of HARQ Processes The number of slots between PDSCH and corresponding HARQ-ACK information Precoding configuration CSI-RS resource N/A N/A N/A N/A -0.5 Hz 200 SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity.				JOI NO TESOUICE		IN/A		
Type 2 QCL information 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 SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity.	ICI State #2			OCL Turns	1	NI/A		
information 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 SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity.		Type 2.00	<u>'</u>					
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 SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity.								
Frequency offset of the second TRxP from the first TRxP	Timing offset of the s				us			
The number of slots between PDSCH and corresponding HARQ-ACK information 2 SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity.	Frequency offset of t	he second T						
ACK information SP Type I, independent precoding generation is applied for both TRxPs, random per slot with PRB bundling granularity.					4	4		
Precoding configuration generation is applied for both TRxPs, random per slot with PRB bundling granularity.								
	Precoding configuration					generation is appli random per slot v	ed for both TRxPs, vith PRB bundling	
	Note 1: PDSCH tr	ansmission is	s done fron	n both TRxPs		granu	ularity.	

Table 5.2.2.1.13-3: Minimum performance for Rank 2

	Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition(Note 1)	. •		SNR (dB) (Note
F	1-1	R.PDSCH.1-2.5	10 / 15	16QAM,	TDLA30-10	2x2, ULA Low	(%) 70	[17.4]
L		FDD		0.54		D #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

5.2.2.1.14 Minimum requirements for PDSCH with single-DCI based Inter-slot TDM scheme

The performance requirements are specified in Table 5.2.2.1.14-3, with the addition of test parameters in Table 5.2.2.1.14-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.1.14-1.

Table 5.2.2.1.14-1: Tests purpose

Purpose	Test index
Verify PDSCH performance under 2 receive antenna	1-1
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]	

Table 5.2.2.1.14-2: Test parameters

Parameter				Value		
				TRxP #1 (Note 1)	TRxP #2 (Note 1)	
Transmit TRxP of SS					P #1	
PDCCH configuration		state			tate #1	
CORESETPOOIIIIdex					nfigured	
First subcarrier index in the				k0=0 for CSI-RS	k0=1 for CSI-RS	
	PR	B used for CSI-RS		resources 1,2,3,4	resources 5,6,7,8	
				10 = 6 for CSI-RS	10 = 6 for CSI-RS	
	Firs	st OFDM symbol in the PRB		resources 1 and 3 I0 = 10 for CSI-	resources 5 and 7 I0 = 10 for CSI-	
	use	ed for CSI-RS		RS resources 2	RS resources 6	
				and 4	and 8	
				1 for CSI-RS	1 for CSI-RS	
001.00 (Nui	mber of CSI-RS ports (X)		resource 1,2,3,4		
CSI-RS for tracking	CD	M.Tupo			SI-RS resource	
	CD	М Туре		1,2,3,4	,5,6,7,8	
		nsity			3	
	CS	I-RS periodicity	Slots	_	20	
				10 for CSI-RS	10 for CSI-RS	
	cs	I-RS offset	Slots	resources 1 and 2	resources 5 and 6	
				11 for CSI-RS	11 for CSI-RS	
	00	L info		resources 3 and 4	resources 7 and 8 rate #0	
Duplex mode	J QC	LINIO			DD	
Active DL BWP index	/			, ,	1	
Active DE DVVI IIIde.	Mapping type			Tyr	e A	
	k0				0	
	Starting symbo	ol (S)		2		
	Length (L)	- (-)		12		
	Repetition num	ber		2		
PDSCH	PRB bundling			Static		
configuration	PRB bundling	size		2		
	Resource alloc	ation type		Тур	oe 0	
	RBG size			Config2		
	VRB-to-PRB m			Non-interleaved		
		RB mapping interleaver bundle		N	/A	
	size					
	Antenna port ir	ort indexes		1000	1000	
PDSCH DMRS	TCI state DMRS Type			TCI State #1	TCI State #2	
configuration		itional DMPS			oe 1 1	
comigaration		of additional DMRS n number of OFDM symbols for			<u> </u>	
	DL front loaded				1	
				CSI-RS resource		
	Tuno 1 OCI	CSI-RS resource		1 from 'CSI-RS	N/A	
	Type 1 QCL information	CSI-RS lesouice		for tracking'	IN/A	
TCI State #1	Inionnation			configuration		
		QCL Type		Type A	N/A	
	Type 2 QCL	CSI-RS resource		N/A	N/A	
	information	QCL Type		N/A	N/A CSI-RS resource	
					5 from 'CSI-RS	
	Type 1 QCL	CSI-RS resource		N/A	for tracking'	
TCI State #2	information				configuration	
. Of Oldio #Z		QCL Type		N/A	Type A	
	Type 2 QCL	CSI-RS resource		N/A	N/A	
	information	QCL Type		N/A	N/A	
Timing offset of the s			us		2	
Frequency offset of t		from the first TRxP	Hz		00	
Number of HARQ Processes				-	4	
The number of slots between PDSCH and corresponding HARQ-					2	
ACK information						
					endent precoding ed for both TRxPs,	
Precoding configurat	ion				vith PRB bundling	
				_	larity.	
				grane		

Note 1: PDSCH transmission is done from both TRxPs

Table 5.2.2.1.13-3: Minimum performance for Rank 1

		erence Subcarrier format and c			Correlation	Reference value			
Test num.	Reference channel			Propagation condition (Note 1)	matrix and antenna configuration Note 2)	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)	[2.6]		
Note 1					xP #2 and are statis		nt.		
Note 2	 Correlation ma 	trix and antenr	na configuratior	n parameters apply	y to each of TRxP #	1 and TRxP #2.			
Note 3	: BLER is define	d as residual E	BLER; i.e. ratio	of incorrectly rece	eived transport block	s / sent transport	blocks,		
	independently	independently of the number HARQ transmission(s) for each transport block.							
Note 4	: SNR correspor	nds to SNR of	TRxP #1 and T	RxP #2 as defined	d in 4.4.2				

5.2.2.2 TDD

5.2.2.2.1 Minimum requirements for PDSCH Mapping Type A

The performance requirements are specified in Table 5.2.2.2.1-3 and Table 5.2.2.2.1-4, with the addition of test parameters in Table 5.2.2.2.1-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.1-1.

Table 5.2.2.2.1-1: Tests purpose

Purpose	Test index
Verify the PDSCH mapping Type A normal performance	1-1, 1-2, 1-3, 1-5, 1-6, 1-7, 1-8, 1-9, 1-10, 1-11, 2-1, 2-2
under 2 receive antenna conditions and with different	
channel models, MCSs and number of MIMO layers	
Verify the PDSCH mapping Type A HARQ soft combining	1-4
performance under 2 receive antenna conditions.	
Verify the PDSCH mapping Type A performance	3-1
requirements for Enhanced Receiver Type 1 under 2	
receive antenna conditions.	

Table 5.2.2.2.1-2: 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, L _{RBs} = 6
			Other tests: Type 0
	RBG size		Test 1-2: N/A
	VOD : PDD	1	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: l_0 = 4 for CSI-RS resource 1 and 3 l_0 = 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:
	Con the policuloity	Cioto	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	1	Test 1-7, 1-10, 1-11:
	, , , , , , , , , , , , , , , , , , , ,		Start PRB 0
			Number of PRB = 52
			Other tests: Table 5.2-1.
Number of HARQ Pro	ocesses		16 for Test 1-4 10 for Test 1-9
The number of elete	between PDSCH and corresponding HARQ-	1	8 for other tests
ACK information	between FD3CH and corresponding HARQ-		Specific to each TDD UL-DL pattern and as defined in Annex A.1.2

Table 5.2.2.2.1-3: Minimum performance for Rank 1

		Bandwidth				Correlation	Reference v	/alue
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL- DL pattern	Propagation condition	matrix and antenna configuration	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]

Table 5.2.2.2.1-4: Minimum performance for Rank 2

		Bandwidth			Correlation	Reference value		
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	matrix and antenna configuration	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 5.2.2.2.1-5: Minimum performance for Rank 2 and Enhanced Receiver Type 1

		Bandwidth		TDD !!!		Correlation	Reference value	
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL- DL pattern	Propagation condition	matrix and antenna configuration	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

5.2.2.2.2 Minimum requirements for PDSCH Mapping Type A and CSI-RS overlapped with PDSCH

The performance requirements are specified in Table 5.2.2.2.2-3, with the addition of test parameters in Table 5.2.2.2.2-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.1.

Table 5.2.2.2-1: 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: Test parameters

	Parameter	Unit	Value
Duplex mode			TDD
Active DL BWP index	X		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
	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		l ₀ = 13
	CSI-RS periodicity	Slots	5
ZP CSI-RS for CSI acquisition	Subcarrier index in the PRB used for CSI-RS		$(k_0, k_1, k_2, k_3)=(2, 4, 6, 8)$
•	Number of CSI-RS ports (X)		8
	CSI-RS periodicity	Slots	5
Number of HARQ Processes			8
The number of slots ACK information	between PDSCH and corresponding HARQ-		Specific to each TDD UL-DL pattern and as defined in Annex A.1.2

Table 5.2.2.2-3: Minimum performance for Rank 2

		Bandwidth	Madulation	TDD III		Correlation	Reference value	
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL- DL pattern	Propagation condition	matrix and antenna configuration	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

5.2.2.2.3 Minimum requirements for PDSCH Mapping Type B

The performance requirements are specified in Table 5.2.2.2.3-3, with the addition of test parameters in Table 5.2.2.2.3-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.3-1.

Table 5.2.2.3-1: Tests purpose

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

Table 5.2.2.2.3-2: Test parameters

	Parameter	Unit	Value
Duplex mode			TDD
Active DL BWP ind	ex		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 F	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 5.2.2.3-3: Minimum performance for Rank 1

		Bandwidth (MHz)/	Modulation	TDD		Correlation	Reference va	lue
Test num.	Reference channel	Subcarrier spacing (kHz)	format and code rate	UL-DL pattern	Propagation condition	matrix and antenna configuration	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

5.2.2.2.4 Minimum requirements for PDSCH Mapping Type A and LTE-NR coexistence

The performance requirements are specified in Table 5.2.2.2.4-3, with the addition of test parameters in Table 5.2.2.2.4-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.4-1.

Table 5.2.2.4-1: 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 5.2.2.4-2: 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	Mapping type		Type A
configuration			
	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		N/A
	size		
PDSCH DMRS	DMRS Type		Type 1
configuration			·
	Position of the first DM-RS for downlink		3
	Number of additional DMRS		1
	Maximum number of OFDM symbols for		1
	DL front loaded DMRS		
CRS for rate	LTE carrier centre subcarrier location		Same as NR carrier centre subcarrier
matching (Note 1)			location
	LTE carrier BW	MHz	10
	Number of antenna ports		4
	v-shift		0
Number of HARQ Pr	ocesses		8
The number of slots	between PDSCH and corresponding HARQ-		Specific to each TDD UL-DL pattern
ACK information			and as defined in Annex A.1.2
Note 1: No MBSFI	N is configured on LTE carrier		

Table 5.2.2.2.4-3: Minimum performance for Rank 1

		Bandwidth			Correlation	Reference value		
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL- DL pattern	Propagation condition	matrix and antenna configuration	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

5.2.2.2.5 Minimum requirements for PDSCH 0.001% BLER

The performance requirements are specified in Table 5.2.2.2.5-3, with the addition of test parameters in Table 5.2.2.2.5-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.5-1.

Table 5.2.2.2.5-1: Tests purpose

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

Table 5.2.2.5-2: Test parameters

	Parameter	Unit	Value
Duplex mode			TDD
Active DL BWP inc	dex		1
PDSCH	Mapping type		Type A
configuration			
	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		N/A
	size		
PDSCH DMRS	DMRS Type		Type 1
configuration			
	Number of additional DMRS		1
	Maximum number of OFDM symbols for		1
	DL front loaded DMRS		
Maximum number of HARQ transmission			1
Number of HARQ	Processes		8
The number of slot	s between PDSCH and corresponding HARQ-	•	Defined in Annex A.1.2 for TDD pattern
ACK information			FR1.30-1

Table 5.2.2.2.5-3: Minimum performance for Rank 1

Test	Deference	Bandwidth (MHz) /	Modulation	TDD UL-DL	Dranagation	Correlation matrix and antenna configuration	Reference value	
num.	Reference channel	Subcarrier spacing (kHz)	format and code rate	pattern	Propagation condition		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%	2.8

5.2.2.2.6 Minimum requirements for PDSCH repetitions over multiple slots

The performance requirements are specified in Table 5.2.2.2.6-3, with the addition of test parameters in Table 5.2.2.2.6-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.6-1.

Table 5.2.2.2.6-1: Tests purpose

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

Table 5.2.2.2.6-2: Test parameters

	Parameter	Unit	Value
Duplex mode			TDD
Active DL BWP index	(1
PDSCH	Mapping type		Type A
configuration	-		·
	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		N/A
	size		
PDSCH DMRS	DMRS Type		Type 1
configuration			
	Number of additional DMRS		1
	Maximum number of OFDM symbols for		1
	DL front loaded DMRS		
Number of HARQ Processes			4
	between final repetition of PDSCH and		Specific to each TDD UL-DL pattern
corresponding HARC			and as defined in Annex A.1.2 (Note 1)
Note 1: ACK/NAC	K feedback is generated for PDSCH on slot i,	where mod	$d(i,10) = \{2, 4, 6\}.$

Table 5.2.2.2.6-3: Minimum performance for Rank 1

Test	Reference	Bandwidth (MHz) /	Modulation	TDD UL-DL	Propagation	Correlation Reference value		alue
num.	channel	Subcarrier spacing (kHz)	format and code rate	pattern	condition antenna	antenna configuration	Target BLER	SNR (dB)
1-1	R.PDSCH.1-16.1 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.

5.2.2.2.7 Minimum requirements for PDSCH Mapping Type B and UE processing capability 2

The performance requirements are specified in Table 5.2.2.2.7-3, with the addition of test parameters in Table 5.2.2.2.7-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.7-1.

Table 5.2.2.2.7-1: Tests purpose

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

Table 5.2.2.2.7-2: Test parameters

	Parameter	Unit	Value
Duplex mode			TDD
Active DL BWP index	X		1
PDSCH	Mapping type		Туре В
configuration			
	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		N/A
	size		
PDSCH DMRS	DMRS Type		Type 1
configuration			
	Number of additional DMRS		0
	Maximum number of OFDM symbols for		1
	DL front loaded DMRS		
Maximum number of HARQ transmission			1
Number of HARQ Pr	ocesses		2
The number of slots ACK information	between PDSCH and corresponding HARQ-		0

Table 5.2.2.2.7-3: Minimum performance for Rank 1

		Bandwidth	Meduletien	TDD		Co	Correlation	Reference va	ılue
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	matrix and antenna configuration	Fraction of maximum throughput (%)	SNR (dB)	
1-1	R.PDSCH.1- 17.1 TDD	40 / 30	QPSK, 0.30	FR1.30- 2	TDLA30-10	2x2, ULA Low	70	[0.6]	

5.2.2.2.8 Minimum requirements for PDSCH pre-emption

The performance requirements are specified in Table 5.2.2.2.8-3, with the addition of test parameters in Table 5.2.2.2.8-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.8-1.

Table 5.2.2.2.8-1: Tests purpose

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

Table 5.2.2.2.8-2: Test parameters

	Parameter	Unit	Value
Duplex mode			TDD
Active DL BWP index	(1
PDCCH	Symbols with PDCCH		0, 1
configuration (Note	DCI format		2_1
4)	timeFrequencySet		14x1
	Mapping type		Type A
	k0		0
	Starting symbol (S)		2
	Length (L)		12
	PDSCH aggregation factor		1
PDSCH	PRB bundling type		Static
configuration	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	Number of additional DMRS		1
configuration	Maximum number of OFDM symbols for DL front loaded DMRS		1
Pre-emption	Starting symbol (S)		3
configuration (Note	Length (L)		2
2)	Pre-emption periodicity and offset	Slots	40/(1,12,23,34) (Note 3)
Number of HARQ Pro	ocesses		8
The number of slots I ACK information	between PDSCH and corresponding HARQ-		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 5.2.2.2.6-3: Minimum performance for Rank 1

		Bandwidth (MHz) /	Modulation			Correlation	Reference value		
Test num.	Reference channel	Subcarrier spacing (kHz)	format and code rate	TDD UL-DL pattern	Propagation condition	matrix and antenna configuration	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]	

5.2.2.2.9 Minimum requirements for HST-SFN

The performance requirements are specified in Table 5.2.2.2.9-3, with the addition of test parameters in Table 5.2.2.2.9-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.9-1.

Table 5.2.2.2.9-1: Tests purpose

Purpose	Test index
Verify PDSCH performance under 2 receive antenna conditions in the HST-SFN scenario defined in B.3.2 when <i>highSpeedDemodFlag-r16</i> [17] is configured	1-1

Table 5.2.2.9-2: Test parameters

Parameter			Value		
Duplex mode			TDD		
Active DL BWP index			1		
	Mapping type		Type A		
	k0		0		
	Starting symbol (S)		2		
	Length (L)		12		
	PDSCH aggregation factor		1		
PDSCH	PRB bundling type		Static		
configuration	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		N/A		
	size		·		
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-			Specific to each TDD UL-DL pattern		
ACK information			and as defined in Annex A.1.2		

Table 5.2.2.2.9-3: Minimum performance for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing (kHz) Bandwidth Modulation format and code rate			Correlation	Reference value		
			format and	TDD UL- DL pattern	Propagation condition	matrix and antenna configuration	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]

5.2.2.2.10 Minimum requirements for HST DPS

The performance requirements are specified in Table 5.2.2.2.10-3, with the addition of test parameters in Table 5.2.2.2.10-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.10-1.

Table 5.2.2.2.10-1: Tests purpose

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

Table 5.2.2.2.10-2: Test parameters

	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
	Length (L)			Specific to each Reference channel
	PDSCH aggregation			1
PDSCH configuration	PRB bundling type			Static
1 Door comigaration	PRB bundling size			2
	Resource allocatio	n type		Type 0
	RBG size			Config2
	VRB-to-PRB mapp			Non-interleaved
		ing interleaver bundle size		N/A
	TCI state			Note 1
PDSCH DMRS	DMRS Type	al DMDC		Type 1
configuration	Number of addition	of OFDM symbols for DL		2
Corniguration	front loaded DMRS			1
	TOTA TOURS	First OFDM symbol in the		$I_0 = 5$ for CSI-RS resource 1 and 3
		PRB used for CSI-RS		$l_0 = 9$ for CSI-RS resource 2 and 4
		CSI-RS periodicity	Slots	20 for CSI-RS resource 1,2,3,4
				1 for CSI-RS resource 1 and 2
	Resource set #1	CSI-RS offset	Slots	2 for CSI-RS resource 3 and 4
		QCL info		TCI state #2
				Start PRB 0
CCI DC for trooting		Frequency Occupation		Number of PRB = 52
CSI-RS for tracking		First OFDM symbol in the		$I_0 = 6$ for CSI-RS resource 5 and 6
		PRB used for CSI-RS		l ₀ = 10 for CSI-RS resource 7 and 8
		CSI-RS periodicity	Slots	20 for CSI-RS resource 5,6,7,8.
	Resource set #2	CSI-RS offset	Slots	1 for CSI-RS resource 5 and 6
	Nesource set #2		51013	2 for CSI-RS resource 7 and 8
		QCL info		TCI state #3
		Frequency Occupation		Start PRB 0
				Number of PRB = 52
		First OFDM symbol in the		$I_0 = 12$
	D + #0	PRB used for CSI-RS	Class	40
	Resource set #3	CSI-RS periodicity CSI-RS offset	Slots Slots	40 0
NZP CSI-RS for CSI		QCL info	31015	TCI state #0
acquisition		First OFDM symbol in the		
acquisition		PRB used for CSI-RS		10 = 13
	Resource set #4	CSI-RS periodicity	Slots	40
	Trooburoo oot ii 1	CSI-RS offset	Slots	0
		QCL info		TCI state #1
				CSI-RS resource 1 from 'CSI-RS
	Type 1 QCL	CSI-RS resource		for tracking Resource set #1'
			i	configuration
I TCI stata #0	information			
TCI state #0		QCL Type		Type A
TCI state #0	Type 2 QCL	CSI-RS resource		Type A N/A
TCI state #0				Type A N/A N/A
TCI state #0	Type 2 QCL information	CSI-RS resource QCL Type		Type A N/A N/A CSI-RS resource 5 from 'CSI-RS
TCI state #0	Type 2 QCL information Type 1 QCL	CSI-RS resource		Type A N/A N/A CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2'
TCI state #0 TCI state #1	Type 2 QCL information	CSI-RS resource QCL Type CSI-RS resource		Type A N/A N/A N/A CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration
	Type 2 QCL information Type 1 QCL information	CSI-RS resource QCL Type CSI-RS resource QCL Type		Type A N/A N/A N/A CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration Type A
	Type 2 QCL information Type 1 QCL information Type 2 QCL	CSI-RS resource QCL Type CSI-RS resource QCL Type CSI-RS resource		Type A N/A N/A N/A CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration Type A N/A
	Type 2 QCL information Type 1 QCL information Type 2 QCL information	CSI-RS resource QCL Type CSI-RS resource QCL Type CSI-RS resource QCL Type QCL Type		Type A N/A N/A N/A CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration Type A N/A N/A
TCI state #1	Type 2 QCL information Type 1 QCL information Type 2 QCL information Type 1 QCL	CSI-RS resource QCL Type CSI-RS resource QCL Type CSI-RS resource QCL Type SSB index		Type A N/A N/A N/A CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration Type A N/A N/A SSB #0
	Type 2 QCL information Type 1 QCL information Type 2 QCL information Type 1 QCL information	CSI-RS resource QCL Type CSI-RS resource QCL Type CSI-RS resource QCL Type SSB index QCL Type		Type A N/A N/A N/A CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration Type A N/A N/A SSB #0 Type C
TCI state #1	Type 2 QCL information Type 1 QCL information Type 2 QCL information Type 1 QCL information Type 2 QCL information Type 2 QCL	CSI-RS resource QCL Type CSI-RS resource QCL Type CSI-RS resource QCL Type SSB index QCL Type SSB index QCL Type SSB index		Type A N/A N/A N/A CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration Type A N/A N/A SSB #0 Type C N/A
TCI state #1	Type 2 QCL information Type 1 QCL information Type 2 QCL information Type 1 QCL information Type 2 QCL information Type 2 QCL information	CSI-RS resource QCL Type CSI-RS resource QCL Type CSI-RS resource QCL Type SSB index QCL Type SSB index QCL Type SSB index QCL Type		Type A N/A N/A N/A CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration Type A N/A N/A SSB #0 Type C N/A N/A
TCI state #1 TCI state #2	Type 2 QCL information Type 1 QCL information Type 2 QCL information Type 1 QCL information Type 2 QCL information Type 2 QCL	CSI-RS resource QCL Type CSI-RS resource QCL Type CSI-RS resource QCL Type SSB index QCL Type SSB index QCL Type SSB index		Type A N/A N/A N/A CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration Type A N/A N/A SSB #0 Type C N/A
TCI state #1	Type 2 QCL information Type 1 QCL information Type 2 QCL information Type 1 QCL information Type 2 QCL information Type 2 QCL information Type 1 QCL information Type 1 QCL	CSI-RS resource QCL Type CSI-RS resource QCL Type CSI-RS resource QCL Type SSB index		Type A N/A N/A N/A CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration Type A N/A N/A SSB #0 Type C N/A N/A SSB #1
TCI state #1 TCI state #2	Type 2 QCL information Type 1 QCL information Type 2 QCL information Type 1 QCL information Type 2 QCL information Type 2 QCL information Type 1 QCL information	CSI-RS resource QCL Type CSI-RS resource QCL Type CSI-RS resource QCL Type SSB index QCL Type		Type A N/A N/A N/A CSI-RS resource 5 from 'CSI-RS for tracking Resource set #2' configuration Type A N/A N/A SSB #0 Type C N/A N/A SSB #1 Type C

Number of HARQ Processes	8
The number of slots between PDSCH and corresponding HARQ-ACK	Specific to each TDD UL-DL pattern
information	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 k^{th} RRH.

For Test 1-1, TCl state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy mod(i, 2n) = n. PDCCH and PDSCH associated with TCl # (k mod 2) is transmitted by k^{th} RRH from slot#

 $\max[(2k-1)n + 1 + T_{HARQ} + T_{MAC proc} + T_{firstTRS} + T_{TRS proc}, 0]$

to slot#

$$(2k+1)n + T_{\text{HARQ}} + T_{\text{MAC proc}},$$

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 mod(i, 2n) = n. PDCCH and PDSCH associated with TCI # (k mod 2) is transmitted by k^{th} RRH from slot#

$$\max[(2k-1)n + 1 + T_{HARO} + T_{MAC, proc}, 0]$$

to slot#

$$(2k + 1)n + T_{HARQ} + T_{MAC proc}$$

Where k=0, 1, 2... is the RRH number, n = 5040 is half of the number of slots between two RRH, T_{HARQ} = 8 is the number of slots between PDSCH and corresponding HARQ-ACK information, $T_{MAC\ proc}$ = 6 is the number of slots for MAC CE processing, $T_{firstTRS}$ = 7 is the number of slots to first TRS transmission occasion after MAC CE command is decoded by the UE, $T_{TRS\ proc}$ = 4 is the number of slots for TRS processing.

Table 5.2.2.2.10-3: Minimum performance for HST DPS

		Bandwidth			Number of	Correlation	Reference value		
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	active PDSCH TCI states	matrix and antenna configuration	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]	

5.2.2.2.11 Minimum requirements for PDSCH Single-DCI based SDM scheme

The performance requirements are specified in Table 5.2.2.2.11-3, with the addition of test parameters in Table 5.2.2.2.11-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.11-1.

Table 5.2.2.2.11-1: Tests purpose

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

Table 5.2.2.2.11-2: Test parameters

Parameter		Daramete	••	Unit	Va	lue	
PDCCH configuration			: 1	Unit			
CORESETPOILIDAX CORESETPOILIDAX First subcarrier index in the PRB used for CSI-RS D = 6 for CSI-RS	Transmit TRxP of SS				TRxP #1		
First subcarrier index in the PRB used for CSI-RS Resources 12,34 resources 56,7.8 Resources 12,34 resources 56,7.8 Resources 56,7.8 Resources 56,7.8 Resources 5 and 7 Resources 12,34 Resources 5 and 7 Resources 12,34 Resources 5 and 7 Resources 12,34 Resources 5 and 7 Resources 6 and 8 Resources 6 and 8 Resources 6 and 8 Resources 12,34 Resources 6 and 8 Resources 12,34 Resources 6 and 8 Resources 12,34 Resources 6,7.8 Resources 12,34 Resource 12,34	PDCCH configuration						
PRB used for CSI-RS					`	,	
CSI-RS for tracking							
First OFDM symbol in the PRB used for CSI-RS Securces 1 and 3 Tesources 6 and 4 10 1 0 for CSI-RS RS resources 2 and 4 and 8 Tesources 6 and 4 and 8 Tesources 6 and 4 and 8 Tesource 12,3.4 Tesources 6 (Tesource 12,3.4 Tesource 13,3.4 Tesource 13,4 Teso					10 = 6 for CSI-RS		
Used for CSI-RS RS resources 2 RS resources 2 and 4 1 for CSI-RS RS resources 2 and 4 1 for CSI-RS and 4 1 for CSI-RS and 4 1 for CSI-RS resource 12,34 1 for CSI-RS resource 12,34 5 for CSI-RS resource 11,234,5 for Resource 12,24 10 for CSI-RS resource 11 for CSI-RS resource 11 for CSI-RS resource 12,24 10 for CSI-RS resource 13,24 10 for CSI-RS resource 14,234 10 for RSI-RS resource 14,234 10 for RSI		Fin	ot OEDM overhol in the DDD			resources 5 and 7	
Number of CSI-RS ports (X)							
Number of CSI-RS ports (X)		ust	50 101 001-100				
Number of CSI-RS ports (X) resource 1.2,3 4 resource 5.6,7,8							
CDM Type		Nu	mber of CSI-RS ports (X)				
Density Slots A	CSI-RS for tracking						
Density		CD	ОМ Туре				
CSI-RS offset		De	nsity				
CSI-RS offset		CS	I-RS periodicity	Slots			
CSI-RS offset							
Duplex mode		CS	SI-RS offset	Slots			
Duplex mode				0.010			
Duplex mode		00	`L info				
Mapping type	Dunlex mode	QC)L IIIIO				
Mapping type	Active DL BWP index	Κ			,	1	
Na		,			Тур	e A	
PDSCH PRB bundling type							
PRS bundling type Static configuration 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 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 CSI-RS resource TYpe 1 QCL information CCI Type Type A N/A Type 2 QCL information CSI-RS resource N/A N/A TVJP 1 QCL information CSI-RS resource N/A N/A TVJP 2 QCL information CSI-RS resource N/A N/A Type 2 QCL information QCL Type <		Starting symbo	ol (S)				
PRB bundling size							
Configuration PR B undling size 2 Resource allocation type Type 1 Type 1 RBG size Config2 Non-interleaved VRB-to-PRB mapping interleaver bundle size N/A N/A Antenna port indexes 1000 1002 TCI state TCI State #1 TCI State #2 PDSCH DMRS configuration DMRS Type Type 1 Number of additional DMRS 1 Type 1 Configuration 1 DMRS Type Type 1 Maximum number of OFDM symbols for DL front loaded DMRS 1 CSI-RS resource TYpe 1 QCL information CSI-RS resource 1 from 'CSI-RS for tracking' configuration N/A Type 2 QCL information QCL Type N/A N/A TYpe 1 QCL information CSI-RS resource N/A N/A TYpe 1 QCL information QCL Type N/A N/A TYpe 2 QCL information QCL Type N/A N/A Type 2 QCL information QCL Type N/A N/A Type 2 QCL information QCL Ty							
Resource allocation type					<u> </u>		
VRB-to-PRB mapping type			cation type				
VRB-to-PRB mapping interleaver bundle size			conning type				
Size							
TCI state TCI			napping interleaver buriale		N	/A	
DMRS Type		Antenna port i	ndexes				
Number of additional DMRS							
Maximum number of OFDM symbols for DL front loaded DMRS 1					Тур	e 1	
Type 1 QCL	configuration				,		
Type 1 QCL					•	1	
TCI State #1 Type 1 QCL Information QCL Type Type A N/A		BE HOTH TOUGO			CSI-RS resource		
TCI State #1 Information QCL Type Type A N/A		Turno 1 OCI	CCL DC resource			NI/A	
Configuration Configuration Type A N/A			CSI-RS lesouice			IN/A	
Type 2 QCL information	TCI State #1	Inionnation				21/2	
TCI State #2 Type 1 QCL information QCL Type Type 2 QCL information QCL Type Type 3 QCL Type Type 4 N/A Type A N/A N/A N/A N/A Resource allocation Timing offset of the second TRxP from the first TRxP Timing offset of the second TRxP from the first TRxP Trequency offset of the second TRxP from the first TRxP Number of HARQ Processes The number of slots between PDSCH and corresponding HARQ- Specific to each TDD UL-DL pattern		T 0.00					
TCI State #2 Type 1 QCL information CSI-RS resource Information CSI-RS resource S from 'CSI-RS for tracking' configuration QCL Type Type 2 QCL information CSI-RS resource N/A Type A Type A CSI-RS resource N/A N/A N/A N/A N/A Resource allocation Timing offset of the second TRxP from the first TRxP Frequency offset of the second TRxP from the first TRxP Number of HARQ Processes The number of slots between PDSCH and corresponding HARQ- Specific to each TDD UL-DL pattern							
TCI State #2 Type 1 QCL information CSI-RS resource N/A Type 2 QCL information QCL Type Type 2 QCL information QCL Type N/A Type A N/A Type A N/A N/A N/A Resource allocation Timing offset of the second TRxP from the first TRxP Frequency offset of the second TRxP from the first TRxP Number of HARQ Processes The number of slots between PDSCH and corresponding HARQ- Specific to each TDD UL-DL pattern		IIIIOIIIIatioii	QCL Type		IN/A		
TCI State #2 Total State #2 Total S							
TCI State #2 Information QCL Type N/A Type A			CSI-RS resource		N/A		
Type 2 QCL information QCL Type N/A N/A N/A Resource allocation Full-overlapping Timing offset of the second TRxP from the first TRxP us Trequency offset of the second TRxP from the first TRxP Hz 300 for test 1-1 Number of HARQ Processes 8 The number of slots between PDSCH and corresponding HARQ- Specific to each TDD UL-DL pattern	TCI State #2	information					
Information QCL Type N/A N/A Resource allocation Timing offset of the second TRxP from the first TRxP us 1 for test 1-1 Frequency offset of the second TRxP from the first TRxP Hz 300 for test 1-1 Number of HARQ Processes The number of slots between PDSCH and corresponding HARQ- Specific to each TDD UL-DL pattern							
Resource allocation Timing offset of the second TRxP from the first TRxP Frequency offset of the second TRxP from the first TRxP Frequency offset of the second TRxP from the first TRxP Number of HARQ Processes The number of slots between PDSCH and corresponding HARQ- Full-overlapping -0.25 for test 1-1 1 for test 1-2 300 for test 1-1 0 for test 1-2 Specific to each TDD UL-DL pattern							
Timing offset of the second TRxP from the first TRxP Frequency offset of the second TRxP from the first TRxP Number of HARQ Processes The number of slots between PDSCH and corresponding HARQ- Us -0.25 for test 1-1 1 for test 1-2 300 for test 1-1 0 for test 1-2 Specific to each TDD UL-DL pattern	Decement of the control of the contr	Information	QCL Type	-			
Frequency offset of the second TRxP from the first TRxP Number of HARQ Processes The number of slots between PDSCH and corresponding HARQ- Us 1 for test 1-2 300 for test 1-1 0 for test 1-2 Specific to each TDD UL-DL pattern	Resource allocation						
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- Specific to each TDD UL-DL pattern	Timing offset of the s	econd TRxP from	m the first TRxP	us			
Number of HARQ Processes The number of slots between PDSCH and corresponding HARQ- Specific to each TDD UL-DL pattern	Frequency offset of the	he second TRVD	from the first TRVP	Н7	300 for	test 1-1	
The number of slots between PDSCH and corresponding HARQ- Specific to each TDD UL-DL pattern			HOTH LIE HISLINAF	1 12			
ACK information Specific to each 100 of and corresponding 17A/Ca and as defined in Annex A.1.2			and corresponding HAPO	1			
	ACK information	SOLWOON I DOOL	rana corresponding riand.				

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 La	yer 0 is transmitted from TRxP #1 and PDSCH

Table 5.2.2.2.11-3: Minimum performance

		Bandwidt	80 - 1 1 - 41 -	TDD		Correlation	Reference value	
Test num	Reference channel	h (MHz) / Subcarri er spacing (kHz)	Modulatio n format and code rate	TDD UL-DL patter n	Propagation condition(No te 1)	matrix and antenna configuration(N ote 2)	Fraction of maximum throughp ut (%)	SNR (dB)(Not e 3)
1-1	R.PDSCH. 2-3.2 TDD	40 / 30	64QAM, 0.50	FR1.3 0-1	TDLA30-10	2x2, ULA Low	70	[19.3]
1-2	R.PDSCH. 2-3.2 TDD	40 / 30	64QAM, 0.50	FR1.3 0-1	TDLA30-10	2x2, ULA Low	70	[19.0]
Note	1: The propa	agation condi	tions apply to	each of T	RxP #1 and TRxl	P #2 and are statistic	ally independ	ent

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 Minimum requirements for PDSCH Multi-DCI based transmission scheme

The performance requirements are specified in Table 5.2.2.2.12-3, with the addition of test parameters in Table 5.2.2.2.12-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.12-1.

Table 5.2.2.2.12-1: Tests purpose

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

Table 5.2.2.2.12-2: Test parameters

	Parar	neter		Unit		lue
T		110101		Onit	TRxP #1(Note 1)	TRxP #2(Note 1)
Transmit TRxP of SS	SB	TCI state			TCI State #1	P #1 TCI State #2
PDCCH configuration	n		TPoolIndex			.1
			arrier index in the		k0=0 for CSI-RS	k0=1 for CSI-RS
			for CSI-RS		resources 1,2,3,4	resources 5,6,7,8
					I0 = 6 for CSI-RS	I0 = 6 for CSI-RS
		Eirct OED	M symbol in the PRB		resources 1 and 3	resources 5 and 7
		used for 0			10 = 10 for CSI-	10 = 10 for CSI-
		4004.0.			RS resources 2	RS resources 6
					and 4 1 for CSI-RS	and 8 1 for CSI-RS
		Number of	of CSI-RS ports (X)			resource 5,6,7,8
CSI-RS for tracking		CDM Tun	•			SI-RS resource
		CDM Typ	e 		1,2,3,4	,5,6,7,8
		Density		61		3
		CSI-RS p	eriodicity	Slots		0
					20 for CSI-RS resources 1 and 2	20 for CSI-RS resources 5 and 6
		CSI-RS o	ffset	Slots	21 for CSI-RS	21 for CSI-RS
						resources 7 and 8
		QCL info				ate #0
Duplex mode	-					DD
Active DL BWP index						1
	Mapping ty	ype				e A
	k0	l L (O)				<u>) </u>
	Starting sy Length (L)	/mbol (S)			2 12	
PDSCH	PRB bund	ling type			Static	
	PRB bundling size					2
configuration	Resource allocation type				Тур	e 1
	RBG size					nfig2
	VRB-to-PRB mapping type				Non-inte	erleaved
	VRB-to-PRB mapping interleaver bundle size				N/A	
		ort indexes			{1000,1001}	{1002,1003}
	TCI state				TCI State #1	TCI State #2
PDSCH DMRS	DMRS Typ	ре			Тур	ne 1
configuration		umber of additional DMRS			,	1
		number of OFDM symbols for				1
	DL front lo	aded DMR	S 		CSI-RS resource	<u> </u>
					1 from 'CSI-RS	
	Type 1 QC		CSI-RS resource		for tracking'	N/A
TCI State #1	information	n			configuration	
			QCL Type		Type A	N/A
	Type 2 QC		CSI-RS resource		N/A	N/A
	informatio	n	QCL Type		N/A	N/A
						CSI-RS resource
	Type 1 QC		CSI-RS resource		N/A	5 from 'CSI-RS for tracking'
TCI State #2	information					configuration
101 State #2			QCL Type		N/A	Type A
	Type 2 QC	CL	CSI-RS resource		N/A	N/A
	information		QCL Type		N/A	N/A
Resource allocation	Resource allocation					erlapping
Timing offset of the s				us		.25
Frequency offset of to Number of HARQ Pro		KXP from t	ne iirst TRXP	Hz		00 3
		SCH and o	orresponding HARQ-			DD UL-DL pattern
ACK information	DOLWICOITT D	COLL ALIU C	oncoponding HAING			in Annex A.1.2
						endent precoding
Precoding configurat	ion				generation is appli	ed for both TRxPs,
. recountly configurat	.011					vith PRB bundling
					j grani	ularity

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 5.2.2.2.12-3: Minimum performance

	n. Reference channel		Bandwid th (MHz) / Subcarri er spacing (kHz) Modula tion format and code rate					Reference value		
Test num.					TDD UL-DL pattern	Propagati on condition(Note 1)	Correlation matrix and antenna configurati on(Note 2)	Fraction of maximu m through put (%)	SNR (dB)(N ote 3)	
	TRxP #1	TRxP #2								
1-1	R.PDSC H.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:	Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent									
Note 2:	Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2									
Note 3:	SNR corr	responds to SN	NR of TRxP#	#1 and TRx	P #2 as de	efined in 4.4.2				

The performance requirements are specified in Table 5.2.2.2.13-3, with the addition of test parameters in Table

The test purposes are specified in Table 5.2.2.2.13-1.

5.2.2.2.13-2 and the downlink physical channel setup according to Annex C.3.1.

5.2.2.2.13

Table 5.2.2.2.13-1: Tests purpose

Minimum requirements for PDSCH with single-DCI based FDM Scheme A

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

Table 5.2.2.1.13-2: Test parameters

	Paran	neter		Unit	Va	lue		
					TRxP #2 (Note 1)			
Transmit TRxP of SS	SB				TRxP #1			
PDCCH configuration	n -	TCI state			TCI State #1			
3			TPoolIndex			nfigured		
			arrier index in the I for CSI-RS		k0=0 for CSI-RS	k0=1 for CSI-RS		
	-	FKD used	1101 C31-K3		resources 1,2,3,4 I0 = 6 for CSI-RS	resources 5,6,7,8 I0 = 6 for CSI-RS		
					resources 1 and 3	resources 5 and 7		
			M symbol in the PRB		10 = 10 for CSI-	10 = 10 for CSI-		
		used for C	SI-RS		RS resources 2	RS resources 6		
					and 4	and 8		
		Numbero	f CSI-RS ports (X)		1 for CSI-RS	1 for CSI-RS		
CSI-RS for tracking		Nullibel 0	i Col-No ports (A)		resource 1,2,3,4			
COI-ICO IOI tracking		CDM Type	9			SI-RS resource		
						,5,6,7,8		
		Density	a vi a ali aitu	Slots		<u>3</u> .0		
		CSI-RS p	enodicity	51015	20 for CSI-RS	20 for CSI-RS		
					resources 1 and 2	resources 5 and 6		
		CSI-RS of	fset	Slots	21 for CSI-RS	21 for CSI-RS		
						resources 7 and 8		
		QCL info				ate #0		
Duplex mode						DD		
Active DL BWP index	Κ					1		
	Mapping ty	⁄ре			Тур	e A		
	k0)		
	Starting sy	mbol (S)			2			
PDSCH configuration	Length (L)				12			
	PRB bundl				Static wideband			
	PRB bundling size							
	Resource allocation type RBG size					pe 0 nfig2		
	VRB-to-PRB mapping type					iligz erleaved		
	VRB-to-PRB mapping interleaver bundle							
	size				N	/A		
	Antenna po	ort indexes			1000, 1001	1000, 1001		
	TCI state				TCI State #1	TCI State #2		
PDSCH DMRS	DMRS Typ				Тур	e 1		
configuration	Number of				,	1		
		number of OFDM symbols for				1		
	DL front loa	aded DMR	S					
					CSI-RS resource			
	Type 1 QCL		CSI-RS resource		1 from 'CSI-RS for tracking'	N/A		
TCI State #1	information	1			configuration			
			QCL Type		Type A	N/A		
	Type 2 QC	L	CSI-RS resource		N/A	N/A		
	information		QCL Type		N/A	N/A		
			·			CSI-RS resource		
	Type 1 QC	:I	CSI-RS resource		N/A	5 from 'CSI-RS		
	information		20010000100			for tracking'		
TCI State #2			OCL Tree-		B1/A	configuration		
	Type 2 QC	1	QCL Type CSI-RS resource		N/A N/A	Type A N/A		
	information		QCL Type		N/A N/A	N/A N/A		
Timing offset of the s				us		.25		
Frequency offset the				Hz		00		
Number of HARQ Pro						3		
The number of slots I	between PDS	SCH and co	orresponding HARQ-			DD UL-DL pattern		
ACK information						in Annex A.1.2		
						endent precoding		
Precoding configurat	ion					ed for both TRxPs,		
						vith PRB bundling llarity.		
Note 1: PDSCH tra	ansmission is	s done from	n both TRxPs		ı granı	nanty.		
1.0001. 1.0001111	a.101111001011 R	J GOLIO IIOII	I SOUT TIVAL O					

Table 5.2.2.2.13-3: Minimum performance for Rank 2

Test num.	Reference channel	Bandwidth (MHz) / Subcarrier spacing	Modulation format and code rate	TDD UL-DL pattern	Propagation condition (Note 1)	Correlation matrix and antenna configuration	Reference Fraction of maximum throughput	value SNR (dB) (Note
		(kHz)				(Note 2)	(%)	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 propaga	tion conditions	apply to each	of TRxP #1	and TRxP #2 a	nd are statisticall	y independent.	
Note 2								
Note 3	: SNR corresp	onds to SNR o	of TRxP #1 and	TRxP #2 a	as defined in 4.4	.2		

5.2.2.2.14 Minimum requirements for PDSCH with single-DCl based Inter-slot TDM scheme

The performance requirements are specified in Table 5.2.2.2.14-3, with the addition of test parameters in Table 5.2.2.2.14-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.2.2.14-1.

Table 5.2.2.2.14-1: 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 5.2.2.2.14-2: Test parameters

	Parameter	Unit	Va	lue		
Transmit TRxP of SSB				TRxP #1 (Note 1)	TRxP #2 (Note 1)	
Transmit TRxP of SSB				TRxP #1		
PDCCH configuration	TCI state			TCI St		
- 20011 001111gurau011		TPoolIndex			nfigured	
		carrier index in the		k0=0 for CSI-RS	k0=1 for CSI-RS	
	PRB use	d for CSI-RS		resources 1,2,3,4 I0 = 6 for CSI-RS	resources 5,6,7,8 10 = 6 for CSI-RS	
				resources 1 and 3	resources 5 and 7	
		OM symbol in the PRB		10 = 10 for CSI-	10 = 10 for CSI-	
	used for 0	CSI-RS		RS resources 2	RS resources 6	
				and 4	and 8	
	Number	of CSI-RS ports (X)		1 for CSI-RS	1 for CSI-RS	
CSI-RS for tracking	Number	or Col-Ro ports (A)		resource 1,2,3,4		
CSI-NS for tracking	CDM Typ	ne			SI-RS resource	
					,5,6,7,8	
	Density		01.4	3		
	CSI-RS p	periodicity	Slots	4	•	
				20 for CSI-RS resources 1 and 2	20 for CSI-RS	
	CSI-RS o	offset	Slots	21 for CSI-RS	resources 5 and 6 21 for CSI-RS	
					resources 7 and 8	
	QCL info			TCI st		
Duplex mode	4020				DD	
Active DL BWP index				1	1	
1	Mapping type			Тур	e A	
	(0)	
:	Starting symbol (S)			2	2	
	Length (L)			12		
	Repetition number			2		
	PRB bundling type			1	atic	
	PRB bundling size				2	
	Resource allocation	type			e 0	
	RBG size	t		Config2		
		RB mapping type		Non-interleaved		
	v k b-to-P k b mappin size	B mapping interleaver bundle		N/	/A	
	Antenna port indexes	2		1000	1000	
	TCI state	,		TCI State #1	TCI State #2	
	DMRS Type			Тур		
	Number of additional	DMRS			1	
	Maximum number of			,	•	
1	DL front loaded DMR	RS			1	
				CSI-RS resource		
-	Type 1 QCL	CSI-RS resource		1 from 'CSI-RS	N/A	
	nformation			for tracking'	. 47.1	
TCI State #1		OCL Type		configuration	N/A	
-	Type 2 QCL	QCL Type CSI-RS resource		Type A N/A	N/A	
	nformation	QCL Type		N/A N/A	N/A	
'		QUE TYPO		13//3	CSI-RS resource	
		001.00			5 from 'CSI-RS	
	Type 1 QCL	CSI-RS resource		N/A	for tracking'	
TCI State #2	nformation				configuration	
		QCL Type		N/A	Type A	
	Type 2 QCL	CSI-RS resource		N/A	N/A	
	nformation	QCL Type		N/A	N/A	
Timing offset of the second TRxP from the first TRxP		us Hz	1	1		
	Frequency offset of the second TRxP from the first TRxP				00	
	Number of HARQ Processes				1 DD UL-DL pattern	
ACK information	The number of slots between PDSCH and corresponding HARQ-			and as defined in A		
/ OK III/OIIIIallOII					endent precoding	
				generation is appli		
Precoding configuration	1				vith PRB bundling	
					larity.	

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 5.2.2.2.14-3: Minimum performance for Rank 1

		Bandwidth		TDD		Correlation	Reference value		
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL- DL pattern	Propagation condition (Note 1)	matrix and antenna configuration (Note 2)	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)	[2.5]	
Note 1	: The propagat	ion conditions	apply to each o	of TRxP #1 a	nd TRxP #2 and	d are statistically	independent.		
Note 2	 Correlation m 	atrix and anter	nna configuration	on paramete	rs apply to each	of TRxP #1 and	TRxP #2.		
Note 3	: BLER is defin	BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks,							
	independently	of the numbe	r HARQ transm	nission(s) for	each transport	block.			
Note 4	: SNR correspo	onds to SNR of	f TRxP #1 and	TRxP #2 as	defined in 4.4.2				

5.2.3 4RX requirements

5.2.3.1 FDD

5.2.3.1.1 Minimum requirements for PDSCH Mapping Type A

The performance requirements are specified in Table 5.2.3.1.1-3, Table 5.2.3.1.1-4, Table 5.2.3.1.1-5 and Table 5.2.3.1.1-6, with the addition of test parameters in Table 5.2.3.1.1-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.1-1.

Table 5.2.3.1.1-1: Tests purpose

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

Table 5.2.3.1.1-2: Test parameters

	Parameter	Unit	Value
Duplex mode			FDD
Active DL BWP index	(1
Nouve DE BVVI IIIde.	Mapping type		Type A
	k0		0
	Starting symbol (S)		2
	Length (L)		12
	PDSCH aggregation factor		1
	PRB bundling type		Static
PDSCH	PRB bundling size		4 for Test 1-1 WB for Test 3-1 2 for other tests
configuration	Resource allocation type		Test 1-2: Type 1 with start RB = 23, $L_{RBs} = 6$ 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
	DMRS Type		Type 1
PDSCH DMRS	Number of additional DMRS		2 for Test 1-1, 1-5, 1-6, 1-7 1 for other tests
configuration	Maximum number of OFDM symbols for DL front loaded DMRS		1
	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 for tracking	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 Pro	ocesses		8 for Test 1-4, 2-1 4 for other tests
The number of slots I ACK information	petween PDSCH and corresponding HARQ-		2

Table 5.2.3.1.1-3: Minimum performance for Rank 1

		Bandwidth			Correlation	Reference value	
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	matrix and antenna configuration	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	[7.0]
1-7	R.PDSCH.1-8.1 FDD	10 / 15	16QAM, 0.48	TDLC300-600	2x4	70	[5.0]

Table 5.2.3.1.1-4: Minimum performance for Rank 2

		Bandwidth	No dedetien		Correlation	Reference	value
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	matrix and antenna configuration	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 5.2.3.1.1-5: Minimum performance for Rank 3

		Bandwidth	Madadatian		Correlation	Reference	/alue
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	matrix and antenna configuration	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 5.2.3.1.1-6: Minimum performance for Rank 4

	Bandwidth			Correlation	Reference value		
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	matrix and antenna configuration	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 5.2.3.1.1-7: Minimum performance for Rank 3 and Enhanced Receiver Type 1

		Bandwidth	Mandadatian		Correlation	Reference	/alue
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	matrix and antenna configuration	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

5.2.3.1.2 Minimum requirements for PDSCH Mapping Type A and CSI-RS overlapped with PDSCH

The performance requirements are specified in Table 5.2.3.1.2-3, with the addition of test parameters in table 5.2.3.1.2-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.2-1.

Table 5.2.3.1.2-1: 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 5.2.3.1.2-2: Test parameters

	Parameter	Unit	Value
Duplex mode			FDD
Active DL BWP index	(1
	Mapping type		Type A
PDSCH	k0		0
	Starting symbol (S)		2
	Length (L)		12
	PDSCH aggregation factor		1
	PRB bundling type		Static
configuration	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		N/A
	size		•
	DMRS Type		Type 1
PDSCH DMRS	Number of additional DMRS		1
configuration	Maximum number of OFDM symbols for DL front loaded DMRS		1
NZP CSI-RS for	OFDM symbols in the PRB used for CSI-RS		l ₀ = 13
CSI acquisition	CSI-RS periodicity	Slots	5
ZP CSI-RS for CSI	Subcarrier index in the PRB used for CSI-RS		$(k_0, k_1, k_2, k_3)=(2, 4, 6, 8)$
acquisition	Number of CSI-RS ports (X)		8
1	CSI-RS periodicity	Slots	5
Number of HARQ Pr			4
The number of slots ACK information	between PDSCH and corresponding HARQ-		2

Table 5.2.3.1.2-3: Minimum performance for Rank 2

Test	Reference	Bandwidth (MHz) / Subcarrier spacing	Modulation format and	Propagation condition	Correlation matrix and antenna configuration	Reference va	llue
num.	channel	(kHz)	code rate			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

5.2.3.1.3 Minimum requirements for PDSCH Mapping Type B

The performance requirements are specified in Table 5.2.3.1.3-3, with the addition of test parameters in Table 5.2.3.1.3-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.3-1.

Table 5.2.3.1.3-1: Tests purpose

Purpose	Test index
PDSCH mapping Type B performance under 4 receive	1-1
antenna conditions	

Table 5.2.3.1.3-2: 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 aggregation factor		1
PDSCH	PRB bundling type		Static
configuration	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	Number of additional DMRS		1
configuration	Maximum number of OFDM symbols for DL front loaded DMRS		1
Number of HARQ Pr	ocesses		4
The number of slots ACK information	between PDSCH and corresponding HARQ-		2

Table 5.2.3.1.3-3: Minimum performance for Rank 1

		Bandwidth Correlation		Correlation	Reference va	lue	
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	matrix and antenna configuration	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

5.2.3.1.4 Minimum requirements for PDSCH Mapping Type A and LTE-NR coexistence

The performance requirements are specified in Table 5.2.3.1.4-3, with the addition of test parameters in Table 5.2.3.1.4-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.4-1.

Table 5.2.3.1.4-1: 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 5.2.3.1.4-2: 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	PDSCH aggregation factor		1
. = 00	PRB bundling type		Static
configuration	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
DD 0011 D14D0	Position of the first DM-RS for downlink		3
PDSCH DMRS	Number of additional DMRS		1
configuration	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	LTE carrier BW	MHz	10
matching (Note 1)	Number of antenna ports		4
	v-shift		0
Number of HARQ Pr	Number of HARQ Processes		4
The number of slots ACK information	The number of slots between PDSCH and corresponding HARQ-		2
Note 1: No MBSFI	N is configured on LTE carrier	•	

Table 5.2.3.1.4-3: Minimum performance for Rank 1

	Bandwidth (MHz) /	Modulation		Correlation	Reference value		
Test num.	Reference channel	Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	matrix and antenna configuration	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

5.2.3.1.5 Minimum requirements for PDSCH 0.001% BLER

The performance requirements are specified in Table 5.2.3.1.5-3, with the addition of test parameters in Table 5.2.3.1.5-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.5-1.

Table 5.2.3.1.5-1: Tests purpose

Purpose	Test index
Verify the PDSCH 0.001% BLER performance under 4	1-1
receive antenna conditions	

Table 5.2.3.1.5-2: Test parameters

	Parameter	Unit	Value
Duplex mode			FDD
Active DL BWP inde	Active DL BWP index		1
	Mapping type		Type A
	k0		0
	Starting symbol (S)		2
	Length (L)		12
	PDSCH aggregation factor		1
PDSCH	PRB bundling type		Static
configuration	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		N/A
	size		
	DMRS Type		Type 1
PDSCH DMRS	Number of additional DMRS		1
configuration	Maximum number of OFDM symbols for		1
	DL front loaded DMRS		!
	f HARQ transmission		1
Number of HARQ Pr	ocesses		4
The number of slots ACK information	between PDSCH and corresponding HARQ-		2

Table 5.2.3.1.5-3: Minimum performance for Rank 1

Test	Reference	Bandwidth (MHz) /	Modulation	Propagation	Correlation matrix and antenna configuration	Reference va	lue
num.	channel	Subcarrier spacing (kHz)	format and code rate	Propagation condition		Target BLER	SNR (dB)
1-1	R.PDSCH.1-1.4 FDD	10 / 15	QPSK, 0.59	AWGN	1x4, ULA Low	0.001%	0.2

5.2.3.1.6 Minimum requirements for PDSCH repetitions over multiple slots

The performance requirements are specified in Table 5.2.3.1.6-3, with the addition of test parameters in Table 5.2.3.1.6-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.6-1.

Table 5.2.3.1.6-1: Tests purpose

Purpose	Test index
Verify the PDSCH repetitions over multiple slots	1-1
performance under 4 receive antenna conditions	

Table 5.2.3.1.6-2: Test parameters

	Parameter	Unit	Value
Duplex mode			FDD
Active DL BWP inde	X		1
	Mapping type		Type A
	k0		0
	Starting symbol (S)		2
	Length (L)		12
	PDSCH aggregation factor		2
PDSCH configuration	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	Number of additional DMRS		1
configuration	Maximum number of OFDM symbols for DL front loaded DMRS		1
Number of HARQ Pr	ocesses		4
The number of slots corresponding HARO	between final repetition of PDSCH and Q-ACK information		2

Table 5.2.3.1.6-3: Minimum performance for Rank 1

Test	Deference	Bandwidth (MHz) /	Modulation	Dranagation	Correlation matrix and		
num.	Reference channel	Subcarrier spacing (kHz)	format and code rate	Propagation condition	antenna configuration	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.

5.2.3.1.7 Minimum requirements for PDSCH Mapping Type B and UE processing capability 2

The performance requirements are specified in Table 5.2.3.1.7-3, with the addition of test parameters in Table 5.2.3.1.7-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.7-1.

Table 5.2.3.1.7-1: Tests purpose

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

Table 5.2.3.1.7-2: Test parameters

	Parameter	Unit	Value
Duplex mode			FDD
Active DL BWP index	x		1
	Mapping type		Type B
	k0		0
	Starting symbol (S)		2
	Length (L)		2
	PDSCH aggregation factor		1
PDSCH	PRB bundling type		Static
configuration	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		N/A
	size		IV/A
	DMRS Type		Type 1
PDSCH DMRS	Number of additional DMRS		0
configuration	Maximum number of OFDM symbols for		1
	DL front loaded DMRS		ľ
Maximum number of	HARQ transmission		1
Number of HARQ Pr	ocesses		2
The number of slots ACK information	between PDSCH and corresponding HARQ-		0

Table 5.2.3.1.7-3: Minimum performance for Rank 1

		Bandwidth	Correlation	Correlation	Reference va	lue	
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	matrix and antenna configuration	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]

5.2.3.1.8 Minimum requirements for PDSCH pre-emption

The performance requirements are specified in Table 5.2.3.1.8-3, with the addition of test parameters in Table 5.2.3.1.8-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.8-1.

Table 5.2.3.1.8-1: Tests purpose

Purpose	Test index
Verify the PDSCH pre-emption performance under 4	1-1
receive antenna conditions	

Table 5.2.3.1.8-2: Test parameters

	Parameter	Unit	Value
Duplex mode			FDD
Active DL BWP index	(1
PDCCH	Symbols with PDCCH		0, 1
configuration (Note	DCI format		2_1
4)	timeFrequencySet		14x1
	Mapping type		Type A
	k0		0
	Starting symbol (S)		2
	Length (L)		12
	PDSCH aggregation factor		1
PDSCH	PRB bundling type		Static
configuration	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	Number of additional DMRS		1
configuration	Maximum number of OFDM symbols for DL front loaded DMRS		1
Pre-emption	Starting symbol (S)		3
configuration (Note	Length (L)		2
2) Pre-emption periodicity and offset (Note 3)		Slots	10/1
Number of HARQ Pro			4
The number of slots I ACK information	petween PDSCH and corresponding HARQ-		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 5.2.3.1.8-3: Minimum performance for Rank 1

		Bandwidth (MHz) /	Meduletien		Correlation	Reference va	alue
Test num.	Reference channel	Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	matrix and antenna configuration	Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH. 1-2.5 FDD	10 / 15	16QAM 0.64	TDLA30-10	2x4, ULA Low	70	[6.5]

5.2.3.1.9 Minimum requirements for PDSCH HST-SFN

The performance requirements are specified in Table 5.2.3.1.9-3, with the addition of test parameters in Table 5.2.3.1.9-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.9-1.

Table 5.2.3.1.9-1: Tests purpose

Purpose	Test index
Verify PDSCH performance under 4 receive antenna conditions in the HST-SFN scenario defined in B.3.2	1-1
when highSpeedDemodFlag-r16 IE [17] is configured	

Table 5.2.3.1.9-2: 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 aggregation factor		1
PDSCH	PRB bundling type		Static
configuration	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		N/A
	SiZe	+	Tuna 4
DD0011 D14D0	DMRS Type	<u> </u>	Type 1
PDSCH DMRS	Number of additional DMRS		2
configuration	Maximum number of OFDM symbols for DL front loaded DMRS		1
	CSI-RS periodicity	Slots	10 for CSI-RS resource 1,2,3,4.
CSI-RS for tracking CSI-RS offset		Slots	1 for CSI-RS resource 1 and 2 2 for CSI-RS resource 3 and 4.
Number of HARQ Pro	ocesses		4
The number of slots I ACK information	petween PDSCH and corresponding HARQ-		2

Table 5.2.3.1.9-3: Minimum performance for Rank 2

		Bandwidth			Correlation	Reference v	alue
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	matrix and antenna configuration	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

5.2.3.1.10 Minimum requirements for HST DPS

The performance requirements are specified in Table 5.2.3.1.10-3, with the addition of test parameters in Table 5.2.3.1.10-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.10-1.

Table 5.2.3.1.10-1: Tests purpose

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

Table 5.2.3.1.10-2: Test parameters

	Parameter		Unit	Value
Duplex mode				FDD
Active DL BWP index				1
PDCCH configuration	TCI state			Note 1
	Mapping type			Type A
	k0			0
	Starting symbol (S)		2
	Length (L)			12
	PDSCH aggregation	on factor		1
DDOOLL fi fi	PRB bundling type			Static
PDSCH configuration	PRB bundling size			2
	Resource allocatio			Type 0
	RBG size			Config2
	VRB-to-PRB mapp	ing type		Non-interleaved
		ing interleaver bundle size		N/A
	TCI state			Note 1
	DMRS Type			Type 1
PDSCH DMRS	Number of addition	nal DMRS		2
configuration		of OFDM symbols for DL		4
	front loaded DMRS			1
		First OFDM symbol in		$I_0 = 5$ for CSI-RS resource 1 and 3
		the PRB used for CSI-		$I_0 = 9$ for CSI-RS resource 2 and 4
		RS		
	Resource set #1	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
			01015	2 for CSI-RS resource 3 and 4
CSI-RS for tracking		QCL info		TCI state #2
COI-NO IOI tracking		First OFDM symbol in		l ₀ = 6 for CSI-RS resource 5 and 6
	Resource set #2	the PRB used for CSI-		$l_0 = 10$ for CSI-RS resource 7 and 8
		RS		
		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
			01013	2 for CSI-RS resource 7 and 8
		QCL info		TCI state #3
		First OFDM symbol in		$I_0 = 12$
		the PRB used for CSI-		
	Resource set #3	RS	-	
	110000100 oot 110	CSI-RS periodicity	Slots	20
N7D 001 D0 (001		CSI-RS offset	Slots	0
NZP CSI-RS for CSI		QCL info		TCI state #0
acquisition		First OFDM symbol in		$I_0 = 13$
		the PRB used for CSI-		
	Resource set #4	RS COLDO noniculiaitu	Clata	20
	1.0000.0000	CSI-RS periodicity	Slots	20
		CSI-RS offset	Slots	0 TCI state #1
		QCL info		CSI-RS resource 1 from 'CSI-RS for
	Type 1 OC	CSI-RS resource		tracking Resource set #1'
	Type 1 QCL information	COI-NO TESOUICE		configuration
TCI state #0	inionnation	QCL Type		Type A
	Type 2 QCL	CSI-RS resource		N/A
	information	QCL Type		N/A N/A
	miomation	QOL Type		CSI-RS resource 5 from 'CSI-RS for
	Type 1 QCL	CSI-RS resource		tracking Resource set #2'
	information	COLING TESOUICE		configuration
TCI state #1	omation	QCL Type		Type A
	Type 2 QCL	CSI-RS resource		N/A
	information	QCL Type		N/A
	Type 1 QCL	SSB index		SSB #0
	information	QCL Type		Type C
TCI state #2	Type 2 QCL	SSB index		N/A
	information	QCL Type		N/A
	Type 1 QCL	SSB index		SSB #1
	information	QCL Type		Type C
TCI state #3	<u> </u>	SSB index		N/A
	Type 2 QCL information	QCL Type		N/A N/A
	miomation	QOL TYPE	L	IW/A

Number of HARQ Processes	4
The number of slots between PDSCH and corresponding HARQ-ACK	2
information	_

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 k^{th} RRH.

For Test 1-1, TCl state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy mod(i, 2n) = n. PDCCH and PDSCH associated with TCl # (k mod 2) is transmitted by kth RRH from slot# $max[(2k-1)n+1+T_{HARO}+T_{MAC\ proc}+T_{firstTRS}+T_{TRS\ proc},0]$

to slot#

$$(2k+1)n + T_{HARQ} + T_{MAC proc}$$

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 mod(i, 2n) = n. PDCCH and PDSCH associated with TCI # (k mod 2) is transmitted by k^{th} RRH from slot#

$$\max[(2k-1)n + 1 + T_{HARO} + T_{MAC, proc}, 0]$$

to slot#

$$(2k + 1)n + T_{HARQ} + T_{MAC proc}$$

Where k=0, 1, 2... is the RRH number, n = 2520 is half of the number of slots between two RRH, T_{HARQ} = 2 is the number of slots between PDSCH and corresponding HARQ-ACK information, $T_{MAC\ proc}$ = 3 is the number of slots for MAC CE processing, $T_{firstTRS}$ = 6 is the number of slots to first TRS transmission occasion after MAC CE command is decoded by the UE, $T_{TRS\ proc}$ = 2 is the number of slots for TRS processing.

Table 5.2.3.1.10-3: Minimum performance for HST DPS

		Bandwidth			Number of	Correlation	Reference	value
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	active PDSCH TCI states	matrix and antenna configuration	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]

5.2.3.1.11 Minimum requirements for PDSCH Single-DCI based SDM scheme

The performance requirements are specified in Table 5.2.3.1.11-3, with the addition of test parameters in Table 5.2.3.1.11-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.11-1.

Table 5.2.3.1.11-1: Tests purpose

Purpose	Test index
Verify the PDSCH performance with Single-DCI based	1-1,1-2
SDM scheme under 4 receive antenna conditions	

Table 5.2.3.1.11-2: Test parameters

	Parameter		Unit	Va	lue	
		Onit	TRxP #1(Note 1)	TRxP #2(Note 1)		
Transmit TRxP of SS					P #1	
PDCCH configuration TCI state CORESETPoolIndex					ate #1	
	COF	Subcarrier index in the		k0=0 for CSI-RS	k0=1 for CSI-RS	
		subcarrier index in the sused for CSI-RS		resources 1,2,3,4	resources 5,6,7,8	
	1100			10 = 6 for CSI-RS	10 = 6 for CSI-RS	
		05514		resources 1 and 3	resources 5 and 7	
		OFDM symbol in the PRB		10 = 10 for CSI-	10 = 10 for CSI-	
	used	used for CSI-RS		RS resources 2	RS resources 6	
				and 4	and 8	
	Num	nber of CSI-RS ports (X)		1 for CSI-RS	1 for CSI-RS	
CSI-RS for tracking		,			resource 5,6,7,8 SI-RS resource	
	CDN	/I Туре			,5,6,7,8	
	Den	sitv			3	
		RS periodicity	Slots	2	.0	
		•		10 for CSI-RS	10 for CSI-RS	
	CSI	RS offset	Slots	resources 1 and 2	resources 5 and 6	
	001	TO Oliset	51013	11 for CSI-RS	11 for CSI-RS	
	0.01	.,			resources 7 and 8	
Dunlay mada	QCL	info			ate #0	
Duplex mode Active DL BWP index	v			L L	DD 1	
Mapping type				Tyr	e A	
	k0)	
	Starting symbol	(S)		2		
	Length (L)			12		
PDSCH	PRB bundling ty	/pe		Static		
configuration	PRB bundling s				2	
Comigaration	Resource alloca	ation type			e 1	
	RBG size			Config2		
	VRB-to-PRB ma			Non-interleaved		
VRB-to-PR		RB mapping interleaver bundle		N	/A	
	Antenna port inc	dexes		1000	1002	
	TCI state			TCI State #1	TCI State #2	
PDSCH DMRS	DMRS Type			Тур	e 1	
configuration	Number of addi			,	1	
		er of OFDM symbols for		1		
	DL front loaded	DMRS		001 00	· 	
				CSI-RS resource 1 from 'CSI-RS		
	Type 1 QCL	CSI-RS resource		for tracking'	N/A	
TCI State #1	information			configuration		
		QCL Type		Type A	N/A	
	Type 2 QCL	CSI-RS resource		N/A	N/A	
	information	QCL Type		N/A	N/A	
					CSI-RS resource	
	Type 1 QCL	CSI-RS resource		N/A	5 from 'CSI-RS for tracking'	
TCI State #2	information				configuration	
TCI State #2		QCL Type		N/A	Type A	
	Type 2 QCL	CSI-RS resource		N/A	N/A	
information QCL Type				N/A	N/A	
Resource allocation	<u> </u>	•			rlapping	
Timing offset of the s	econd TRxP from	the first TRxP	us		test 1-1	
ing onder or trie s		and mot mot	45		est 1-2	
Frequency offset of t	he second TRxP f	rom the first TRxP	Hz	200 for test 1-1		
Number of HARQ Pr				0 for test 1-2 4		
		and corresponding HARQ-				
ACK information	ACK information				2	

Precodin	g 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 5.2.3.1.11-3: Minimum performance

		Bandwidt	Modulatio Correlation matrix		Reference value		
Test num	Reference channel	h (MHz) / Subcarrier spacing (kHz)	n format and code rate	Propagation condition(Not e 1)	and antenna configuration(Not e 2)	Fraction of maximum throughpu t (%)	SNR (dB)(Not e 3)
1-1	R.PDSCH.1 -3.2 FDD	10 / 15	64QAM, 0.50	TDLA30-10	2x4, ULA Low	70	[13.4]
1-2	R.PDSCH.1 -3.2 FDD	10 / 15	64QAM, 0.50	TDLA30-10	2x4, ULA Low	70	[13.1]
Note 1	Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent						

Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2 Note 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 Minimum requirements for PDSCH Multi-DCI based transmission scheme

The performance requirements are specified in Table 5.2.3.1.12-3, with the addition of test parameters in Table 5.2.3.1.12-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.12-1.

Table 5.2.3.1.12-1: Tests purpose

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

Table 5.2.3.1.12-2: Test parameters

	Parar	meter	Unit		lue		
T		110101	Onit	TRxP #1(Note 1)	TRxP #2(Note 1)		
Transmit TRxP of SS	iB I	TCI state		TCI State #1	P #1 TCI State #2		
PDCCH configuration TCI state CORESETPoolIndex					1	.1	
			arrier index in the		k0=0 for CSI-RS	k0=1 for CSI-RS	
			for CSI-RS		resources 1,2,3,4	resources 5,6,7,8	
					I0 = 6 for CSI-RS	I0 = 6 for CSI-RS	
		First OFD	M symbol in the PRB		resources 1 and 3	resources 5 and 7	
		used for CSI-RS			10 = 10 for CSI-	10 = 10 for CSI-	
					RS resources 2 and 4	RS resources 6 and 8	
					1 for CSI-RS	1 for CSI-RS	
			of CSI-RS ports (X)			resource 5,6,7,8	
CSI-RS for tracking		CDM Typ	^			SI-RS resource	
		• •				,5,6,7,8	
		Density	. p,	01.1		3	
		CSI-RS p	eriodicity	Slots	10 for CSI-RS	10 for CSI-RS	
					resources 1 and 2	resources 5 and 6	
		CSI-RS o	ffset	Slots	11 for CSI-RS	11 for CSI-RS	
						resources 7 and 8	
		QCL info				ate #0	
Duplex mode						DD .	
Active DL BWP index						1	
	Mapping ty	ype				oe A O	
	Starting sy	mbol (S)				<u>) </u>	
	Length (L)				12		
PDSCH	PRB bund				Static		
configuration	PRB bundling size				2		
Comiguration	Resource allocation type				Type 1		
	RBG size				Config2		
	VRB-to-PRB mapping type VRB-to-PRB mapping interleaver bundle				Non-interleaved		
VRB-to-F		RB mapping interleaver bundle			N/A		
	Antenna p	ort indexes			{1000,1001}	{1002,1003}	
	TCI state				TCI State #1	TCI State #2	
PDSCH DMRS	DMRS Typ				Тур	oe 1	
configuration		f additional			,	1	
	l	number of OFDM symbols for				1	
	DL Iront io	aded DMR	ა 		CSI-RS resource		
					1 from 'CSI-RS		
	Type 1 QCL information		CSI-RS resource		for tracking'	N/A	
TCI State #1	information				configuration		
			QCL Type		Type A	N/A	
	Type 2 QC		CSI-RS resource		N/A	N/A	
	information	[]	QCL Type		N/A	N/A CSI-RS resource	
	_		201.75			5 from 'CSI-RS	
	Type 1 QC		CSI-RS resource		N/A	for tracking'	
TCI State #2	information	n				configuration	
			QCL Type		N/A	Type A	
	Type 2 QC		CSI-RS resource		N/A	N/A	
information QCL Type					N/A	N/A	
Resource allocation Timing offset of the second TRxP from the first TRxP			us		erlapping 0.5		
Frequency offset of the second TRxP from the first TRxP			Hz		00		
Number of HARQ Pro			· · · · · · · · · · · · · · · · · · ·	<u></u>		4	
The number of slots I		SCH and c	orresponding HARQ-		,	2	
ACK information							
						endent precoding	
Precoding configurati	ion					ed for both TRxPs, vith PRB bundling	
						ularity	
					, 3,411	- ·- ·- ·- ·	

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 5.2.3.1.12-3: Minimum performance

Ī				Modula			Referenc	e value	
	Test num.	Referen	ce channel	Bandwidt h (MHz) / Subcarrier spacing (kHz)	tion format and code rate	Propagati on condition(Note 1)	Correlation matrix and antenna configuratio n(Note 2)	Fraction of maximu m throughp ut (%)	SNR (dB)(No te 3)
Ī	1-1	R.PDSCH.	R.PDSCH.1-	10 / 15	64QAM	TDLA30-	2x4, ULA	70	[14.6]
ļ	N 4	1-3.3 FDD	3.4 FDD		, 0.50	10	Low	_	

Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent 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 Minimum requirements for PDSCH with single-DCI based FDM Scheme A

The performance requirements are specified in Table 5.2.3.1.13-3, with the addition of test parameters in Table 5.2.3.1.13-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.13-1.

Table 5.2.3.1.13-1: 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 5.2.3.1.13-2: Test parameters

Parameter					Value		
					TRxP #1 (Note 1) TRxP #2 (Note 1)		
Transmit TRxP of SSB					TRx		
PDCCH configuration	n -	TCI state			TCI State #1		
J 11 J			TPoolIndex			nfigured	
		First subcarrier index in the			k0=0 for CSI-RS	k0=1 for CSI-RS	
		PRB used for CSI-RS			resources 1,2,3,4 I0 = 6 for CSI-RS	resources 5,6,7,8 I0 = 6 for CSI-RS	
					resources 1 and 3	resources 5 and 7	
		First OFDM symbol in the PRB			10 = 10 for CSI-	10 = 10 for CSI-	
		used for CSI-RS			RS resources 2	RS resources 6	
					and 4	and 8	
CSI-RS for tracking		Number of CSI-RS ports (X)			1 for CSI-RS	1 for CSI-RS	
					resource 1,2,3,4		
		CDM Type			'No CDM' for CSI-RS resource		
					1,2,3,4,5,6,7,8		
		Density CSL BS periodicity		Slots	3		
		CSI-RS periodicity		51015	20 10 for CSI-RS 10 for CSI-R		
				Slots	resources 1 and 2	10 for CSI-RS resources 5 and 6	
		CSI-RS of	ffset		11 for CSI-RS	11 for CSI-RS	
					resources 3 and 4		
	-	QCL info			TCI state #0		
Duplex mode		1 22			FDD		
Active DL BWP index	X				•	1	
	Mapping type				Type A		
	k0				0		
	Starting sy	mbol (S)			2		
	Length (L)				12		
PDSCH	PRB bundl				Static		
configuration	PRB bundl				wideband		
	Resource a	allocation ty	ype		Type 0 Config2		
		R manning	n type		Non-interleaved		
	VRB-to-PRB mapping type VRB-to-PRB mapping interleaver bundle						
	size				N.	/A	
	Antenna po	ort indexes			1000, 1001	1000, 1001	
	TCI state				TCI State #1	TCI State #2	
PDSCH DMRS	DMRS Typ				Тур	e 1	
configuration	Number of				,	1	
			OFDM symbols for		,	1	
	DL front loa	aded DMR	S			· 	
	Type 1 QCL information				CSI-RS resource		
			CSI-RS resource		1 from 'CSI-RS for tracking'	N/A	
TCI State #1					configuration		
			QCL Type		Type A	N/A	
	Type 2 QCL information		CSI-RS resource		N/A	N/A	
			QCL Type		N/A	N/A	
						CSI-RS resource	
	Type 1 QC	1	CSI-RS resource		N/A	5 from 'CSI-RS	
	information Type 2 QCL		33.1.3 10000100		13//	for tracking'	
TCI State #2			001 7		N1/A	configuration	
			QCL Type		N/A N/A	Type A N/A	
	information		CSI-RS resource QCL Type		N/A N/A	N/A N/A	
Timing offset of the second TRxP from the first TRxP).5	
Frequency offset of the second TRxP from the first TRxP					200		
Number of HARQ Processes					4		
The number of slots between PDSCH and corresponding HARQ-					,	2	
ACK information						2	
						endent precoding	
Precoding configuration				generation is applied for both TRXPs			
					random per slot with PRB bundling granularity.		
Note 1: PDSCH tra	anemiccion i	dono fron	n both TRxPs	<u> </u>	<u>granu</u>	ııaılıy.	
INDIE I. FUSCH III	ariorilloolUll IS	aurie IIUII	I DOUI I I IXE 2				

Table 5.2.3.1.13-3: Minimum performance for Rank 2

		Bandwidth			Correlation	Reference value	
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition (Note 1)	matrix and antenna configuration (Note 2)	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	[11.0]

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

5.2.3.1.14 Minimum requirements for PDSCH with single-DCI based Inter-slot TDM scheme

The performance requirements are specified in Table 5.2.3.1.14-3, with the addition of test parameters in Table 5.2.3.1.14-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.1.14-1.

Table 5.2.3.1.14-1: Tests purpose

Test index			
1-1			

Table 5.2.3.1.14-2: Test parameters

	Parame	eter		Unit	Value		
					TRxP #1 (Note 1)	TRxP #2 (Note 1)	
Transmit TRxP of SS					TRx		
PDCCH configuration		TCI state				ate #1	
			TPoolIndex			nfigured	
			arrier index in the		k0=0 for CSI-RS	k0=1 for CSI-RS	
	<u> </u>	PRB used	I for CSI-RS		resources 1,2,3,4 I0 = 6 for CSI-RS	resources 5,6,7,8 10 = 6 for CSI-RS	
					resources 1 and 3	resources 5 and 7	
			M symbol in the PRB		10 = 10 for CSI-	10 = 10 for CSI-	
	1	used for C	SI-RS		RS resources 2	RS resources 6	
					and 4	and 8	
		Numbere	f CSI-RS ports (X)		1 for CSI-RS	1 for CSI-RS	
CSI-RS for tracking		Number o	i CSI-RS ports (X)		resource 1,2,3,4	resource 5,6,7,8	
CSI-RS for tracking	۱ ا	CDM Type	۵			SI-RS resource	
						,5,6,7,8	
		Density				3	
	<u> </u>	CSI-RS pe	eriodicity	Slots		0	
					10 for CSI-RS	10 for CSI-RS	
	(CSI-RS of	ffset	Slots	resources 1 and 2	resources 5 and 6 11 for CSI-RS	
					11 for CSI-RS	resources 7 and 8	
	<u> </u>	QCL info				ate #0	
Duplex mode	1	QUE IIIIU				DD	
Active DL BWP index	x				,	-	
7.104.10 22 2711 11140	Mapping typ	ре			Tvp	e A	
	k0	-)	
	Starting sym	nbol (S)			2		
	Length (L)	. ,			1	2	
	Repetition n	umber			2	2	
PDSCH configuration	PRB bundlir	ng type			Sta	atic	
	PRB bundlir	ng size				2	
	Resource al	llocation ty	ype			oe 0	
	RBG size					nfig2	
	VRB-to-PRE				Non-inte	erleaved	
		3 mapping	g interleaver bundle		N	/A	
	size	m4 !.a.al.a.v.a.a					
	Antenna por TCI state	rt indexes			1000 TCI State #1	1000 TCI State #2	
PDSCH DMRS	DMRS Type				Typ		
configuration	Number of a		DMRS			1	
Johngaration			OFDM symbols for				
	DL front loa				•	1	
					CSI-RS resource		
	Type 1 001		CSI-RS resource		1 from 'CSI-RS	N/A	
	Type 1 QCL information	_	COI-NO TESUUICE		for tracking'	IN/A	
TCI State #1	IIIIOIIIIalioII				configuration		
			QCL Type	ļ	Type A	N/A	
	Type 2 QCL	-	CSI-RS resource	-	N/A	N/A	
	information		QCL Type		N/A	N/A	
						CSI-RS resource 5 from 'CSI-RS	
	Type 1 QCL	-	CSI-RS resource		N/A	for tracking'	
TCI State #2	information					configuration	
101 Glate #2			QCL Type		N/A	Type A	
Type 2		_	CSI-RS resource		N/A	N/A	
information 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	20	00		
Number of HARQ Pr					4	1	
	between PDS	CH and co	orresponding HARQ-			2	
ACK information							
						endent precoding	
Precoding configurat	tion					ed for both TRxPs,	
						vith PRB bundling	
				1	y grant	ılarity.	

Note 1: PDSCH transmission is done from both TRxPs

Table 5.2.3.1.13-3: Minimum performance for Rank 1

		Bandwidth			Correlation			
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition (Note 1)	matrix and antenna configuration (Note 2)	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)	[-1.1]	
Note 1	- 1 - 1 - 3				kP #2 and are statis		ıt.	
Note 2	ote 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.							
Note 3				of incorrectly rece ssion(s) for each t	ived transport block ransport block.	ks / sent transport	blocks,	

5.2.3.2 TDD

Note 4:

5.2.3.2.1 Minimum requirements for PDSCH Mapping Type A

SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2

The performance requirements are specified in Table 5.2.3.2.1-3, Table 5.2.3.2.1-4, Table 5.2.3.2.1-5 and Table 5.2.3.2.1-6, with the addition of test parameters in Table 5.2.3.2.1-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.1-1.

Table 5.2.3.2.1-1: Tests purpose

Purpose	Test index
Verify the PDSCH mapping Type A normal performance	1-1, 1-2, 1-3, 1-5, 1-6, 1-7, 1-8, 1-9, 1-10, 1-11, 2-1, 2-2,
under4 receive antenna conditions and with different	3-1, 4-1
channel models, MCSs and number of MIMO layers	
Verify the PDSCH mapping Type A HARQ soft combining	1-4
performance under 4 receive antenna conditions.	
Verify the PDSCH mapping Type A performance	5-1
requirements for Enhanced Receiver Type 1 under 4	
receive antenna conditions.	

Table 5.2.3.2.1-2: Test parameters

	Parameter	Unit	Value	
Duplex mode			TDD	
Active DL BWP index			1	
	Mapping type		Type A	
	k0		0	
	Starting symbol (S)		2	
			Specific to each Reference channel	
			1	
	PRB bundling type			
PDSCH	PRB bundling size			
configuration				
· ·	D H C A			
	Resource allocation type			
	RBG size			
	V/PP to PPP manning type			
			Non-interieaved	
			N/A	
			Type 1	
	Divince Type			
PDSCH DMRS	Number of additional DMRS			
configuration	Transor of additional Biring		1 for other tests	
· ·	Maximum number of OFDM symbols for		1	
	DL front loaded DMRS			
	First OFDM symbol in the PRB used for			
	CSI-RS		I ₀ = 8 for CSI-RS resource 2 and 4	
			l ₀ = 8 for CSI-RS resource 2 and 4 Other tests; Table 5.2-1.	
	CSI-RS periodicity	Slots	20101 001 110 10000100 1,2,0,1.	
			Other tests: Table 5.2-1.	
CSI-RS for tracking			Test 1-7, 1-10, 1-11:	
•			1 for CSI-RS resource 1 and 2	
	Specific to each Reference change			
			Tests 1-8, 1-9: l ₀ = 4 for CSI-RS resource 1 and 3 l ₀ = 8 for CSI-RS resource 2 and 4 Other tests; Table 5.2-1. Test 1-7, 1-10, 1-11: 20 for CSI-RS resource 1,2,3,4. Other tests: Table 5.2-1. 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. Test 1-7, 1-10, 1-11: Start PRB 0	
	Francisco de Compatione			
	Frequency Occupation		Number of PKB = 52	
			Other tests: Table 5 2-1	
	<u>I</u>			
Number of HARQ Pro	ocesses			
The number of slots I	petween PDSCH and corresponding HARQ-		Specific to each TDD UL-DL pattern	
ACK information			and as defined in Annex A.1.2	
		•		

Table 5.2.3.2.1-3: Minimum performance for Rank 1

		Bandwidth				Correlation	Reference v	/alue
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL- DL pattern	Propagati on condition	matrix and antenna configuration	Fraction of maximum throughput (%)	SN R (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]

Table 5.2.3.2.1-4: Minimum performance for Rank 2

		Bandwidth	Madulation	TDD		Correlation	Reference	value
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	matrix and antenna configuration	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 5.2.3.2.1-5: Minimum performance for Rank 3

		Bandwidth	Madulation			Correlation	Reference	value
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL- DL pattern	Propagation condition	matrix and antenna configuration	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 5.2.3.2.1-6: Minimum performance for Rank 4

		Bandwidth	Mandadatian	TDD !!!		Correlation	Reference	value
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL- DL pattern	Propagation condition	matrix and F antenna	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 5.2.3.2.1-7: Minimum performance for Rank 3 and Enhanced Receiver Type 1

		Bandwidth		TDD III		Correlation	Reference	/alue
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL- DL pattern	Propagation condition	matrix and antenna configuration	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

5.2.3.2.2 Minimum requirements for PDSCH Mapping Type A and CSI-RS overlapped with PDSCH

The performance requirements are specified in Table 5.2.3.2.2-3, with the addition of test parameters in table 5.2.3.2.2-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.2-1.

Table 5.2.3.2.2-1: Tests purpose

Purpose	Test index
Verify the PDSCH mapping Type A normal performance	1-1
under 4 receive antenna conditions and CSI-RS	
overlapped with PDSCH	

Table 5.2.3.2.2-2: Test parameters

	Parameter	Unit	Value
Duplex mode			TDD
Active DL BWP index	(1
	Mapping type		Type A
	k0		0
	Starting symbol (S)		2
	Length (L)		12
	PDSCH aggregation factor		1
PDSCH	PRB bundling type		Static
configuration	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		N/A
	size		IN/A
	DMRS Type		Type 1
PDSCH DMRS	Number of additional DMRS		1
configuration	Maximum number of OFDM symbols for DL front loaded DMRS		1
NZP CSI-RS for	OFDM symbols in the PRB used for CSI-RS		l ₀ = 13
CSI acquisition	CSI-RS periodicity	Slots	5
ZP CSI-RS for CSI	Subcarrier index in the PRB used for CSI-RS		$(k_0, k_1, k_2, k_3)=(2, 4, 6, 8)$
acquisition	Number of CSI-RS ports (X)		8
	CSI-RS periodicity	Slots	5
Number of HARQ Pr	ocesses		8
The number of slots ACK information	between PDSCH and corresponding HARQ-		Specific to each TDD UL-DL pattern and as defined in Annex A.1.2

Table 5.2.3.2.2-3: Minimum performance for Rank 2

		Bandwidth	Madulation	TDD III		Correlation matrix and antenna configuration Reference volume fraction of maximum throughput (%)	/alue	
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL- DL pattern	Propagation condition		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

5.2.3.2.3 Minimum requirements for PDSCH Mapping Type B

The performance requirements are specified in Table 5.2.3.2.3-3, with the addition of test parameters in Table 5.2.3.2.3-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.3-1.

Table 5.2.3.2.3-1: Tests purpose

Purpose	Test index
PDSCH mapping Type B performance under 4 receive antenna conditions	1-1

Table 5.2.3.2.3-2: Test parameters

	Parameter	Unit	Value
Duplex mode			TDD
Active DL BWP inde	ex		1
	Mapping type		Type B
	k0		0
	Starting symbol (S)		5
	Length (L)		7
	PDSCH aggregation factor		1
PDSCH	PRB bundling type		Static
configuration	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	Number of additional DMRS		1
configuration	Maximum number of OFDM symbols for DL front loaded DMRS		1
Number of HARQ Processes			8
The number of slots ACK information	between PDSCH and corresponding HARQ-		Specific to each TDD UL-DL pattern and as defined in Annex A.1.2

Table 5.2.3.2.3-3: Minimum performance for Rank 1

		Bandwidth	TDD !!!		Correlation	Reference value		
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL- DL pattern	Propagation condition	matrix and antenna configuration	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

5.2.3.2.4 Minimum requirements for PDSCH Mapping Type A and LTE-NR coexistence

The performance requirements are specified in Table 5.2.3.2.4-3, with the addition of test parameters in Table 5.2.3.2.4-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.4-1.

Table 5.2.3.2.4-1: 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 5.2.3.2.4-2: 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
	Mapping type		Type A
PDSCH configuration	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
configuration	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
DUSCH UMDS	Position of the first DM-RS for downlink		3
	Number of additional DMRS		1
PDSCH DMRS configuration CRS for rate matching (Note 1)	Maximum number of OFDM symbols for DL front loaded DMRS		1
CDC for rate	LTE carrier centre subcarrier location		Same as NR carrier centre subcarrier location
0.10.10.10.0	LTE carrier BW	MHz	10
matching (Note 1)	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 MBSFI	N is configured on LTE carrier	•	

Table 5.2.3.2.4-3: Minimum performance for Rank 1

	Bandwidth (MHz) /		(MHz) /			Correlation	Reference value	
Test num.	Reference channel	Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL- DL pattern	Propagation condition	matrix and antenna configuration	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

5.2.3.2.5 Minimum requirements for PDSCH 0.001% BLER

The performance requirements are specified in Table 5.2.3.2.5-3, with the addition of test parameters in Table 5.2.3.2.5-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.5-1.

Table 5.2.3.2.5-1: Tests purpose

Purpose	Test index
Verify the PDSCH 0.001% BLER performance under 4	1-1
receive antenna conditions	

Table 5.2.3.2.5-2: Test parameters

	Parameter	Unit	Value
Duplex mode			TDD
Active DL BWP inde	x		1
	Mapping type		Type A
	k0		0
	Starting symbol (S)		2
	Length (L)		12
	PDSCH aggregation factor		1
PDSCH	PRB bundling type		Static
configuration	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	Number of additional DMRS		1
configuration	Maximum number of OFDM symbols for		1
	DL front loaded DMRS		<u>'</u>
Maximum number of HARQ transmission			1
Number of HARQ Processes			8
	between PDSCH and corresponding HARQ-		Defined in Annex A.1.2 for TDD pattern
ACK information			FR1.30-1

Table 5.2.3.2.5-3: Minimum performance for Rank 1

Toot	Toot Deference	Bandwidth (MHz) / Modulation	TDD UL-DL P	Propagation	Correlation matrix and antenna configuration	Reference value		
Test Reference num. channel	Subcarrier spacing (kHz)	spacing code rate	pattern	Propagation condition		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%	0.2

5.2.3.2.6 Minimum requirements for PDSCH repetitions over multiple slots

The performance requirements are specified in Table 5.2.3.2.6-3, with the addition of test parameters in Table 5.2.3.2.6-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.6-1.

Table 5.2.3.2.6-1: Tests purpose

Purpose	Test index
Verify the PDSCH repetitions over multiple slots	1-1
performance under 4 receive antenna conditions	

Table 5.2.3.2.6-2: Test parameters

	Parameter	Unit	Value
Duplex mode			TDD
Active DL BWP inde	X		1
	Mapping type		Type A
	k0		0
	Starting symbol (S)		2
	Length (L)		12
	PDSCH aggregation factor		2
PDSCH	PRB bundling type		Static
configuration	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	Number of additional DMRS		1
configuration	Maximum number of OFDM symbols for DL front loaded DMRS		
Number of HARQ Processes			4
The number of slots	between final repetition of PDSCH and		Specific to each TDD UL-DL pattern
corresponding HAR			and as defined in Annex A.1.2 (Note 1)
Note 1: ACK/NAC	CK feedback is generated for PDSCH on slot i,	where mo	$d(i,10) = \{2, 4, 6\}.$

Table 5.2.3.2.6-3: Minimum performance for Rank 1

Toot	Poforonoo	Bandwidth (MHz) /	Modulation	TDD UL-DL	Propagation	Correlation	Reference va	alue
Test I	Reference channel	Subcarrier tormat and	pattern	Propagation condition	matrix and antenna configuration	Target BLER	SNR (dB)	
1-1	R.PDSCH.1-16.1 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.

5.2.3.2.7 Minimum requirements for PDSCH Mapping Type B and UE processing capability 2

The performance requirements are specified in Table 5.2.3.2.7-3, with the addition of test parameters in Table 5.2.3.2.7-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.7-1.

Table 5.2.3.2.7-1: Tests purpose

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

Table 5.2.3.2.7-2: Test parameters

Parameter			Value
Duplex mode			TDD
Active DL BWP index			1
DDCCH	Mapping type		Type B
PDSCH configuration	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	N/A
	size	IV/A
	DMRS Type	Type 1
PDSCH DMRS	Number of additional DMRS	0
configuration	Maximum number of OFDM symbols for DL front loaded DMRS	1
Maximum number of	of HARQ transmission	1
Number of HARQ F	rocesses	2
The number of slots ACK information	s between PDSCH and corresponding HARQ-	0

Table 5.2.3.2.7-3: Minimum performance for Rank 1

		Bandwidth		Modulation TDD UL-		Correlation	Reference value	
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	format and code rate	DL pattern	Propagation condition	matrix and antenna configuration	Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH.1- 17.1 TDD	40 / 30	QPSK, 0.30	FR1.30- 2	TDLA30-10	2x4, ULA Low	70	[- 2.5]

5.2.3.2.8 Minimum requirements for PDSCH pre-emption

The performance requirements are specified in Table 5.2.3.2.8-3, with the addition of test parameters in Table 5.2.3.2.8-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.8-1.

Table 5.2.3.2.8-1: Tests purpose

Purpose	Test index
Verify the PDSCH pre-emption performance under 4	1-1
receive antenna conditions	

Table 5.2.3.2.8-2: Test parameters

	Parameter	Unit	Value
Duplex mode			TDD
Active DL BWP index	(1
PDCCH	Symbols with PDCCH		0, 1
configuration (Note	DCI format		2_1
4)	timeFrequencySet		14x1
	Mapping type		Type A
	k0		0
	Starting symbol (S)		2
	Length (L)		12
	PDSCH aggregation factor		1
PDSCH	PRB bundling type		Static
configuration	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	Number of additional DMRS		1
configuration	Maximum number of OFDM symbols for DL front loaded DMRS		1
Pre-emption	Starting symbol (S)		3
configuration (Note	Length (L)		2
2)	Pre-emption periodicity and offset	Slots	40/(1,12,23,34) (Note 3)
Number of HARQ Processes			8
ACK information	petween PDSCH and corresponding HARQ-		FR1.30-1
The number of slots between PDSCH and corresponding HARQ-			

Note 1: Void

Note 2: Interference modelled as random data on pre-empted REs.

Note 3: Pre-emption is scheduled with with 10% probability with 20ms periodicity.

Note 4: In addition to PDCCH configuration in Table 5.2-1.

Table 5.2.3.2.8-3: Minimum performance for Rank 1

		Bandwidth (MHz) / Madulation			Correlation	Reference value		
Test num.	Reference channel	Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition	matrix and antenna configuration	Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH. 2-2.5 TDD	40 / 30	16QAM 0.48	FR1.30-1	TDLA30-10	2x4, ULA Low	70	[8.7]

5.2.3.2.9 Minimum requirements for HST-SFN

The performance requirements are specified in Table 5.2.3.2.9-3, with the addition of test parameters in Table 5.2.3.2.9-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.9-1.

Table 5.2.3.2.9-1: Tests purpose

Purpose	Test index
Verify PDSCH performance under 4 receive antenna conditions in the HST-SFN scenario defined in B.3.2 when <i>highSpeedDemodFlag-r16</i> [17] is configured.	1-1

Table 5.2.3.2.9-2: Test parameters

	Parameter	Unit	Value	
Duplex mode			TDD	
Active DL BWP index	(1	
	Mapping type		Type A	
	k0		0	
	Starting symbol (S)		2	
	Length (L)		12	
	PDSCH aggregation factor		1	
PDSCH	PRB bundling type		Static	
configuration	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		N/A	
	size		IN/A	
	DMRS Type		Type 1	
PDSCH DMRS	Number of additional DMRS		2	
configuration	Maximum number of OFDM symbols for		1	
	DL front loaded DMRS		·	
	CSI-RS periodicity	Slots	20 for CSI-RS resource 1,2,3,4.	
CSI-RS for tracking	CSI-RS offset	Slots	1 for CSI-RS resource 1 and 2	
3			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-			Specific to each TDD UL-DL pattern	
ACK information		l	and as defined in Annex A.1.2	

Table 5.2.3.2.9-3: Minimum performance for Rank 2

		Bandwidth (MHz) /	Modulation TDD		TDD		D	Correlation	Reference	value
Test num.	Reference channel	Subcarrier spacing (kHz)	format and code rate	UL-DL pattern	Propagation condition		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]		

5.2.3.2.10 Minimum requirements for HST DPS

The performance requirements are specified in Table 5.2.3.2.10-3, with the addition of test parameters in Table 5.2.3.2.10-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.10-1.

Table 5.2.3.2.10-1: Tests purpose

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

Table 5.2.3.2.10-2: Test parameters

	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
	Length (L)			Specific to each Reference channel
	PDSCH aggregation	on factor		1
DDCCH configuration	PRB bundling type	•		Static
PDSCH configuration	PRB bundling size			2
	Resource allocation	n type		Type 0
	RBG size			Config2
	VRB-to-PRB mapp			Non-interleaved
		ping interleaver bundle size		N/A
	TCI state			Note 1
	DMRS Type			Type 1
PDSCH DMRS	Number of addition			2
configuration	Maximum number front loaded DMRS	of OFDM symbols for DL		1
	HOIR IDAGED DIVING	First OFDM symbol in the		I0 = 5 for CSI-RS resource 1 and 3
		PRB used for CSI-RS		I0 = 9 for CSI-RS resource 2 and 4
		CSI-RS periodicity	Slots	20 for CSI-RS resource 1,2,3,4
	Resource set #1	CSI-RS offset	Slots	1 for CSI-RS resource 1 and 2
	Resource set #1	CSI-RS dilset	Siois	2 for CSI-RS resource 3 and 4
		QCL info		TCI state #2
		Frequency Occupation		Start PRB 0
CSI-RS for tracking		. , , , ,		Number of PRB = 52
CSI-NS for tracking		First OFDM symbol in the		$I_0 = 6$ for CSI-RS resource 5 and 6
		PRB used for CSI-RS		$l_0 = 10$ for CSI-RS resource 7 and 8
		CSI-RS periodicity	Slots	20 for CSI-RS resource 5,6,7,8.
	Resource set #2	CSI-RS offset	Slots	1 for CSI-RS resource 5 and 6
			51013	2 for CSI-RS resource 7 and 8
		QCL info		TCI state #3
		Frequency Occupation		Start PRB 0
		. , , ,		Number of PRB = 52
		First OFDM symbol in the		10 = 12
		PRB used for CSI-RS		-
	Resource set #3	CSI-RS periodicity	Slots	40
NITE 001 E0 (001		CSI-RS offset	Slots	0
NZP CSI-RS for CSI		QCL info		TCI state #0
acquisition		First OFDM symbol in the PRB used for CSI-RS		10 = 13
	Resource set #4		Slots	40
	Resource set #4	CSI-RS periodicity CSI-RS offset	Slots	0
		QCL info	31013	TCI state #1
		QUE IIIIU		CSI-RS resource 1 from 'CSI-RS
	Type 1 QCL	CSI-RS resource		for tracking Resource set #1'
	information			configuration
TCI state #0		QCL Type		Type A
	Type 2 QCL	CSI-RS resource		N/A
	information	QCL Type		N/A
				CSI-RS resource 5 from 'CSI-RS
	Type 1 QCL	CSI-RS resource		for tracking Resource set #2'
TCI atata #4	information			configuration
TCI state #1		QCL Type		Type A
	Type 2 QCL	CSI-RS resource		N/A
	information	QCL Type		N/A
	Type 1 QCL	SSB index		SSB #0
TCI state #2	information	QCL Type		Туре С
TOT State #Z	Type 2 QCL	SSB index		N/A
	information	QCL Type		N/A
	Type 1 QCL	SSB index		SSB #1
TCI state #3	information	QCL Type		Type C
101 31410 #0	Type 2 QCL	SSB index		N/A
	information	QCL Type		N/A

Number of HARQ Processes	8
The number of slots between PDSCH and corresponding HARQ-ACK	Specific to each TDD UL-DL pattern
information	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 k^{th} RRH.

For Test 1-1, TCl state switching command scheduled by MAC CE with MCS 4 is transmitted in slot #i that satisfy mod(i, 2n) = n. PDCCH and PDSCH associated with TCl # (k mod 2) is transmitted by k^{th} RRH from slot#

 $\max[(2k-1)n + 1 + T_{HARQ} + T_{MAC proc} + T_{firstTRS} + T_{TRS proc}, 0]$

to slot#

$$(2k + 1)n + T_{HARQ} + T_{MAC proc}$$

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 mod(i, 2n) = n. PDCCH and PDSCH associated with TCI # (k mod 2) is transmitted by k^{th} RRH from slot#

$$\max[(2k-1)n + 1 + T_{HARO} + T_{MAC, proc}, 0]$$

to slot#

$$(2k + 1)n + T_{HARQ} + T_{MAC proc}$$

Where k=0, 1, 2... is the RRH number, n = 5040 is half of the number of slots between two RRH, T_{HARQ} = 8 is the number of slots between PDSCH and corresponding HARQ-ACK information, $T_{MAC\;proc}$ = 6 is the number of slots for MAC CE processing, $T_{firstTRS}$ = 7 is the number of slots to first TRS transmission occasion after MAC CE command is decoded by the UE, $T_{TRS\;proc}$ = 4 is the number of slots for TRS processing.

Table 5.2.3.2.10-3: Minimum performance for HST DPS

	Bandy				Number of	Correlation	Reference value	
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	Propagation condition	active PDSCH TCI states	matrix and antenna configuration	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]

5.2.3.2.11 Minimum requirements for PDSCH Single-DCI based SDM scheme

The performance requirements are specified in Table 5.2.3.2.11-3, with the addition of test parameters in Table 5.2.3.2.11-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.11-1.

Table 5.2.3.2.11-1: Tests purpose

Purpose	Test index
Verify the PDSCH performance with Single-DCI based	1-1,1-2
SDM scheme under 4 receive antenna conditions.	

Table 5.2.3.2.11-2: Test parameters

	Doromo	to:	I Init	Va	lue	
	Parame	ter	Unit	TRxP #1(Note 1)	TRxP #2(Note 1)	
Transmit TRxP of SS				TRx		
PDCCH configuration	_	CI state			ate #1	
	U	ORESETPoolIndex irst subcarrier index in the		k0=0 for CSI-RS) 	
		RB used for CSI-RS		resources 1,2,3,4	k0=1 for CSI-RS resources 5,6,7,8	
	-	KB used for CSI-KS		10 = 6 for CSI-RS	10 = 6 for CSI-RS	
				resources 1 and 3	resources 5 and 7	
		irst OFDM symbol in the PRB		10 = 10 for CSI-	10 = 10 for CSI-	
		sed for CSI-RS		RS resources 2	RS resources 6	
				and 4	and 8	
	N	umber of CSI-RS ports (X)		1 for CSI-RS	1 for CSI-RS	
CSI-RS for tracking	_ IN	uniber of CSI-KS ports (X)		resource 1,2,3,4		
CSI-IXS for tracking	C	DM Type			SI-RS resource	
					,5,6,7,8	
		ensity	01.1		3	
	<u> </u>	SI-RS periodicity	Slots		0	
				20 for CSI-RS resources 1 and 2	20 for CSI-RS resources 5 and 6	
	C	SI-RS offset	Slots	21 for CSI-RS	21 for CSI-RS	
					resources 7 and 8	
	C	CL info			ate #0	
Duplex mode					DD	
Active DL BWP index	K				1	
	Mapping type	9		Тур	e A	
	k0			0		
	Starting symb	ool (S)		2		
	Length (L)			12		
PDSCH	PRB bundling				atic	
configuration	PRB bundling				2	
	Resource allo	ocation type			<u>e 1</u>	
	RBG size	manning tune		Config2 Non-interleaved		
		mapping type mapping interleaver bundle		Non-interieaved		
	size	mapping interleaver buridle		N	/A	
	Antenna port	oort indexes		1000	1002	
	TCI state			TCI State #1	TCI State #2	
PDSCH DMRS	DMRS Type			Тур		
configuration		dditional DMRS		•	1	
	Maximum nu	mber of OFDM symbols for			1	
	DL front load	ed DMRS			<u>'</u>	
				CSI-RS resource		
	Type 1 QCL	CSI-RS resource		1 from 'CSI-RS for tracking'	N/A	
TCI State #1	information			configuration		
101 State #1		QCL Type		Type A	N/A	
	Type 2 QCL	CSI-RS resource		N/A	N/A	
	information	QCL Type		N/A	N/A	
					CSI-RS resource	
	Type 1 QCL	CSI-RS resource		N/A	5 from 'CSI-RS	
	information	COI NO leaduide		13//3	for tracking'	
TCI State #2		001.7	-	N1/A	configuration	
	Turno 0.001	QCL Type	1	N/A	Type A	
	Type 2 QCL information	CSI-RS resource QCL Type	-	N/A N/A	N/A N/A	
Resource allocation			-		rlappling	
				-0.25 for	r test 1-1	
Timing offset of the second TRxP from the first TRxP			us		est 1-2	
Frague and all all all all all all all all all al	ho 00-5-1-TD	D from the first TDvD	Hz		test 1-1	
	Frequency offset of the second TRxP from the first TRxP				est 1-2	
Number of HARQ Pro					3	
	between PDSC	H and corresponding HARQ-			DD UL-DL pattern	
ACK information				and as defined	in Annex A.1.2	

Precodin	g 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 PDS layer 1 is transmitted from TRxP #2)			

Table 5.2.3.2.11-3: Minimum performance

		Bandwidt				Correlation	Reference value	
Test num	Reference channel	h (MHz) / Subcarri er spacing (kHz)	Modulatio n format and code rate	TDD UL-DL patter n	Propagation condition(No te 1)	matrix and antenna configuration(N ote 2)	Fraction of maximum throughp ut (%)	SNR (dB)(Not e 3)
1-1	R.PDSCH. 2-3.2 TDD	40 / 30	64QAM, 0.50	FR1.3 0-1	TDLA30-10	2x4, ULA Low	70	[13.3]
1-2	R.PDSCH. 2-3.2 TDD	40 / 30	64QAM, 0.50	FR1.3 0-1	TDLA30-10	2x4, ULA Low	70	[12.9]
Note 1	1: The propa	agation condi	tions apply to	each of T	RxP #1 and TRx	P #2 and are statistic	ally independ	ent

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 Minimum requirements for PDSCH Multi-DCI based transmission scheme

The performance requirements are specified in Table 5.2.3.2.12-3, with the addition of test parameters in Table 5.2.3.2.12-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.12-1.

Table 5.2.3.2.12-1: Tests purpose

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

Table 5.2.3.2.12-2: Test parameters

Parameter					Va	lue	
Parameter Transmit TRxP of SSB					TRxP #1(Note 1)	TRxP #2(Note 1)	
Transmit TRxP of SS				TRx			
PDCCH configuration	n	TCI state			TCI State #1	TCI State #2	
- 2 con connigations	-		TPoolIndex		0.		
			arrier index in the I for CSI-RS		k0=0 for CSI-RS	k0=1 for CSI-RS resources 5,6,7,8	
		FIVE 0360	1101 031-103		resources 1,2,3,4 10 = 6 for CSI-RS	10 = 6 for CSI-RS	
					resources 1 and 3	resources 5 and 7	
			M symbol in the PRB		10 = 10 for CSI-	10 = 10 for CSI-	
		used for C	SI-RS		RS resources 2	RS resources 6	
					and 4	and 8	
		Number o	f CSI-RS ports (X)		1 for CSI-RS	1 for CSI-RS	
CSI-RS for tracking		Number o	T COI-ING POITS (X)		resource 1,2,3,4	resource 5,6,7,8	
Correction tracking		CDM Type	е		'No CDM' for C		
					1,2,3,4		
		Density CSI-RS po	ariodicity	Slots	3		
		COI-IXO PI	enodicity	31013	20 for CSI-RS	20 for CSI-RS	
					resources 1 and 2	resources 5 and 6	
		CSI-RS of	ffset	Slots	21 for CSI-RS	21 for CSI-RS	
					resources 3 and 4		
		QCL info			TCI st		
Duplex mode					TC)D	
Active DL BWP index					1		
	Mapping t	уре				e A	
	k0				0		
	Starting sy				2		
	Length (L)				12 Static		
PDSCH	PRB bundling type						
configuration		PRB bundling size Resource allocation type			7		
	RBG size	allocation ty	ype		Тур		
		VRB-to-PRB mapping type			Con Non-inte		
		/RB-to-PRB mapping interleaver bundle					
	size		to mapping intendates business		N/	/A	
		port indexes			{1000,1001}	{1002,1003}	
	TCI state				TCI State #1	TCI State #2	
PDSCH DMRS	DMRS Ty				Тур	e 1	
configuration		f additional			1		
			OFDM symbols for				
	DL front lo	DL front loaded DMRS			001.00		
					CSI-RS resource 1 from 'CSI-RS		
	Type 1 QC		CSI-RS resource		for tracking'	N/A	
TCI State #1	information	n			configuration		
101 State #1			QCL Type		Type A	N/A	
	Type 2 QC	CL	CSI-RS resource		N/A	N/A	
	information		QCL Type		N/A	N/A	
						CSI-RS resource	
	Type 1 QC	2.1	CSI-RS resource		N/A	5 from 'CSI-RS	
	information		JOI NO TOUGHTOE		13//3	for tracking'	
TCI State #2	i iii oii ii da					configuration	
	Tura 0.00	N .	QCL Type		N/A	Type A	
	Type 2 QC information		CSI-RS resource QCL Type		N/A N/A	N/A N/A	
Resource allocation	ווויייוומנוטו	11	WOL TYPE		·		
Timing offset of the s	econd TRxF	from the fi	rst TRxP	us	Non-overlapping -0.25		
Frequency offset of the second TRxP from the first TRxP				Hz	30		
Number of HARQ Processes					8		
The number of slots between PDSCH and corresponding HARQ-					Specific to each T	DD UL-DL pattern	
ACK information					and as defined	in Annex A.1.2	
						endent precoding	
Precoding configurat	ion				generation is appli		
. 1000anig ooningalat					random per slot w	_	
				granı	ılarity		

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 5.2.3.2.12-3: Minimum performance

Test num.	Reference channel		Bandwid th (MHz) / Subcarri er and code rate	TDD UL-DL pattern	Propaga tion conditio n(Note	Correlation matrix and antenna configurati	Reference Fraction of maximu m	SNR (dB)(N	
			spacing (kHz)	rate		1)	on(Note 2)	through put (%)	ote 3)
	TRxP #1	TRxP #2							
1-1	R.PDSC H.2-3.3 TDD	R.PDSC H.2-3.4 TDD	40 / 30	64QAM, 0.50	FR1.30 -1	TDLA30- 10	2x4, ULA Low	70	[14.5]
Note 1: Note 2:	Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent								

SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2

5.2.3.2.13 Minimum requirements for PDSCH with single-DCI based FDM Scheme A

The performance requirements are specified in Table 5.2.3.2.13-3, with the addition of test parameters in Table 5.2.3.2.13-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.13-1.

Table 5.2.3.2.13-1: Tests purpose

Purpose	Test index
Verify PDSCH performance under 4 receive antenna	1-1
conditions when UE is configured with "FDMSchemeA" in	
"RepetitionScheme-r16" defined in clause 5.1 of TS 38.214	
[12]	

Table 5.2.3.1.13-2: Test parameters

Transmit TRxP of SSB PDCCH configuration	First su PRB us First Of used fo	EETPoolIndex bcarrier index in the ed for CSI-RS FDM symbol in the PRB r CSI-RS		TRxP #1 (Note 1) TRx TCI St Not cor k0=0 for CSI-RS resources 1,2,3,4 l0 = 6 for CSI-RS resources 1 and 3	P #1 ate #1 ifigured k0=1 for CSI-RS resources 5,6,7,8	
PDCCH configuration	First Of used fo	ETPoolIndex bcarrier index in the ed for CSI-RS FDM symbol in the PRB		TCI St Not cor k0=0 for CSI-RS resources 1,2,3,4 I0 = 6 for CSI-RS	ate #1 figured k0=1 for CSI-RS resources 5,6,7,8	
	First Of used fo	ETPoolIndex bcarrier index in the ed for CSI-RS FDM symbol in the PRB		Not cor k0=0 for CSI-RS resources 1,2,3,4 I0 = 6 for CSI-RS	figured k0=1 for CSI-RS resources 5,6,7,8	
	First su PRB us First Of used fo	bcarrier index in the ed for CSI-RS FDM symbol in the PRB		k0=0 for CSI-RS resources 1,2,3,4 I0 = 6 for CSI-RS	k0=1 for CSI-RS resources 5,6,7,8	
	PRB us First Of used fo	ed for CSI-RS FDM symbol in the PRB		resources 1,2,3,4 I0 = 6 for CSI-RS	resources 5,6,7,8	
	First OF used fo	FDM symbol in the PRB		I0 = 6 for CSI-RS		
	used fo				10 = 6 for CSI-RS	
	used fo			i igoualded i dilu 3	resources 5 and 7	
		i CSI-RS		10 = 10 for CSI-	10 = 10 for CSI-	
	Numbe			RS resources 2	RS resources 6	
	Numbe			and 4	and 8	
		r of CSI-RS ports (X)		1 for CSI-RS	1 for CSI-RS	
CSI-RS for tracking		1 (/		resource 1,2,3,4	resource 5,6,7,8 SI-RS resource	
	CDM T	/pe		1,2,3,4		
	Density			1,2,0,4		
		periodicity	Slots	4		
		,		20 for CSI-RS	20 for CSI-RS	
	CSI-RS	offoot	Slots	resources 1 and 2	resources 5 and 6	
	Col-No	Oliset	31015	21 for CSI-RS	21 for CSI-RS	
					resources 7 and 8	
D l	QCL inf	0		TCI st		
Duplex mode Active DL BWP index				IL.	DD I	
	Mapping type			· ·	e A	
	(0			(
<u> </u>	Starting symbol (S)			2		
	Length (L)			12		
PDSCH	PRB bundling type			Sta	atic	
configuration	PRB bundling size			wide		
<u> </u>	Resource allocation type				e 0	
	RBG size				fig2	
	VRB-to-PRB mapp			Non-inte	erleaved	
	v RB-to-PRB mapp size	ing interleaver bundle		N/A		
	Antenna port index	ort indexes		1000, 1001	1000, 1001	
	TCI state			TCI State #1	TCI State #2	
	DMRS Type			Тур	e 1	
	Number of addition			1		
		of OFDM symbols for		1	1	
L	DL front loaded DM	IRS		001 00		
				CSI-RS resource 1 from 'CSI-RS		
	Type 1 QCL	CSI-RS resource		for tracking'	N/A	
TCI State #1	nformation			configuration		
		QCL Type		Type A	N/A	
	Type 2 QCL	CSI-RS resource		N/A	N/A	
ļ i	nformation	QCL Type		N/A	N/A	
					CSI-RS resource	
7	Type 1 QCL	CSI-RS resource		N/A	5 from 'CSI-RS for tracking'	
	nformation				configuration	
1 Of Oldie #2		QCL Type		N/A	Type A	
	Type 2 QCL	CSI-RS resource		N/A	N/A	
i	nformation	QCL Type		N/A	N/A	
Timing offset of the second TRxP from the first TRxP			us Hz		25	
	Frequency offset of the second TRxP from the first TRxP			30		
Number of HARQ Processes The number of elete between RDSCH and corresponding HARQ.				0 : :: - t b T		
The number of slots between PDSCH and corresponding HARQ-					DD UL-DL pattern	
ACK information					in Annex A.1.2 endent precoding	
.				generation is appli		
Precoding configuration	1			random per slot v		
				granu		
Note 1: PDSCH trans	<u>smission is done fr</u>	om both TRxPs				

Table 5.2.3.2.13-3: Minimum performance for Rank 2

		Bandwidth	Mandadatian		Dti	Correlation	Reference value		
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL-DL pattern	Propagation condition (Note 1)	matrix and antenna configuration (Note 2)	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	Note 1: The propagation conditions apply to each of TRxP #1 and TRxP #2 and are statistically independent.								
Note 2	Note 2: Correlation matrix and antenna configuration parameters apply to each of TRxP #1 and TRxP #2.								
Note 3	: SNR corresp	onds to SNR o	of TRxP #1 and	TRxP #2 a	as defined in 4.4	.2			

5.2.3.2.14 Minimum requirements for PDSCH with single-DCI based Inter-slot TDM scheme

The performance requirements are specified in Table 5.2.3.2.14-3, with the addition of test parameters in Table 5.2.3.2.14-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2.3.2.14-1.

Table 5.2.3.2.14-1: 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 5.2.3.2.14-2: Test parameters

Parameter				Unit	Va	lue
					TRxP #1 (Note 1)	TRxP #2 (Note 1)
Transmit TRxP of SS					TRx	
PDCCH configuratio		TCI state				ate #1
	,		TPoolIndex			nfigured
			arrier index in the		k0=0 for CSI-RS	k0=1 for CSI-RS
	<u> -</u>	PRB used	for CSI-RS		resources 1,2,3,4 I0 = 6 for CSI-RS	resources 5,6,7,8 10 = 6 for CSI-RS
					resources 1 and 3	resources 5 and 7
			M symbol in the PRB		10 = 10 for CSI-	10 = 10 for CSI-
		used for C	SI-RS		RS resources 2	RS resources 6
					and 4	and 8
	Γ,	Numbara	f CSI-RS ports (X)		1 for CSI-RS	1 for CSI-RS
CSI-RS for tracking	L'	Number o	i CSI-RS ports (A)		resource 1,2,3,4	
CSI-RS for tracking	، ا	CDM Type	2			SI-RS resource
						,5,6,7,8
		Density				3
	<u> </u>	CSI-RS pe	eriodicity	Slots	-	0
					20 for CSI-RS	20 for CSI-RS
		CSI-RS of	fset	Slots	resources 1 and 2	resources 5 and 6 21 for CSI-RS
					21 for CSI-RS	resources 7 and 8
	 	QCL info				ate #0
Duplex mode	1	QOL IIIIO				DD
Active DL BWP inde	x					1
7 totivo BE BYTT III do	Mapping typ	oe .			Tvn	e A
	k0	-)
	Starting symbol (S)				2	2
	Length (L)				12	
	Repetition number				2	
PDSCH	PRB bundlir	PRB bundling type			Static	
configuration	PRB bundlir	PRB bundling size				2
		Resource allocation type				oe 0
	RBG size					nfig2
		o-PRB mapping type			Non-interleaved	
		RB mapping interleaver bundle			N/A	
	size					
	Antenna poi TCI state				1000	1000 TCI State #2
PDSCH DMRS	DMRS Type				TCI State #1 TCI State #2 Type 1	
configuration	Number of a		DMRS			1
Comigaration			OFDM symbols for			
	DL front load				·	1
			-		CSI-RS resource	
	T 4 OCL		CCI DC *****		1 from 'CSI-RS	N1/A
	Type 1 QCL information	-	CSI-RS resource		for tracking'	N/A
TCI State #1	IIIIOIIIIatioii				configuration	
			QCL Type		Type A	N/A
	Type 2 QCL	-	CSI-RS resource		N/A	N/A
	information		QCL Type		N/A	N/A
						CSI-RS resource
	Type 1 QCL	_	CSI-RS resource		N/A	5 from 'CSI-RS
TCI Ctoto #2	information					for tracking' configuration
TCI State #2			QCL Type		N/A	Type A
	Type 2 QCL		CSI-RS resource		N/A N/A	N/A
	information	_	QCL Type		N/A	N/A
Timing offset of the s	Timing offset of the second TRxP from the first TRxP			us	1	
Frequency offset of the second TRxP from the first TRxP			Hz	30	00	
Number of HARQ Processes					4	
		CH and co	orresponding HARQ-		Specific to each T	DD UL-DL pattern
ACK information			-		and as defined in A	nnex A.1.2 (Note 2)
	<u> </u>					endent precoding
Precoding configurat	tion					ed for both TRxPs,
					Table	vith PRB bundling
				j	ı granı	ılarity.

Note 4:

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 5.2.3.2.13-3: Minimum performance for Rank 1

		Bandwidth		TDD	Dranagation	Correlation	Reference	value
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL- DL pattern	Propagation condition (Note 1)	matrix and antenna configuration (Note 2)	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)	[-1.5]
Note 2	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.							

5.2A PDSCH demodulation requirements for CA

SNR corresponds to SNR of TRxP #1 and TRxP #2 as defined in 4.4.2

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 inde	ex		1
	Mapping type		Type A
	k0		0
	Starting symbol (S)		2
	Length (L)		FDD: 12TDD: Specific to each Reference channel
PDSCH	PDSCH aggregation factor		1
	PRB bundling type		Static
configuration	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	Number of additional DMRS		1
configuration	Maximum number of OFDM symbols for DL front loaded DMRS		1
Number of HARQ P	rocesses		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

Table 5.2A-2: Test parameters for number of HARQ processes

HARQ proces	ss number	CCs with the same duplex mode & SCS with Pcell	CCs with different duplex mode / SCS with Pcell
FDD 15 kHz +	FDD PCell	4	8
TDD 30 kHz CA	TDD PCell	8	8
FDD 15 kHz +	FDD PCell	4	4
TDD 15 kHz CA	TDD PCell	8	8
TDD 15 kHz +	15kHz PCell	8	12
TDD 30 kHz CA	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 +	FDD PCell	{2}	{2}
TDD 30 kHz CA	TDD PCell	{8,7,6,5,5,4,3,2}	{7,5,4,11,9}
FDD 15 kHz +	FDD PCell	{2}	{2}
TDD 15 kHz CA	TDD PCell	{4,3,2,6}	{4,3,2,6,5}
TDD 15 kHz +	15kHz PCell	{4,3,2,6}	{4,4,3,3,2,2,6,6}
TDD 30 kHz CA	30kHz PCell	{8,7,6,5,5,4,3,2}	{7,5,4,11}
FDD 15 kHz +	FDD PCell	(2)	N/A
FDD 15 kHz CA	FDD FCell	{2}	IN/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 Minimum requirements

For CA with different numbers of DL component carriers, the requirements are defined in Table 5.2A.2.1-4 based on the single carrier requirements for different SCSs and different bandwidth specified in Table 5.2A.2.1-1 ~ Table 5.2A.2.1-3, with the parameters in Table 5.2A-1 ~ Table 5.2A-3 and the downlink physical channel setup according to Annex C.3.1. The performance requirements specified in this sub-cluase do not apply for UE single carrier test.

Table 5.2A.2.1-1: Single carrier performance for FDD 15 kHz SCS for CA configurations

D. 1.181	D. (Modulation	Correlation	Reference value		
Bandwidth (MHz)	Reference channel	format and code rate	Propagation condition	matrix and antenna configuration	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.2.1-2 Single carrier performance for TDD 15 kHz SCS for CA configurations

5	D. C	Modulation	D	Correlation	Reference va	lue
Bandwidth (MHz)	Reference channel	format and code rate	Propagation condition	matrix and antenna configuration	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.2.1-3 Single carrier performance for TDD 30 kHz SCS for CA configurations

D. 1.181	D. C.	Modulation	D	Correlation	Reference value	
Bandwidth (MHz)	Reference channel	format and code rate	Propagation condition	matrix and antenna configuration	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.2.1-4: 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.2.1-1			
2	TDD 30 kHz + TDD 30 kHz	As defined in Table 5.2A.2.1-3			
3	FDD 15 kHz + TDD 30 kHz	As defined in Table 5.2A.2.1-1 and Table 5.2A.2.1-3 per CC			
4	FDD 15 kHz + TDD 15 kHz	As defined in Table 5.2A.2.1-1 and Table 5.2A.2.1-2 per CC			
5	TDD 15 kHz + TDD 30 kHz	As defined in Table 5.2A.2.1-2 and Table 5.2A.2.1-3 per CC			
Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth					
cor	combination sets is defined in 5.1.1.5.				

5.2A.2.2 Minimum requirements for carrier aggregation with power imbalance

The performance requirements are specified in Table 5.2A.2.2-3 and Table 5.2A.2.2-4, with the addition of test parameters in Table 5.2A.2.2-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2A.2.2-1.

Table 5.2A.2.2-1: 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.2.2-2: Test parameters

	Parameter	Unit	Value
Duplex mode			FDD and TDD
Active DL BWP index			1
Propagation condition	n		Static propagation condition No external noise sources are applied
Antenna configuration	n		1x2
PDSCH	Length (L)		FDD: 12TDD: 12 for DL slot, 4 for special slot
configuration	PRB bundling size		WB
Modulation and code	rate		64QAM, MCS 26
Number of HARQ Pro	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 I ACK information	petween PDSCH and corresponding HARQ-		As defined in Table A.1.2-2 for FR1.30-
PUCCH format for H	ARQ-ACK feedback		PUCCH format 1
Overhead for TBS de	etermination		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 [6]

Table 5.2A.2.2-3: 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	\hat{E}_{s_PCell} for PCell	\hat{E}_{s_SCell} for Scell	PCell	SCell
1	bandwid	Channel Ith as per 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.2.2-4: Minimum performance for TDD CA with 30 kHz SCS

Test Number	Bandwidth (MHz)		Reference	e channel	Power at antenna port (dBm/Hz)		Reference value Fraction of Maximu Throughput (%)	
	PCell	SCell	PCell	SCell	\hat{E}_{s_PCell} for PCell	\hat{E}_{s_SCell} for Scell	PCell	SCell
1	bandwid	Channel Ith as per 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 4RX requirements

5.2A.3.1 Minimum requirements

For CA with different numbers of DL component carriers, the requirements are defined in Table 5.2A.3.1-4 based on the single carrier requirements for different SCSs and different bandwidth specified in Table 5.2A.3.1-1 ~ Table 5.2A.3.1-3, with the parameters in Table 5.2A-1 ~ Table 5.2A-3 and the downlink physical channel setup according to Annex C.3.1. The performance requirements specified in this sub-cluase do not apply for UE single carrier test.

Table 5.2A.3.1-1: Single carrier performance for FDD 15 kHz SCS for CA configurations

D I W	D. (Modulation	D	Correlation	Reference value		
Bandwidth (MHz)	Reference channel	format and code rate	Propagation condition	matrix and antenna configuration	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.3.1-2: Single carrier performance for TDD 15 kHz SCS for CA configurations

D. 1.14	D. (Modulation		Correlation	Reference value		
Bandwidth (MHz)	Reference channel	format and code rate	Propagation condition	matrix and antenna configuration	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.3.1-3: Single carrier performance for TDD 30 kHz SCS for CA configurations

D. L.W.	Beforence Modulation		D	Correlation	Reference val	lue
Bandwidth (MHz)	Reference channel	format and code rate	Propagation condition	matrix and antenna configuration	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.3.1-4: Minimum performance for multiple CA configurations

Test numbe	r CA duplex mode	Minimum performance requirements					
1 FDD 15 kHz + FDD 15 kHz		As defined in Table 5.2A.3.1-1					
2	TDD 30 kHz + TDD 30 kHz	As defined in Table 5.2A.3.1-3					
3	FDD 15 kHz + TDD 30 kHz	As defined in Table 5.2A.3.1-1 and Table 5.2A.3.1-3 per CC					
4	FDD 15 kHz + TDD 15 kHz	As defined in Table 5.2A.3.1-1 and Table 5.2A.3.1-2 per CC					
5	TDD 15 kHz + TDD 30 kHz	As defined in Table 5.2A.3.1-2 and Table 5.2A.3.1-3 per CC					
Note 1: The	Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth						
cor	combination sets is defined in 5.1.1.5.						

5.2A.3.2 Minimum requirements for carrier aggregation with power imbalance

The performance requirements are specified in Table 5.2A.3.2-3 and Table 5.2A.3.2-4, with the addition of test parameters in Table 5.2A.3.2-2 and the downlink physical channel setup according to Annex C.3.1.

The test purposes are specified in Table 5.2A.3.2-1.

Table 5.2A.3.2-1: 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.3.2-2: Test parameters

Parameter			Value
Duplex mode			FDD and TDD
Active DL BWP index			1
Propagation condition	Propagation condition		Static propagation condition No external noise sources are applied
Antenna configuration	n		1x4
PDSCH	Length (L)		FDD: 12TDD: 12 for DL slot, 4 for special slot
configuration	PRB bundling size		WB
Modulation and code	rate		64QAM, MCS 27
Number of HARQ Pro	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 I ACK information	between PDSCH and corresponding HARQ-		As defined in Table A.1.2-2 for FR1.30-
PUCCH format for H	ARQ-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 [6]

Table 5.2A.3.2-3: 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	\hat{E}_{s_PCell} for PCell	\hat{E}_{s_SCell} for Scell	PCell	SCell
1	bandwid	Channel Ith as per 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.3.2-4: Minimum performance for TDD CA with 30 kHz SCS

Test Number	Bandwidth (MHz)		Reference	channel		antenna Bm/Hz)	Fraction o	ce value f Maximum hput (%)
	PCell	SCell	PCell	SCell	\hat{E}_{s_PCell}	\hat{E}_{s_SCell}	PCell	SCell
					for PCell	for 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

5.3 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

	Paramete	er	Unit	Value
Carrier		een Point A and the		0
configuration	lowest usab	le subcarrier on this		
	carrier (Note	e 1)		
DL BWP	Cyclic prefix			Normal
configuration #1	RB offset		RBs	0
Common	Physical Ce			0
serving cell	SSB position			1
parameters	SSB periodi		ms	20
		CCH monitoring PDCCH candidates		Each slot
PDCCH	Number of F	DCCH candidates		Start from RB = 0
configuration		domain resource		with contiguous RB
oomigaration	allocation fo	r CORESET		allocation
	TCI state			TCI state #1
		rier index in the PRB		
	used for CS	I-RS (<i>k</i> ₀)		0
				CSI-RS resource 1:
				4
	Circt OCDM	average at in the DDD		CSI-RS resource 2:
	used for CS	symbol in the PRB		8 CSI-RS resource 3:
	used for CS	1-13 (10)		4
				CSI-RS resource 4:
				8
	Number of 0	CSI-RS ports (X)		1
	CDM Type			No CDM
	Density (ρ)			3
CCL DC for	CSI-RS peri	odicity	Slots	15 kHz SCS: 20
CSI-RS for			0.010	30 kHz SCS: 40
tracking				15 kHz SCS: 10 for CSI-RS
				resource 1 and 2
				11 for CSI-RS
				resource 3 and 4
	CSI-RS offs	et	Slots	
				30 kHz SCS:
				20 for CSI-RS
				resource 1 and 2
				21 for CSI-RS resource 3 and 4
				Start PRB 0
	Frequency (Occupation		Number of PRB =
	1,111,11	· · · · · · · · · · · · · · · · ·		BWP size
	QCL info			TCI state #0
	Type 1	SSB index		SSB #0
	QCL	QCL Type		Type C
TCI state #0	information			
	Type 2 QCL	SSB index		SSB #0
	information	QCL Type		Type D
				CSI-RS resource 1
	Type 1	CSI-RS resource		from 'CSI-RS for
	QCL	OOI NO TOSOUTOC		tracking'
	information	OOL Torre		configuration
TCI state #1		QCL Type		Type A
	Type 2			CSI-RS resource 1 from 'CSI-RS for
	QCL	CSI-RS resource		tracking'
	information			configuration
		QCL Type		Type D

PDCCH & PDCCH DMRS Precoding configuration	Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i ₁ , i ₂ combination with REG bundling granularity for number of Tx larger than 1						
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						
Note 1: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-1 [6] for tested channel bandwidth and subcarrier spacing.							

5.3.1 1RX requirements

(Void)

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 1 Tx Antenna performances

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 5.3.2.1.1-1. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.2.1.1-1: Minimum performance for PDCCH with 15 kHz SCS

		CORES			Antenna	Reference value			
Test numbe r	Bandw idth (MHz)	CORE SET RB	ET duratio n	Aggregati on level	Reference Channel	Propagation Condition	configurat ion and correlatio n Matrix	Pm-dsg (%)	SNR (dB)
1	10	24	2	2	R.PDCCH. 1-2.1 FDD	TDLA30-10	1x2 Low	1	8.1
2	10	24	2	2	R.PDCCH. 1-2.3 FDD	TDLC300- 100	1x2 Low	1	8.2
3	10	48	2	4	R.PDCCH. 1-2.4 FDD	TDLA30-10	1x2 Low	1	5.5
4	10	48	1	4	R.PDCCH. 1-1.1 FDD	TDLA30-10	1x2 Low	1	4.4
5	10	48	2	16	R.PDCCH. 1-2.6 FDD	TDLA30-10	1x2 Low	1	-2.1

5.3.2.1.2 2 Tx Antenna performances

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 5.3.2.1.2-1. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.2.1.2-1: Minimum performance for PDCCH with 15 kHz SCS

			CORES				Antenna	Reference value	
Test numbe r	Bandw idth (MHz)	CORE SET RB	ET duratio n	Aggregati on level	Reference Channel	Propagation Condition	configurat ion and correlatio n Matrix	Pm-dsg (%)	SNR (dB)
1	10	24	2	4	R.PDCCH.	TDLC300-	2x2 Low	1	2.0
					1-2.2 FDD	100			
2	10	48	2	8	R.PDCCH.	TDLC300-	2x2 Low	1	-1.3
					1-2.5 FDD	100			
3	10	48	1	8	R.PDCCH.	TDLA30-10	2x2 Low	1	-0.2
					1-1.3 FDD				

5.3.2.1.3 Minimum requirements for power saving

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 5.3.2.1.3-1 are valid for FDD test unless otherwise stated.

Table 5.3.2.1.3-1: 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
	PS-offset		$(T_{minimumTimeGap} + 1)/2^{\mu}/0.125$
	Number of PDCCH candidates		1
PDCCH DCI format 2_6 configuration	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: T _{minimumTimeGap} is signaled as	a part of drx-Adaptation-r1	16 UE car	pability.

For the parameters specified in Table 5.3.2.1.3-1, the average probability of a missed downlink scheduling grant (Pmdsg) observed on PDCCH during DRX on shall be below the specified value in Table 5.3.2.1.3-2. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.2.1.3-2: Minimum performance for PDCCH with 15 kHz SCS

			CORES			Propagation Condition	Antenna	Reference value	
Test numbe r	Bandw idth (MHz)	CORE SET RB	ET duratio n	Aggregati on level	Reference Channel		configurat ion and correlatio n Matrix	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				

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	6
Shift Index		0	

5.3.2.2.1 1 Tx Antenna performances

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 5.3.2.2.1-1. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.2.2.1-1: Minimum performance for PDCCH with 30 kHz SCS

			CORES				Antenna	Reference value	
Test numbe r	Bandw idth (MHz)	CORE SET RB	ET duratio n	Aggregati on level	Reference Channel	Propagation Condition	configurat ion and correlatio n Matrix	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

5.3.2.2.2 2 Tx Antenna performances

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 5.3.2.2.2-1. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.2.2.2-1: Minimum performance for PDCCH with 30 kHz SCS

			CORES				Antenna	Reference value	
Test numbe r	Bandw idth (MHz)	CORE SET RB	ET duratio n	Aggregati on level	Reference Channel	Propagation Condition	configurat ion and correlatio n Matrix	Pm-dsg (%)	SNR (dB)
1	40	90	1	8	R.PDCCH. 2-1.3 TDD	TDLC300- 100	2x2 Low	1	-1.2

5.3.2.2.3 Minimum requirements for power saving

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 5.3.2.2.3-1 are valid for all TDD tests for power saving unless otherwise stated.

Table 5.3.2.2.3-1: 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
Take up maleader. Bit in Bot format 2_	PS-offset		$(T_{minimumTimeGap}+1)/2^{\mu}/0.125$
	Number of PDCCH candidates		1
PDCCH DCI format 2_6 configuration	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 signaled as	a part of drx-Adaptation-r	16 UE ca	pability.

For the parameters specified in Table 5.3.2.2.3-1, the average probability of a missed downlink scheduling grant (Pmdsg) observed on PDCCH during DRX on shall be below the specified value in Table 5.3.2.2.3-2. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.2.2.3-2: Minimum performance with 30 kHz SCS

		CORES				Antenna	Reference value		
Test numbe r	Bandw idth (MHz)	CORE SET RB	ET duratio n	Aggregati on level	Reference Channel	Propagation Condition	configurat ion and correlatio n Matrix	Pm-dsg (%)	SNR (dB)
4	40	400	4	4	R.PDCCH. 2-1.2 TDD	TDLC300-	4.40.1	4	2.0
'	1 40 102	Į.	1 8		100	1x2 Low		3.0	

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 1 Tx Antenna performances

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 5.3.3.1.1-1. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.3.1.1-1: Minimum performance for PDCCH with 15 kHz SCS

			CORES				Antenna	Reference	value
Test numbe r	Bandw idth (MHz)	CORE SET RB	ET duratio n	Aggregati on level	Reference Channel	Propagation Condition	configurat ion and correlatio n Matrix	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

5.3.3.1.2 2 Tx Antenna performances

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 5.3.3.1.2-1. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.3.1.2-1: Minimum performance for PDCCH with 15 kHz SCS

			CORES				Antenna	Reference value	
Test numbe r	Bandw idth (MHz)	CORE SET RB	ET duratio n	Aggregati on level	Reference Channel	I ' O I ION AND I I		Pm-dsg (%)	SNR (dB)
1	10	24	2	4	R.PDCCH.	TDLC300-	2x4 Low	1	-1.9
					1-2.2 FDD	100			
2	10	48	2	8	R.PDCCH.	TDLC300-	2x4 Low	1	-4.5
					1-2.5 FDD	100			
3	10	48	1	4	R.PDCCH.	TDLA30-10	2x4 Low	1	-1.0
					1-1.2 FDD				

5.3.3.1.3 Minimum requirements for power saving

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 5.3.3.1.3-1 are valid for FDD test unless otherwise stated.

Table 5.3.3.1.3-1: 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
	PS-offset		$(T_{minimumTimeGap} + 1)/2^{\mu}/0.125$
	Number of PDCCH candidates		1
PDCCH DCI format 2_6 configuration	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 signaled as	a part of drx-Adaptation-r1	6 UE ca	pability.

For the parameters specified in Table 5.3.3.1.3-1, the average probability of a missed downlink scheduling grant (Pmdsg) observed on PDCCH during DRX on shall be below the specified value in Table 5.3.3.1.3-2. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.3.1.3-2: Minimum performance for PDCCH with 15 kHz SCS

		CORES				Antenna	Reference value		
Test numbe r	Bandw idth (MHz)	CORE SET RB	ET duratio n	Aggregati on level	Reference Channel	Propagation Condition	configurat ion and correlatio n Matrix	Pm-dsg (%)	SNR (dB)
1	10	48	2	4	R.PDCCH.	TDLA30-10	1x4 Low	1	0.2
					1-2.4 FDD				
			2	8	R.PDCCH.				
					1-2.7 FDD				

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 1 Tx Antenna performances

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 5.3.3.2.1-1. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.3.2.1-1: Minimum performance for PDCCH with 30 kHz SCS

	T		CORES				Antenna	Reference value	
Test numbe r	Bandw idth (MHz)	CORE SET RB	ET duratio n	Aggregati on level	Reference Channel	Propagation Condition	configurat ion and correlatio n Matrix	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

5.3.3.2.2 2 Tx Antenna performances

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 5.3.3.2.2-1. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.3.2.2-1: Minimum performance for PDCCH with 30 kHz SCS

			CORES				Antenna	Reference value	
Test numbe r	Bandw idth (MHz)	CORE SET RB	ET duratio n	Aggregati on level	Reference Channel	Propagation Condition	configurat ion and correlatio n Matrix	Pm-dsg (%)	SNR (dB)
1	40	90	1	8	R.PDCCH.	TDLC300-	2x4 Low	1	-4.3
					2-1.3 TDD	100			

5.3.3.2.3 Minimum requirements for power saving

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 5.3.3.2.3-1, the average probability of a missed downlink scheduling grant (Pmdsg) observed on PDCCH during DRX on shall be below the specified value in Table 5.3.3.2.3-2. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.3.3.2.3-1: 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_		1	
rane up maioanen bit in Borioimat 2_	PS-offset		(T _{minimumTimeGap} +1)/2 ^μ /0.125
	Number of PDCCH candidates		1
PDCCH DCI format 2_6 configuration	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: T _{minimumTimeGap} is signaled as	a part of drx-Adaptation-r1	6 UE cap	pability.

Table 5.3.3.2.3-2: Minimum performance with 30 kHz SCS

			CORES				Antenna	Reference value	
Test numbe r	Bandw idth (MHz)	CORE SET RB	ET duratio n	Aggregati on level	Reference Channel	Propagation Condition	configurat ion and correlatio n Matrix	Pm-dsg (%)	SNR (dB)
1 40 1	102 1	4	4	R.PDCCH. 2-1.2 TDD	TDLC300- 100	1x4 Low	1	0.0	
		1	8	R.PDCCH. 2-1.4 TDD				-0.9	

5.4 PBCH demodulation requirements

The receiver characteristics of PBCH are determined by the probability of miss-detection of the PBCH (Pm-bch), which is defined as

$$Pm - bch = 1 - \frac{A}{B}$$

Where A is the number of correctly decoded MIB PDUs and B is the number of transmitted MIB PDUs. The Pm-bch is derived with the assumption UE combines the PBCH symbols of the same SS/PBCH block index within the MIB TTI (80ms).

5.4.1 1RX requirements

(Void)

5.4.2 2RX requirements

5.4.2.1 FDD

Table 5.4.2.1-1: Test parameters for PBCH

Parameter	Unit	Single antenna port
Physical Cell ID		0
Cyclic prefix		Normal
Number of SS/PBCH blocks within an SS burst set periodicity		1
SS/PBCH block index Note1		0
SS/PBCH block periodicity	ms	20
Note 1: as specified in clause 4.1 of TS 38.213 [11]		

For the parameters specified in Table 5.4.2.1-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified values in Table 5.4.2.1-2 in case SS/PBCH block index is not known and below the specifies values in Table.5.4.2.1-3 in case SS/PBCH block index is known. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.4.2.1-2: Minimum performance PBCH in case SS/PBCH block index is not known

Test number	Bandwidth (MHz) / Subcarrier spacing	Reference channel	Propagation condition	Antenna configuration and correlation matrix	Refer val	
	(kHz)				Pm- bch (%)	SNR (dB)
1	10 / 15	R.PBCH.1	TDLC300-100	1 x 2 Low	1	-6.7

Table 5.4.2.1-3 Minimum performance PBCH in case SS/PBCH block index is known

Test	Bandwidth (MHz) /	Reference	Propagation	Antenna configuration	Referer	nce value
number	Subcarrier spacing (kHz)	channel	condition	and correlation matrix	Pm- bch (%)	SNR (dB)
1	10 / 15	R.PBCH.1	TDLC300-100	1 x 2 Low	1	-8.3

5.4.2.2 TDD

Table 5.4.2.2-1: Test parameters for PBCH

Parameter	Unit	Single antenna port
Physical Cell ID		0
Cyclic prefix		Normal
Number of SS/PBCH blocks within an SS burst set periodicity		1
SS/PBCH block index Note1		0
SS/PBCH block periodicity	ms	20
TDD UL-DL pattern		FR1.30-1
Note 1: as specified in clause 4.1 of TS 38.213 [11]		
Note 2: as specified in clause 11.1 of TS 38.213 [11]		

For the parameters specified in Table 5.4.2.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified values in Table 5.4.2.2-2 in case SS/PBCH block index is not known and below the specified values in Table.5.4.2.2-3 in case SS/PBCH block index is known. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.4.2.2-2: Minimum performance PBCH in case SS/BPCH block index is not known

Test number	Bandwidth (MHz) / Subcarrier spacing	Reference channel	Propagation condition	Antenna configuration and correlation matrix	Reference value	
	(kHz)				Pm- bch (%)	SNR (dB)
1	40 / 30	R.PBCH.2	TDLA30-10	1 x 2 Low	1	-5.3

Table 5.4.2.2-3 Minimum performance PBCH in case SS/BPCH block index is known

Test number	Bandwidth (MHz) / Subcarrier spacing	Reference channel	Propagation condition	Antenna configuration and correlation matrix	Refer val	
	(kHz)				Pm- bch (%)	SNR (dB)
1	40 / 30	R.PBCH.2	TDLA30-10	1 x 2 Low	1	-6.5

5.4.3 4RX requirements

5.4.3.1 FDD

Table 5.4.3.1-1: Test parameters for PBCH

Parameter	Unit	Single antenna port
Physical Cell ID		0
Cyclic prefix		Normal
Number of SS/PBCH blocks within an SS burst set periodicity		1
SS/PBCH block index Note1		0
SS/PBCH block periodicity	ms	20
Note 1: as specified in clause 11.1 of TS 38.213 [11]		

For the parameters specified in Table 5.4.3.1-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified values in Table 5.4.3.1-2 in case SS/PBCH block index is not known and below the specified values in Table.5.4.3.1-3 in case SS/PBCH block index is known. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.4.3.1-2: Minimum performance PBCH in case SS/PBCH block index is not known

Test number	Bandwidth (MHz) / Subcarrier spacing	Reference channel	Propagation condition	Antenna configuration and correlation matrix	Reference value	
	(kHz)				Pm- bch	SNR (dB)
					(%)	
1	10 / 15	R.PBCH.1	TDLC300-100	1 x 4 Low	1	-8.9

Table 5.4.3.1-3 Minimum performance PBCH in case SS/PBCH block index is known

Test number	Bandwidth (MHz) / Subcarrier spacing	Reference channel	Propagation condition	Antenna configuration and correlation matrix	Reference value	
	(kHz)				Pm- bch	SNR (dB)
					(%)	, ,
1	10 / 15	R.PBCH.1	TDLC300-100	1 x 4 Low	1	-10.9

5.4.3.2 TDD

Table 5.4.3.2-1: Test parameters for PBCH

Parameter	Unit	Single antenna port
Physical Cell ID		0
Cyclic prefix		Normal
Number of SS/PBCH blocks within an SS burst set periodicity		1
SS/PBCH block index Note1		0
SS/PBCH block periodicity	ms	20
TDD UL-DL pattern		FR1.30-1
Note 1: as specified in clause 4.1 of TS 38.213 [11]		
Note 2: as specified in clause 11.1 of TS 38.213 [11]		

For the parameters specified in Table 5.4.3.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified values in Table 5.4.3.2-2 in case SS/PBCH block index is not known and below the specified values in Table.5.4.3.2-3 in case SS/PBCH block index is known. The downlink physical setup is in accordance with Annex C.3.1.

Table 5.4.3.2-2: Minimum performance PBCH in case SS/BPCH block index is not known

Test number	Bandwidth (MHz) / Subcarrier spacing	Reference channel	Propagation condition	Antenna configuration and correlation matrix	Reference value	
	(kHz)				Pm- bch (%)	SNR (dB)
1	40 / 30	R.PBCH.2	TDLA30-10	1 x 4 Low	1	-8.6

Table 5.4.3.2-3: Minimum performance PBCH in case SS/BPCH block index is known

Test number	Bandwidth (MHz) / Subcarrier spacing	Reference channel	Propagation condition	Antenna configuration and correlation matrix	Refer val	
	(kHz)				Pm- bch (%)	SNR (dB)
1	40 / 30	R.PBCH.2	TDLA30-10	1 x 4 Low	1	-9.6

5.5 Sustained downlink data rate provided by lower layers

5.5.1 FR1 single carrier requirements

The requirements in this clause are applicable to the FR1 single carrier case.

The requirements and procedure defined in Clause 5.5A.1 apply using operating band instead of CA configuration, and bandwidth instead of bandwidth combination.

5.5A Sustained downlink data rate provided by lower layers

5.5A.1 FR1 CA requirements

< Editor's note: Open issues to be resolved:

Whether same requirements apply for FR1 DC>

The Sustained Data Rate (SDR) requirements in this clause are applicable to the FR1 CA.

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.

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-5 to determine MCS based on test parameters and indicated UE capabilities.

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.3.1.

The TB success rate is defined as $100\%*N_{DL_correct_rx}/(N_{DL_newtx} + N_{DL_retx})$, where N_{DL_newtx} is the number of newly transmitted DL transport blocks, N_{DL_retx} is the number of retransmitted DL transport blocks, and $N_{DL_correct_rx}$ is the number of correctly received DL transport blocks.

The common test parameters are specified in Table 5.5A-1. The parameters specified in Table 5.5A-2 are applicable for tests on FDD CCs and parameters specified in Table 5.5A-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: Common test parameters for FDD and TDD component carriers

	Parameter	Unit	Value
PDSCH transmission	scheme		Transmission scheme 1
EPRE ratio of PTRS to PDSCH			N/A
Channel bandwidth		MHz	Channel bandwidth from selected CA bandwidth combination
	Physical Cell ID		0
Common serving	SSB position in burst		First SSB in Slot #0
cell parameters	SSB periodicity First DMRS position for Type A PDSCH	ms	20
	mapping		2
Cross carrier schedu	ů .		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
- comigaration	Subcarrier spacing	kHz	15 or 30
	RB offset	RBs	0
DL BWP configuration #1	Number of contiguous PRB		Maximum transmission bandwidth configuration as specified in clause 5.3.2 of TS 38.101-1 [6] for tested channel bandwidth and subcarrier spacing
	Subcarrier spacing	kHz	15 or 30
	Cyclic prefix		Normal
	Slots for PDCCH monitoring		Each slot
	Symbols with PDCCH		Symbols #0
	Number of PRBs in CORESET		Table 5.5A-4
	Number of PDCCH candidates and aggregation levels		1/AL 1 for 30 kHz / 5 MHz 1/AL4 for 15 kHz / 5 MHz, 30 kHz / 10 MHz and 30 kHz / 15 MHz 1/AL 8 for other combinations
	CCE-to-REG mapping type		Non-interleaved
	DCI format		1_1
PDCCH	TCI State		TCI state #1
configuration	PDCCH & PDCCH DMRS Precoding configuration		For 2Tx: Single Panel Type I, Random precoder chosen from precoder index 0 and 2, selection updated per slot For 4Tx: Single Panel Type I, Random precoder chosen from precoders with i_1,1 in {1,2,3,5,6,7} and i_2 in {0,2}, selection updated per slot
	Mapping type		Type A
	k0		0
	PDSCH aggregation factor	+	1
PDSCH	PRB bundling type		Static WB
configuration	PRB bundling size Resource allocation type		Type 0
	VRB-to-PRB mapping type		Non-interleaved
	VRB-to-PRB mapping interleaver bundle		N/A
	size DMRS Type		Type 1
	Number of additional DMRS		1 1 1
	Length		1
PDSCH DMRS configuration	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
	Subcarrier indexes in the PRB used for CSI-RS		k ₀ = 3 for CSI-RS resource 1,2,3,4
CSI-RS for tracking	OFDM symbols in the PRB used for CSI-RS		$l_0 = 6$ for CSI-RS resource 1 and 3 $l_0 = 10$ 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
	, , , , , , , , , , , , , , , , , , ,			15 kHz SCS: 20 for CSI-RS resource 1,2,3,4
	CSI-RS period	dicity	Slots	30 kHz SCS: 40 for CSI-RS resource 1,2,3,4
				15 kHz SCS: 10 for CSI-RS resource 1 and 2
	CSI-RS offset	t	Slots	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 Od	ccupation		Start PRB 0 Number of PRB = BWP size
	QCL info			TCI state #0
	CSI-RS	dexes in the PRB used for		k ₀ = 4
	RS	ols in the PRB used for CSI-		I ₀ = 12
		SI-RS ports (X)		Same as number of transmit antenna
NZP CSI-RS for	CDM Type			'FD-CDM2'
CSI acquisition	Density (ρ)			1 15 kHz SCS: 20
·	CSI-RS period	dicity		15 KHZ SCS: 20 30 kHz SCS: 40
	CSI-RS offset	 t		0 KHZ 9C9. 40
				Start PRB 0
	Frequency Od	ccupation		Number of PRB = BWP size
	QCL info			TCI state #1
	Subcarrier indexes in the PRB used for CSI-RS			$k_0 = 0$
	RS	ols in the PRB used for CSI-		I ₀ = 12
	Number of CS	SI-RS ports (X)		4
ZP CSI-RS for CSI	CDM Type			'FD-CDM2'
acquisition	Density (ρ)			1
	CSI-RS perio	dicity		15 kHz SCS: 20 30 kHz SCS: 40
	CSI-RS offset	İ .		0
	Frequency Od	•		Start PRB 0 Number of PRB = BWP size
	Type 1 QCL	SSB index		SSB #0
TCI state #0	information	QCL Type		Type C
TOI State #0	Type 2 QCL	SSB index		N/A
	information	QCL Type		N/A
	Type 1 QCL information	CSI-RS resource		CSI-RS resource 1 from 'CSI-RS for tracking' configuration
TCI state #1		QCL Type		Type A
	Type 2 QCL	CSI-RS resource		N/A
	information	QCL Type		N/A
		ups for ACK/NACK feedback	ļ	1
Maximum number of		ssion		4
HARQ ACK/NACK bundling				Multiplexed
Redundancy version coding sequence				{0,2,3,1} Single Panel Type I, Random precoder
PDSCH & PDSCH DMRS Precoding configuration				selection updated per slot, with equal probability of each applicable i ₁ , i ₂ combination with PRB bundling
Symbols for all unused REs				granularity OP.1 FDD as defined in Annex A.5.1.1
Propagation condition	•			OP.1 TDD as defined in Annex A.5.2.1 Static propagation condition
. ropagation condition				No external noise sources are applied
Antenna	1 layer CCs			1x2 or 1x4
configuration	2 layers CCs 4 layers CCs			2x2 or 2x4 4x4
<u> </u>	1 + layers CCS		1	<u> </u>

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 identicated	al to the TO	CI state applied for the PDCCH	
transmission				
Note 2:	Point A coincides with minimum guard band as specified	in Table 5	5.3.3-1 from TS 38.101-1 [6] for tested	
	channel bandwidth and subcarrier spacing			

Table 5.5A-2: Additional test parameters for FDD CC

Parameter			Value
Duplex mode			FDD
PDSCH	Starting symbol (S)		1
configuration	Length (L)		13
Number of HARQ Processes			4
K1 value			2

Table 5.5A-3: Additional test parameters for TDD CC

	Parameter	Unit	Value
Duplex mode			TDD
PDSCH	Starting symbol (S)		1
configuration	Length (L)		13
Number of HARQ	Processes		8
K1 value			Specific to each UL-DL pattern
TDD III DI nettern			15 kHz SCS: FR1.15-1
TDD UL-DL pattern			30 kHz SCS: FR1.30-1
Note 1: PDSCI	H is scheduled only on full DL slots		

Table 5.5A-4: 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	100MHz
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 5.5A-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 2	4	0.73	10
2	2	1	9
2	2	0.8	9
2	2	0.75	9
2		0.73	4
4	2 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
Note 1: MCS Index fo	2 or maximum modulation	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]

6 CSI reporting requirements (Conducted requirements)

6.1 General

This clause includes conducted requirements for the reporting of channel state information (CSI).

6.1.1 Applicability of requirements

6.1.1.1 General

The minimum performance requirements are applicable to all FR1 operating bands defined in TS 38.101-1 [6].

The minimum performance requirements in Clause 6 are mandatary for UE supporting NR operation, except test cases listed in Clause 6.1.1.3, 6.1.1.4.

6.1.1.2 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 [6]. The UE requirements applicability for UEs with different number of RX antenna ports is defined in Table 6.1.1.2-1.

Test list Supported RX Test type antenna ports UE supports only CQI All tests in Clause 6.2.2 2RX PMI All tests in Clause 6.3.2 RΙ All tests in Clause 6.4.2 UE supports only CQI All tests in Clause 6.2.3 4RX or both 2RX PMI All tests in Clause 6.3.3 and 4RX All tests in Clause 6.4.3 RI

Table 6.1.1.2-1: Requirements applicability

6.1.1.3 Applicability of requirements for optional UE features

The performance requirements in Table 6.1.1.3-1 shall apply for UEs which support optional UE features with capability signalling only.

Table 6.1.1.3-1: Requirements applicability for optional features with UE capability signalling

UE feature/capability [14]	Test	type	Test list	Applicability notes
CQI table with target BLER of	FR1 FDD	CQI	Clause 6.2.2.1.1.2 Clause 6.2.3.1.1.2	
10^-5New CQI table (cqi- TableAlt)	FR1 TDD	CQI	Clause 6.2.2.2.1.2 Clause 6.2.3.2.1.2	
Alternative 64QAM MCS table for PDSCH New 64QAM MCS	FR1 FDD	CQI	Clause 6.2.2.1.1.2 Clause 6.2.3.1.1.2	
table for PDSCH (<i>dl-64QAM-MCS-TableAlt</i>)	FR1 TDD	CQI	Clause 6.2.2.2.1.2 Clause 6.2.3.2.1.2	

The performance requirements in Table 6.1.1.3-2 shall apply for UEs which support optional UE features only.

Table 6.1.1.3-2: Requirements applicability for optional UE features

UE feature/capability [14]	Test	type	Test list	Applicability notes
Support of Type II codebook	FR1 FDD	PMI	Clause 6.3.2.1.5	
(CodebookParameters contains type2,			Clause 6.3.3.1.5	
supportedCSI-RS-ResourceList,	FR1 TDD	PMI	Clause 6.3.2.2.5	
parameterLx, amplitudeScalingType,			Clause 6.3.3.2.5	
amplitudeSubsetRestriction)				
Support of Enhanced Type II codebook	FR1 FDD	PMI	Clause 6.3.2.1.6	
with at least 16 ports per CSI-RS			Clause 6.3.3.1.6	
resource(codebookParametersAddition-	FR1 TDD	PMI	Cluase 6.3.2.2.6	
r16 contains etype2R1-r16,			Cluase 6.3.3.2.6	
supportedCSI-RS-ResourceListAdd-r16,				
maxNumberTxPortsPerResource)				

6.1.1.4 Applicability of requirements for mandatory UE features with capability signalling

The performance requirements in Table 6.1.1.4-1 shall apply for UEs which support mandatory UE features with capability signalling only.

Table 6.1.1.4-1: Requirements applicability for mandatory features with UE capability signalling

UE feature/capability [14] Test type		Test list	Applicability notes	
	FR1 FDD	CQI	Clause 6.2.3.1.1.1	The requirements
		PMI	Clause 6.3.3.1.2	apply only in case the
		RI	Clause 6.4.2.1	PDSCH MIMO rank in
			Clause 6.4.3.1	the test case does not
Supported maximum number of PDSCH MIMO layers (maxNumberMIMO-	FR1 TDD	CQI	Clause 6.2.3.2.1.1	exceed UE PDSCH MIMO layers capability
LayersPDSCH)		PMI	Clause 6.3.3.2.2	
		RI	Clause 6.4.2.2	
		IXI	Clause 6.4.3.2	
Supported maximum number of ports across all configured NZP-CSI-RS resources per CC (maxConfigNumberPortsAcross NZP-CSI-RS-PerCC)	FR1 TDD	RI PMI	Clause 6.3.2.1.1 Clause 6.3.2.1.2 Clause 6.3.2.1.3 Clause 6.3.2.1.4 Clause 6.3.3.1.1 Clause 6.3.3.1.2 Clause 6.3.3.1.3 Clause 6.3.3.1.4 Clause 6.3.3.1.4 Clause 6.3.2.2.1 Clause 6.3.2.2.1 Clause 6.3.2.2.2 Clause 6.3.2.2.2 Clause 6.3.2.2.4 Clause 6.3.3.2.1 Clause 6.3.3.2.1 Clause 6.3.3.2.2 Clause 6.3.3.2.4 Clause 6.3.3.2.4 Clause 6.3.3.2.4 Clause 6.3.3.2.4 Clause 6.4.3.2 (Test 4)	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

6.1.1.5 Applicability of Channel Quality Indicator (CQI) reporting requirements for CA

6.1.1.5.1 Applicability and test rules for different duplex modes and SCS combinations

The applicability and test rules for different duplex modes and SCS combinations are defined in Table 6.1.1.5.1-1.

Table 6.1.1.5.1-1: Applicability for different duplex modes and SCS combinations

Tests	PCell CC configuration	
Test 1 in Clause 6.2A.3.1.1	TDD CC if supported, otherwise FDD CC	
Test 2 in Clause 6.2A.3.1.1 (NOTE 2)	Any of CCs	
Test 3 in Clause 6.2A.3.1.1	Any of CCs	
the CC NOTE 2: These	t coverage can be considered fulfilled if UE passes one of as PCell in Test 1. scenarios are only tested for UEs which are not verified with in Clause 6.2A.3.1.1.	

6.1.1.5.2 Applicability and test rules for different CA configurations and bandwidth combination sets

The performance requirement for CA CQI tests in clause 6.2A are defined independent of CA configurations and bandwidth combination sets specified in clasue 5.5A in TS 38.101-1 [6].

For UEs supporting multiple CA capabilities, test any one of the supported CA capabilities with largest aggregated CA bandwidth combination. The categorization of CA capability is specified in clasue 5.1.1.7.1.

For UEs supporting multiple CA configurations from the selected CA capability, test any one of the supported CA configurations with largest aggregated CA bandwidth combination. For simplicity, the CA configuration refers to combination of CA configuration and bandwidth combination set.

A single uplink CC is configured for all tests.

6.1.1.5.3 Test coverage for different number of componenet carriers

For CA CQI tests specified in clause 6.2A, among all supported CA capabilities, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the CA tests with less than the largest number of CCs supported by the UE.

6.1.1.5.4 Applicability rule and antenna connection for CA tests with 4 RX

All the requirements specified in clause 6.2A for CA with 2 RX are applied for 4 RX capable UEs by connecting all 4 RX with data source from system simulator and reducing the signal power density by 3 dB compared to the signal power density for 2 RX in the test configurations.

6.1.2 Common test parameters

Parameters specified in Table 6.1.2-1 are applied for all test cases in this clause unless otherwise stated.

Table 6.1.2-1: Test parameters for CSI test cases

	Parameter	Unit	Value
PDSCH transmis	ssion scheme		Transmission
1 BOOT transmit			scheme 1
Actual carrier configuration	Offset between Point A and the lowest usable subcarrier on this carrier (Note 3)	RBs	0
	Subcarrier spacing	kHz	15 or 30
	Cyclic prefix		Normal
	RB offset	RBs	0
DL BWP configuration #1	Number of contiguous PRB	PRBs	Maximum transmission bandwidth configuration as specified in clause 5.3.2 of TS 38.101-1 [6] for tested channel bandwidth and subcarrier spacing
Additional PDCCH	Slots for PDCCH monitoring		Each slot
Configuration for Aperiodic	Symbols with PDCCH Number of PDCCH candidates and aggregation levels		0,1 1/AL8
Reporting	DCI format		0_1
(Note 4)	TCI state		TCI state #1
	PDCCH & PDCCH DMRS Precoding configuration		Multi-path fading propagation conditions: Single Panel Type I, Random per slot with equal probability of each applicable i1, i2 combination, and with REG bundling granularity for number of Tx larger than 1
Active DL BWP			1
Common	Physical Cell ID		0 First CCR in Clot #0
serving cell parameters	SSB position in burst SSB periodicity	ma	First SSB in Slot #0 20
parameters	Slots for PDCCH monitoring	ms	Each slot
	Symbols with PDCCH		0,1
PDCCH	Number of PDCCH candidates		
configuration	and aggregation levels		1/AL8
	DCI format		1_1
	TCI state		TCI state #1
Cross carrier sch	neduling		Not configured
	Mapping type		Type A
	k0		0
	Starting symbol (S)		2
	Length (L)		12
PDSCH	PDSCH aggregation factor		1
configuration	PRB bundling type		Static
	PRB bundling size		2
	Resource allocation type		type 0
	VRB-to-PRB mapping type		Non-interleaved
	VRB-to-PRB mapping interleaver bundle size		N/A

	PDCCH & PDCCH DMRS Precoding configuration		Multi-path fading propagation conditions: Single Panel Type I, Random per slot with equal probability of each applicable i1, i2 combination, and with REG bundling granularity for number of Tx larger than 1 Static propagation
	DMRS Type		conditions: Single Panel Type I, Random precoder chosen from precoder index 0 an 2, selection updated per slot Type 1
	Number of additional DMRS		1
	Maximum number of OFDM symbols for DL front loaded DMRS		1
PDSCH DMRS configuration	DMRS ports indexes		{1000} for Rank1 {1000,1001} for Rank2 {1000,1001,1002} for Rank3 {1000,1001,1002,100 3} for Rank4
	Number of PDSCH DMRS CDM group(s) without data		2
PTRS	Frequency density (KPT-RS)		N/A
configuration	Time density (Lpt-Rs)		N/A
	First subcarrier index in the PRB used for CSI-RS (<i>k</i> ₀)		0 for CSI-RS resource 1,2,3,4
	First OFDM symbol in the PRB used for CSI-RS (<i>lo</i>)		4 for CSI-RS resource 1 and 3 8 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 for tracking	CSI-RS periodicity	slot	15 kHz SCS: 20 for CSI-RS resource 1,2,3,4 30 kHz SCS: 40 for CSI-RS resource
	CSI-RS offset	slot	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 TCl state #0					
				Start PRB 0	
NZP CSI-RS for	Frequency O	ccupation		Number of PRB =	
CSI acquisition				BWP size	
QCL info				TCI state #1	
ZP CSI-RS for				Start PRB 0	
CSI acquisition	Frequency O	ccupation		Number of PRB =	
	Type 1 QCL	SSB index		BWP size SSB #0	
	information				
TCI state #0	momation	QCL Type		Type C	
TOT State #0	Type 2 QCL	SSB index		N/A	
	information	QCL Type		N/A	
				CSI-RS resource 1	
	Type 1 QCL	CSI-RS resource		from 'CSI-RS for	
	information	Col-No resource		tracking'	
TCI state #1				configuration	
101 State #1		QCL Type		Type A	
	Type 2 QCL	CSI-RS resource		N/A	
	information	QCL Type		N/A	
Number of HARC	Processes			4 For FDD	
				8 for TDD	
HARQ ACK/NAC				Multiplexed	
Redundancy vers	sion coding seq	uence		{0,2,3,1}	
				2 for FDD	
				For FR1.30-1:	
				8 if $mod(i,10) = 0$	
				6 if $mod(i,10) = 2$	
K1 value				5 if mod(i,10) = 3	
(PDSCH-to-HAR	Q-timing-indicat	or)		5 if mod(i,10) = 4	
(* = = = : : : : : : : : : : : : : : : :		,		4 if $mod(i,10) = 5$	
				3 if $mod(i,10) = 6$	
				Where i is slot index	
				per radio frame with	
				0~19 OP.1 FDD as defined	
				in Annex A.5.1.1	
Symbols for unus	ed REs			OP.1 TDD as defined	
				in Annex A.5.2.1	
Physical signals,	Physical signals, channels mapping and precoding			As specified in Annex	
Note 1: PDSCH is not scheduled on slots containing CSI-RS or slots which are not fu					
DL.					
Note 2: UE assumes that the TCI state for the PDSCH is identical to the TCI state					
applied for the PDCCH transmission.					
Note 3: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from					
TS 38.101-1 [6] for tested channel bandwidth and subcarrier spacing.					
	Note 4: Additional PDCCH configuration for aperiodic reporting is only for test cases with aperiodic CSI reporting configured.				
with a	benounces rep	orang configured.			

6.2 Reporting of Channel Quality Indicator (CQI)

This clause includes the requirements for the reporting of channel quality indicator (CQI).

6.2.1 1RX requirements

(Void)

6.2.2 2RX requirements

This sub-clause includes the requirements for reporting of CQI for UE equipped with 2 receiver antennas.

6.2.2.1 FDD

6.2.2.1.1 CQI reporting definition under AWGN conditions

The reporting accuracy of the channel quality indicator (CQI) under frequency non-selective conditions is determined by the reporting variance and the BLER performance using the transport format indicated by the reported CQI median. The purpose is to verify that the reported CQI values are in accordance with the CQI definition given in TS 38.214 [12]. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

6.2.2.1.1.1 Minimum requirement for periodic CQI reporting

For the parameters specified in Table 6.2.2.1.1.1-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) The reported CQI value according to the reference channel shall be in the range of ± 1 of the reported median more than 90% of the time.
- b) If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, then the BLER using transport format indicated by (median CQI-1) shall be less than or equal to 0.1.

Table 6.2.2.1.1.1-1: CQI reporting definition test

Parameter		Unit	Т	est 1	Te	st 2
Bandwidth		MHz		1(
Duplex Mode			FDD			
	Subcarrier spacing			15	5	
SNR		dB	8	9	14	15
Propagation chan	nel			AW		
Antenna configura	ation		2×2 wi	2x2 with static channel specified i Annex B.1		ecified in
Beamforming Mod	del		As	specified in	Annex I	3.4.1
	CSI-RS resource Type		Periodic			
	Number of CSI-RS ports (X)			4		
	CDM Type			FD-CDM2		
ZP CSI-RS	Density (ρ)			1		
configuration	First subcarrier index in the PRB			Row	5.4	
Comiguration	used for CSI-RS (k ₀)			ROW	J, 4	
	First OFDM symbol in the PRB used			9		
	for CSI-RS (I ₀)			9		
	CSI-RS	slot		5/	1	
	periodicity and offset	3101				
	CSI-RS resource Type			Perio	odic	
	Number of CSI-RS ports (X)			2		
	CDM Type			FD-C	DM2	
NZP CSI-RS for	Density (ρ)			1		
CSI acquisition	First subcarrier index in the PRB			Row 3	(6 -)	
OOI doquioition	used for CSI-RS (k ₀ , k ₁)		Row 3,(6,-)			
	First OFDM symbol in the PRB used			13	3	
	for CSI-RS (I ₀)					
	NZP CSI-RS-timeConfig	slot	5/1			
	periodicity and offset	0.01				
	CSI-IM resource Type		Periodic			
001.184	CSI-IM RE pattern			0		
CSI-IM	CSI-IM Resource Mapping			(4,	9)	
configuration	(kcsi-im, lcsi-im)				,	
	CSI-IM timeConfig	slot		5/	1	
periodicity and offset				Perio	odio	
ReportConfigType CQI-table				Tabl		
				cri-RI-PI		
reportQuantity	rChannelMeasurements					
	rInterferenceMeasurements			Not con Not con		
				Widel		
cqi-FormatIndicate pmi-FormatIndicate				Widel		
Sub-band Size	loi	RB		8		
	d	KB		1111		
Csi-ReportingBand CSI-Report periodicity and offset		slot		5/		
aperiodicTriggeringOffset		5101		Not con		
apenouic mggenn	Codebook Type			typel-Sing		
	Codebook Type Codebook Mode			typer-ong 1	-	
Codebook	(Codebook Config-					
configuration	N1,CodebookConfig-N2)			Not con	figured	
oormgaration	CodebookSubsetRestriction			0100	200	
	RI Restriction			N/.		
Physical channel for CSI report			1	PUC		
CQI/RI/PMI delay		ms		8		
Maximum number of HARQ transmission		1110	1	1		
	Maximum number of HARQ transmission		As sne	cified in Tal	ble A 4-2	TBS 2-
Measurement cha	nnel		, 13 Spc	2		, 150.2
2						

6.2.2.1.1.2 Minimum requirement for periodic CQI reporting with Table 3

For the parameters specified in Table 6.2.2.1.1.2-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) The reported CQI value according to the reference channel shall be in the range of ± 1 of the reported median more than 90% of the time.
- b) If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 10⁻⁵, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 10⁻⁵. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 10⁻⁵, then the BLER using transport format indicated by (median CQI-1) shall be less than or equal to 10⁻⁵.
- c) The reported CQI value according to the reference channel shall be ≥ 1 .

Table 6.2.2.1.1.2-1: CQI reporting definition test

	Parameter	Unit	Test 1
Bandwidth		MHz	10
Duplex Mode			FDD
Subcarrier spacin			15
SNR	9	kHz dB	[1] [2]
Propagation chan	nel	u.b	AWGN
Antenna configura			1x2 with static channel specified in
Beamforming Mod			Annex B.1 As specified in Annex B.4.1
beamiorning woo	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		4
			FD-CDM2
	CDM Type		
7D CCL DC	Density (ρ)		1
ZP CSI-RS configuration	First subcarrier index in the PRB used for CSI-RS (k ₀)		Row 5,4
	First OFDM symbol in the PRB used for CSI-RS (I ₀)		9
	CSI-RS periodicity and offset	slot	5/1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		1
	CDM Type		No CDM
	Density (ρ)		3
NZP CSI-RS for	First subcarrier index in the PRB		Day 4 (0.)
CSI acquisition	used for CSI-RS (k ₀ , k ₁)		Row 1,(0,-)
	First OFDM symbol in the PRB used for CSI-RS (I ₀)		13
	NZP CSI-RS-timeConfig periodicity and offset	slot	5/1
	CSI-IM resource Type		Periodic
	CSI-IM RE pattern		0
CSI-IM	CSI-IM Resource Mapping		(1.5)
configuration	(kcsi-im,lcsi-im)		(4, 9)
3	CSI-IM timeConfig periodicity and offset	slot	5/1
ReportConfigType			Periodic
CQI-table	,		Table 3
reportQuantity			cri-RI-PMI-CQI
	rChannelMeasurements		Not configured
	timeRestrictionForInterferenceMeasurements		Not configured
			Wideband
cqi-FormatIndicator			Wideband
pmi-FormatIndicator Sub-band Size		DD	8
Csi-ReportingBand		RB	<u> </u>
CSI-Reportingband CSI-Report periodicity and offset		olot	1111111 5/0
aperiodicTriggeringOffset		slot	Not configured
apenouicinggenr	<u> </u>		· · · · · · · · · · · · · · · · · · ·
	Codebook Type		typel-SinglePanel
0	Codebook Mode		1
Codebook configuration	(CodebookConfig- N1,CodebookConfig-N2)		Not configured
	CodebookSubsetRestriction		000001
	RI Restriction		N/A

Physical channel for CSI report		PUCCH
CQI/RI/PMI delay		8
Maximum number of HARQ transmission		1
Measurement channel		As specified in Table A.4-4, TBS.4-1

6.2.2.1.2 CQI reporting under fading conditions

6.2.2.1.2.1 Minimum requirement for wideband CQI reporting

The purpose of the requirements is to verify that the UE is tracking the channel variations and selecting the largest transport format possible according to the prevailing channel state for the frequency non-selective scheduling.

The reporting accuracy of CQI under frequency non-selective fading conditions is determined by the reporting variance, the relative increase of the throughput obtained when the transport format is indicated by the reported CQI compared to the throughput obtained when a fixed transport format is configured according to the reported median CQI, and a minimum BLER using the transport formats indicated by the reported CQI. To account for sensitivity of the input SNR the wideband CQI reporting under frequency selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

For the parameters specified in Table 6.2.2.1.2.1-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) A CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least α % of the time where α % is specified in Table 6.2.2.1.2.1-2;
- b) The ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be $\geq \gamma$, where γ is specified in Table 6.2.2.1.2.1-2;
- c) When transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater than or equal to 0.02.

Table 6.2.2.1.2.1-1: Wideband CQI reporting test under frequency non-selective fading conditions

Parameter		Unit	Test 1 Test 2
Bandwidth		MHz	10
Subcarrier spacing		kHz	15
Duplex Mode			FDD
SNR		dB	6 7 12 13
Propagation chan	nel		TDLA30-5
Antenna configura			2×2
Correlation config			ULA high
Beamforming Mod			As specified in Annex B.4.1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		4
	CDM Type		FD-CDM2
7D CCL DC	Density (ρ)		1
ZP CSI-RS	First subcarrier index in the PRB		D
configuration	used for CSI-RS (k ₀)		Row 5,4
	First OFDM symbol in the PRB used		0
	for CSI-RS (I ₀)		9
	CSI-RS	alat	F/4
	periodicity and offset	slot	5/1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		2
	CDM Type		FD-CDM2
NZD COLDC for	Density (p)		1
NZP CSI-RS for	First subcarrier index in the PRB		Day: 2 (C.)
CSI acquisition	used for CSI-RS (k ₀ , k ₁)		Row 3,(6,-)
	First OFDM symbol in the PRB used		13
	for CSI-RS (I ₀)		13
	NZP CSI-RS-timeConfig	slot	5/1
	periodicity and offset	SIOL	5/1
	CSI-IM resource Type		Periodic
	CSI-IM RE pattern		0
CSI-IM	CSI-IM Resource Mapping		
configuration	(Ксы-ім,Ісы-ім)		(4, 9)
garano			
	CSI-IM timeConfig	slot	5/1
	periodicity and offset		
ReportConfigType)		Periodic
CQI-table			Table 2
reportQuantity			cri-RI-PMI-CQI
	rChannelMeasurements		Not configured
	rInterferenceMeasurements		Not configured
cqi-FormatIndicate			Wideband
pmi-FormatIndica	tor		Wideband
Sub-band Size		RB	8
Csi-ReportingBand			1111111
CSI-Report periodicity and offset		slot	5/0
aperiodicTriggeringOffset			Not configured
	Codebook Type		typel-SinglePanel
	Codebook Mode		1
Codebook	(CodebookConfig-		Not configured
configuration	N1,CodebookConfig-N2)		
	CodebookSubsetRestriction		000001
RI Restriction			N/A
Physical channel for CSI report			PUCCH
CQI/RI/PMI delay		ms	8
Maximum number of HARQ transmission			1
Measurement cha	innel		As specified in Table A.4-2, TBS.2-
Modern on anno		<u> </u>	1

Table 6.2.2.1.2.1-2: Minimum requirements

Parameters	Test 1	Test 2
α[%]	20	20
γ	1.05	1.05

6.2.2.1.2.2 Minimum requirement for sub-band CQI reporting

The purpose of the requirements is to verify that the preferred sub-bands can be used for frequency-selective scheduling under the frequency-selective fading conditions.

The accuracy of sub-band channel CQI reporting under the frequency-selective fading conditions is determined by a double-sided percentile of the reported differential CQI offset level 0 per sub-band, and the relative increase of the throughput obtained when transmitting the transport format indicated by the corresponding reported sub-band CQI on a randomly selected sub-band among the sub-bands with the highest reported differential CQI offset level compared to the throughput when transmitting a fixed transport format according to the wideband CQI median on a randomly selected sub-band among all the sub-bands. To account for sensitivity of the input SNR the sub-band CQI reporting under frequency selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

For the parameters specified in Table 6.2.2.1.2.2-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) A sub-band differential CQI offset level of 0 shall be reported at least α % of the time but less than β % of the time for each sub-band, where α and β are specified in Table 6.2.2.1.2.2-2;
- b) The ratio of the throughput obtained when transmitting the corresponding transport format on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level and that obtained when transmitting the transport format indicated by the reported wideband CQI median on a randomly selected sub-band among all the sub-bands shall be $\geq \gamma$, where γ is specified in Table 6.2.2.1.2.2-2;
- c) When transmitting the corresponding transport format on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level, the average BLER for the indicated transport format shall be greater than or equal to 0.02.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD.

Table 6.2.2.1.2.2-1: Sub-band CQI reporting test under frequency-selective fading conditions

	Parameter	Unit	Test 1 Test 2
Bandwidth		MHz	10
Subcarrier spacing		kHz	15
Duplex Mode	5		FDD
SNR		dB	8 9 14 15
			Two tap model specified in Annex
Propagation chan	nel		B.2.4 with $a=1$, $f_D = 5$ Hz, and
			т _d =0.45µs
Antenna configura			2×2
Correlation config			As per Annex B.1
Beamforming Mod			As specified in Annex B.4.1
	CSI-RS resource Type Number of CSI-RS ports (X)		Periodic 4
			FD-CDM2
	CDM Type Density (ρ)		1 1
ZP CSI-RS	First subcarrier index in the PRB		·
configuration	used for CSI-RS (k ₀)		Row 5,4
	First OFDM symbol in the PRB used		_
	for CSI-RS (I ₀)		9
	CSI-RS	-1-4	E /4
	periodicity and offset	slot	5/1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		2
	CDM Type		FD-CDM2
NZP CSI-RS for	Density (ρ)		1
CSI acquisition	First subcarrier index in the PRB		Row 3,(6,-)
	used for CSI-RS (k ₀ , k ₁)		11011 0,(0, 7
	First OFDM symbol in the PRB used		13
	for CSI-RS (I ₀) NZP CSI-RS-timeConfig		
	periodicity and offset	slot	5/1
	CSI-IM resource Type		Periodic
	CSI-IM RE pattern		0
	CSI-IM Resource Mapping		Ŭ
CSI-IM	(kcsi-im,lcsi-im)		(4, 9)
configuration			
	CSI-IM timeConfig	slot	5/1
periodicity and offset		3101	
ReportConfigType	9		Aperiodic
CQI-table			Table 2
reportQuantity			cri-RI-PMI-CQI
	rChannelMeasurements		Not configured
cqi-FormatIndicate	rInterferenceMeasurements		Not configured Subband
pmi-FormatIndicat			Wideband
Sub-band Size	toi	RB	8
csi-ReportingBand	<u> </u>	ייי	1111111
CSI-Report interva		slot	Not configured
Aperiodic Report			5
			1 in slots i, where mod(i, 5) = 1,
CSI request			otherwise it is equal to 0
reportTriggerSize			1
CSI-AperiodicTriggerStateList		-	One State with one Associated
			Report Configuration
			Associated Report Configuration
			contains pointers to NZP CSI-RS
aperiodicTriggerin	ogOffcot		and CSI-IM Not configured
apenouic i riggerin	Codebook Type		typel-SinglePanel
	Codebook Type Codebook Mode		1 (yper-onlyler after
Codebook	(Codebook Mode (CodebookConfig-		1
configuration	N1,CodebookConfig-N2)		Not configured
Johngaradon	CodebookSubsetRestriction		000001
	RI Restriction		N/A
Physical channel	Physical channel for CSI report		PUSCH
CQI/RI/PMI delay		ms	8
OQI/INI/I-IVII UCIAY			

Maximum number of HARQ transmission	1
Measurement channel	As specified in Table A.4-2, TBS.2- 5

Table 6.2.2.1.2.2-2: Minimum requirements

Parameters	Test 1	Test 2
α [%]	2	2
β [%]	55	55
γ	1.05	1.05

6.2.2.2 TDD

6.2.2.2.1 CQI reporting definition under AWGN conditions

6.2.2.2.1.1 Minimum requirement for periodic CQI reporting

The purpose of the requirements is to verify that the reported CQI values are in accordance with the CQI definition given in TS 38.214 [12]. The reporting accuracy of CQI under AWGN condition is determined by the reporting variance and BLER performance using the transport format indicated by the reported CQI median. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

For the parameters specified in Table 6.2.2.2.1.1-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) The reported CQI value according to the reference channel shall be in the range of ± 1 of the reported median more than 90% of the time.
- b) If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, then the BLER using transport format indicated by (median COI-1) shall be less than or equal to 0.1.

Table 6.2.2.2.1.1-1: CQI reporting definition test

Parameter		Unit	Test 1	Test 2
Bandwidth	Bandwidth		40	
Subcarrier spacing		kHz	30	
Duplex Mode			TDD	
TDD UL-DL patter	rn		FR1.	
SNR		dB	8 9	14 15
Propagation chan	nel		AWO	
Antenna configura			2x2 with static channel specified in Annex B.1	
Beamforming Mod			As specified in Annex B.4.1	
	CSI-RS resource Type		Perio	
	Number of CSI-RS ports (X)		4	
	CDM Type		FD-CDM2	
ZP CSI-RS	Density (ρ)		1	
configuration	First subcarrier index in the PRB		Row	5,4
	used for CSI-RS (k ₀)			,
	First OFDM symbol in the PRB used		9	
	for CSI-RS (I ₀) CSI-RS			
	periodicity and offset	slot	10/	′1
	CSI-RS resource Type		Perio	ndic
	Number of CSI-RS ports (X)		2	
	CDM Type		FD-CI	
N70 001 00 (Density (p)		1	
NZP CSI-RS for	First subcarrier index in the PRB		Б. 0	(0.)
CSI acquisition	used for CSI-RS (k ₀ , k ₁)		Row 3	,(6,-)
	First OFDM symbol in the PRB used		10	.
	for CSI-RS (I ₀)		13	3
	NZP CSI-RS-timeConfig	slot	10/	/1
	periodicity and offset	3101		
	CSI-IM resource Type		Perio	odic
	CSI-IM RE pattern		0	
CSI-IM	CSI-IM Resource Mapping			- \
configuration	(kcsi-im,lcsi-im)		(4,	9)
	CCI IM time Config			
	CSI-IM timeConfig periodicity and offset	slot	10/	′1
ReportConfigType			Perio	odic
CQI-table	7		Tabl	
reportQuantity			cri-RI-PI	
timeRestrictionFo	rChannelMeasurements		Not con	
	rInterferenceMeasurements		Not con	
cgi-FormatIndicate			Widek	
pmi-FormatIndica			Widel	
Sub-band Size		RB	16	
Csi-ReportingBan	d		1111	111
CSI-Report periodicity and offset		slot	10/	9
aperiodicTriggeringOffset			Not con	figured
	Codebook Type		typel-Sing	glePanel
	Codebook Mode		1	
Codebook	(CodebookConfig-		Not con	figured
configuration	N1,CodebookConfig-N2)			ŭ
	CodebookSubsetRestriction		0100	
	RI Restriction		N/A	
Physical channel for CSI report			PUC	
CQI/RI/PMI delay		ms	9.	5
Maximum number of HARQ transmission			1	
Measurement cha	innel		As specified in Tal	
modeli ondino			4	

6.2.2.2.1.2 Minimum requirement for periodic CQI reporting with Table 3

The purpose of the requirements is to verify that the reported CQI values are in accordance with the CQI definition given in TS 38.214 [12]. The reporting accuracy of CQI under AWGN condition is determined by the reporting variance and BLER performance using the transport format indicated by the reported CQI median. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

For the parameters specified in Table 6.2.2.2.1.2-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) The reported CQI value according to the reference channel shall be in the range of ± 1 of the reported median more than 90% of the time.
- b) If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 10⁻⁵, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 10⁻⁵. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 10⁻⁵, then the BLER using transport format indicated by (median CQI-1) shall be less than or equal to 10⁻⁵.
- c) The reported CQI value according to the reference channel shall be ≥ 1 .

Table 6.2.2.2.1.2-1: CQI reporting definition test

Parameter		Unit	Test 1	
Bandwidth	Bandwidth		40	
Subcarrier spacing	g	kHz	30	
Duplex Mode			TDD	
TDD UL-DL patter	rn		FR1.30-1	
SNR		dB	[1] [2]	
Propagation chan	nel		AWGN	
Antenna configura	ation		1x2 with static channel specified in Annex B.1	
Beamforming Mod	del		As specified in Annex B.4.1	
_	CSI-RS resource Type		Periodic	
	Number of CSI-RS ports (X)		4	
	CDM Type		FD-CDM2	
	Density (ρ)		1	
ZP CSI-RS configuration	First subcarrier index in the PRB used for CSI-RS (k ₀)		Row 5,4	
	First OFDM symbol in the PRB used for CSI-RS (I ₀)		9	
	CSI-RS periodicity and offset	slot	10/1	
	CSI-RS resource Type		Periodic	
	Number of CSI-RS ports (X)		1	
	CDM Type		No CDM	
	Density (ρ)		3	
NZP CSI-RS for CSI acquisition	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 1,(0,-)	
·	First OFDM symbol in the PRB used for CSI-RS (I ₀)		1	
	NZP CSI-RS-timeConfig periodicity and offset	slot	10/1	
CSI-IM configuration	CSI-IM resource Type		Periodic	
	CSI-IM RE pattern		0	
	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(4, 9)	
	CSI-IM timeConfig periodicity and offset	slot	10/1	

ReportConfigTyp	e		Periodic
CQI-table			Table 3
reportQuantity			cri-RI-PMI-CQI
timeRestrictionFo	orChannelMeasurements		Not configured
timeRestrictionFo	orInterferenceMeasurements		Not configured
cqi-FormatIndica	tor		Wideband
pmi-FormatIndica	ator		Wideband
Sub-band Size		RB	16
Csi-ReportingBa	nd		1111111
CSI-Report perio	dicity and offset	slot	10/9
aperiodicTriggeri	periodicTriggeringOffset Not configur		Not configured
	Codebook Type		typel-SinglePanel
	Codebook Mode		1
Codebook configuration	(CodebookConfig- N1,CodebookConfig-N2)		Not configured
	CodebookSubsetRestriction		000001
	RI Restriction		N/A
Physical channe	Physical channel for CSI report		PUCCH
CQI/RI/PMI delay		ms	9.5
Maximum numbe	Maximum number of HARQ transmission		1
Measurement channel			As specified in Table A.4-4, TBS.4-2

6.2.2.2.2 CQI reporting under fading conditions

6.2.2.2.2.1 Minimum requirement for wideband CQI reporting

The purpose of the requirements is to verify that the UE is tracking the channel variations and selecting the largest transport format possible according to the prevailing channel state for the frequency non-selective scheduling.

The reporting accuracy of CQI under frequency non-selective fading conditions is determined by the reporting variance, the relative increase of the throughput obtained when the transport format is indicated by the reported CQI compared to the throughput obtained when a fixed transport format is configured according to the reported median CQI, and a minimum BLER using the transport formats indicated by the reported CQI. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

For the parameters specified in Table 6.2.2.2.2.1-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) A CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least α % of the time where α % is specified in Table 6.2.2.2.1-2;
- b) The ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be $\geq \gamma$, where γ is specified in Table 6.2.2.2.1-2;
- c) When transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater than or equal to 0.02.

Table 6.2.2.2.1-1: Wideband CQI reporting test under frequency non-selective fading conditions

	Parameter		Test 1 Test :		st 2	
Bandwidth		MHz		40		
Subcarrier spacin	g	kHz	30			
Duplex Mode				TD		
TDD UL-DL patte	rn			FR1.	30-1	
SNR		dB	6	7	12	13
Propagation chan				TDLA	30-5	
Antenna configura				2×		
Correlation config				ULA high As specified in Annex B.4.1		
Beamforming Mod	•		As			3.4.1
	CSI-RS resource Type Number of CSI-RS ports (X)		Periodic 4			
	. ,			FD-C		
	CDM Type Density (ρ)			<u> </u>	DIVIZ	
ZP CSI-RS	First subcarrier index in the PRB				<u> </u>	
configuration	used for CSI-RS (k₀)			Row	5,4	
	First OFDM symbol in the PRB used for CSI-RS (I ₀)			9)	
	CSI-RS periodicity and offset	slot		10	/1	
	CSI-RS resource Type			Peri	odic	
	Number of CSI-RS ports (X)			2		
	CDM Type			FD-C	DM2	
NZP CSI-RS for	Density (ρ)			1		
CSI acquisition	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 3,(6,-)			
	First OFDM symbol in the PRB used for CSI-RS (I ₀)		13			
	NZP CSI-RS-timeConfig periodicity and offset	slot	10/1			
	CSI-IM resource Type			Peri	odic	
	CSI-IM RE pattern					
CCLIM	CSI-IM Resource Mapping					
CSI-IM configuration	(kcsi-im,lcsi-im)			(4,	9)	
	CSI-IM timeConfig periodicity and offset	slot	10/1			
ReportConfigType				Peri	odic	
CQI-table	,			Tab		
reportQuantity				cri-RI-P		
	rChannelMeasurements			Not con		
	rInterferenceMeasurements			Not con		
cqi-FormatIndicate	or			Wide		
pmi-FormatIndica	tor			Wide	band	
Sub-band Size		RB		1	6	
Csi-ReportingBan			<u> </u>	1111		
CSI-Report period		slot		10		
		Not con				
	Codebook Type		1	typeI-Sin		
	Codebook Mode		1	1		
Codebook configuration	(CodebookConfig- N1,CodebookConfig-N2)			Not con	figured	
	CodebookSubsetRestriction		000001			
RI Restriction				N/		
Physical channel for CSI report		ms	1	PUC		
	CQI/RI/PMI delay		1	9.		
Maximum number	of HARQ transmission		1	<u> 1</u>		TD 0 =
Measurement cha	nnel		As spe	cified in Ta		, IBS.2-

Table 6.2.2.2.1-2: Minimum requirements

Parameters	Test 1	Test 2
<i>α</i> [%]	20	20
γ	1.05	1.05

6.2.2.2.2.2 Minimum requirement for sub-band CQI reporting

The purpose of the requirements is to verify that the preferred sub-bands can be used for frequency-selective scheduling under the frequency-selective fading conditions.

The accuracy of sub-band channel CQI reporting under the frequency-selective fading conditions is determined by a double-sided percentile of the reported differential CQI offset level 0 per sub-band, and the relative increase of the throughput obtained when transmitting the transport format indicated by the corresponding reported sub-band CQI on a randomly selected sub-band among the sub-bands with the highest reported differential CQI offset level compared to the throughput when transmitting a fixed transport format according to the wideband CQI median on a randomly selected sub-band among all the sub-bands. To account for sensitivity of the input SNR the sub-band CQI reporting under frequency selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

For the parameters specified in Table 6.2.2.2.2-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) A sub-band differential CQI offset level of 0 shall be reported at least $\alpha\%$ of the time but less than $\beta\%$ of the time for each sub-band, where α and β are specified in Table 6.2.2.2.2.2;
- b) The ratio of the throughput obtained when transmitting the corresponding transport format on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level and that obtained when transmitting the transport format indicated by the reported wideband CQI median on a randomly selected sub-band among all the sub-bands shall be $\geq \gamma$, where γ is specified in Table 6.2.2.2.2.2;
- c) When transmitting the corresponding transport format on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level, the average BLER for the indicated transport format shall be greater than or equal to 0.02.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each available downlink transmission instance for TDD.

Table 6.2.2.2.2-1: Sub-band CQI reporting test under frequency-selective fading conditions

	Parameter	Unit	Test 1 Test 2
Bandwidth			40
Subcarrier spacin	bcarrier spacing		30
Duplex Mode			TDD
TDD UL-DL patte	rn		FR1.30-1
SNR		dB	8 9 14 15
Propagation chan	nnel		Two tap model specified in Annex B.2.4 with $a=1$, $f_D=5$ Hz, and $\tau_d=0.1125\mu s$
Antenna configura	ation		2x2
Correlation config			As per Annex B.1
Beamforming Mo	del		As specified in Annex B.4.1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		4
	CDM Type		FD-CDM2
ZP CSI-RS	Density (ρ)		1
configuration	First subcarrier index in the PRB used for CSI-RS (k ₀)		Row 5,4
	First OFDM symbol in the PRB used for CSI-RS (I_0)		9
	CSI-RS periodicity and offset	slot	10/1
	CSI-RS resource Type	-	Periodic
	Number of CSI-RS ports (X)	-	2
	CDM Type		FD-CDM2
NZP CSI-RS for	Density (ρ)		1
CSI acquisition	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 3,(6,-)
	First OFDM symbol in the PRB used for CSI-RS (I ₀)		13
	NZP CSI-RS-timeConfig periodicity and offset	slot	10/1
	CSI-IM resource Type		Periodic
	CSI-IM RE pattern		0
CSI-IM configuration	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(4, 9)
	CSI-IM timeConfig periodicity and offset	slot	10/1
ReportConfigType	e		Aperiodic
CQI-table			Table 2
reportQuantity			cri-RI-PMI-CQI
	rChannelMeasurements		Not configured
timeRestrictionFo	rInterferenceMeasurements		Not configured
cqi-FormatIndicat			Subband
pmi-FormatIndica	itor		Wideband
Sub-band Size		RB	16
csi-ReportingBan			1111111
CSI-Report interv		slot	Not configured
CSI request	Aperiodic Report Slot Offset CSI request		1 in slots i, where mod(i, 10) = 1,
reportTriggerSize			otherwise it is equal to 0
reportringgersize			One State with one Associated Report Configuration
CSI-AperiodicTriggerStateList			Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
aperiodicTriggerir	ngOffset		Not configured
aponodio i riggorii	Codebook Type		typel-SinglePanel
	Codebook Node		1
Codebook	(Codebook Config-		'
configuration	N1,CodebookConfig-N2)		Not configured
209010001	CodebookSubsetRestriction		000001
	RI Restriction		N/A
Physical channel for CSI report			PUSCH

CQI/RI/PMI delay	ms	9.5
Maximum number of HARQ transmission		1
Measurement channel		As specified in Table A.4-2, TBS.2-6

Table 6.2.2.2.2-2: Minimum requirements

Parameters	Test 1	Test 2
α [%]	2	2
β [%]	55	55
γ	1.05	1.05

6.2.3 4RX requirements

This sub-clause includes the requirements for reporting of CQI for UE equipped with 4 receiver antennas.

6.2.3.1 FDD

6.2.3.1.1 CQI reporting definition under AWGN conditions

The purpose of the requirements is to verify that the reported CQI values are in accordance with the CQI definition given in TS 38.214 [12]. The reporting accuracy of CQI under AWGN condition is determined by the reporting variance and BLER performance using the transport format indicated by the reported CQI median. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

6.2.3.1.1.1 Minimum requirement for period CQI reporting

For the parameters specified in Table 6.2.3.1.1.1-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) The reported CQI value according to the reference channel shall be in the range of ± 1 of the reported median more than 90 % of the time.
- b) If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, then the BLER using transport format indicated by (median CQI-1) shall be less than or equal to 0.1.

Table 6.2.2.1.1.1-1: CQI reporting definition test

Parameter		Unit	Test 1	Test 2
Bandwidth	Bandwidth		1	0
Subcarrier spacing	Subcarrier spacing		1	5
Duplex Mode			FD	DD
SNR		dB	5 6	11 12
Propagation chan	nel		AW	
Antenna configura	ation		2x4 with static ch Anne	
Beamforming Mod	101		As specified in	
Boarmonning woo	CSI-RS resource Type		Peri	
	Number of CSI-RS ports (X)		2	
	CDM Type		FD-C	DM2
7D CCL DC	Density (ρ)		1	
ZP CSI-RS configuration	First subcarrier index in the PRB		Dou	. 5. 4
Corniguration	used for CSI-RS (k ₀)		Row	5,4
	First OFDM symbol in the PRB used for CSI-RS (I ₀)		Ş)
	CSI-RS		_	
	periodicity and offset	slot	5/	1
	CSI-RS resource Type		Peri	odic
	Number of CSI-RS ports (X)		2)
	CDM Type		FD-C	DM2
NZP CSI-RS for	Density (ρ)		1	
CSI acquisition	First subcarrier index in the PRB		Row	3 (6 -)
OOI acquisition	used for CSI-RS (k ₀ , k ₁)		NOW	5,(0,-)
	First OFDM symbol in the PRB used		1	3
	for CSI-RS (I ₀)			
	NZP CSI-RS-timeConfig	slot	5/	′1
	periodicity and offset CSI-IM resource Type		Peri	odio
	CSI-IM RE pattern		reii (
	CSI-IM Resource Mapping)
CSI-IM configuration	(ксы-ім,Ісы-ім)		(4,	9)
	CSI-IM timeConfig periodicity and offset	slot	5/	′1
ReportConfigType	9		Peri	
CQI-table			Tab	
reportQuantity			cri-RI-P	
	rChannelMeasurements		Not con	
	rInterferenceMeasurements		Not con	
cqi-Formatindicate			Wide	
pmi-FormatIndicate Sub-band Size	tor	RB	Wide 8	
csi-ReportingBand	4	KD	1111	
CSI-Report period		slot	5/	
aperiodicTriggerin		3101	Not cor	
apendalerriggenin	Codebook Type		typel-Sin	
	Codebook Mode		1	g
Codebook	(CodebookConfig-		***	<i>t</i> :
configuration	N1,CodebookConfig-N2)		Not con	ingurea
_	CodebookSubsetRestriction		010	
	RI Restriction		N/	
	Physical channel for CSI report		PUC	CCH
CQI/RI/PMI delay		ms	8	3
Maximum number	of HARQ transmission		1	,
Measurement cha	nnel		As specified in Ta	

6.2.3.1.1.2 Minimum requirement for period CQI reporting with Table 3

For the parameters specified in Table 6.2.3.1.1.2-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) The reported CQI value according to the reference channel shall be in the range of ± 1 of the reported median more than 90 % of the time.
- b) If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 10⁻⁵, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 10⁻⁵. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 10⁻⁵, then the BLER using transport format indicated by (median CQI-1) shall be less than or equal to 10⁻⁵.
- c) The reported CQI value according to the reference channel shall be ≥ 1 .

Table 6.2.2.1.1.2-1: CQI reporting definition test

	Parameter	Unit	Test 1
Bandwidth		MHz	10
Subcarrier spacin	n	kHz	15
Duplex Mode	9	10.12	FDD
SNR	•		[-2] [-1]
Propagation chan	nel	dB	AWGN
Antenna configura			1x4 with static channel specified in
)			Annex B.1 As specified in Annex B.4.1
Beamforming Mod	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		4
	CDM Type		FD-CDM2
7D 001 D0	Density (ρ)		1
ZP CSI-RS	First subcarrier index in the PRB		Row 5,4
configuration	used for CSI-RS (k ₀)		
	First OFDM symbol in the PRB used for CSI-RS (I ₀)		9
	CSI-RS	slot	5/1
	periodicity and offset	SIOL	3/1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		1
	CDM Type		No CDM
	Density (ρ)		3
NZP CSI-RS for	First subcarrier index in the PRB		Day 4 (0.)
CSI acquisition	used for CSI-RS (k ₀ , k ₁)		Row 1,(0,-)
-	First OFDM symbol in the PRB used		1
	for CSI-RS (I ₀) NZP CSI-RS-timeConfig	slot	5/1
	periodicity and offset	0.01	
	CSI-IM resource Type		Periodic
	CSI-IM RE pattern		0
CSI-IM	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(4, 9)
configuration	,		, ,
	CSI-IM timeConfig periodicity and offset	slot	5/1
ReportConfigType			Periodic
CQI-table			Table 3
reportQuantity			cri-RI-PMI-CQI
timeRestrictionFo	rChannelMeasurements		Not configured
	rInterferenceMeasurements		Not configured
cqi-FormatIndicate			Wideband
pmi-FormatIndicator			Wideband
Sub-band Size		RB	8
csi-ReportingBand		1,0	1111111
CSI-Report period		slot	5/0
aperiodicTriggeringOffset		3101	Not configured
aponodio i riggerii	Codebook Type		typel-SinglePanel
	Codebook Type Codebook Mode		typer-Singler anel
Codobook	(CodebookConfig-		<u> </u>
Codebook configuration	N1,CodebookConfig-N2)		Not configured
	CodebookSubsetRestriction		000001
	RI Restriction		N/A

Physical channel for CSI report		PUCCH
CQI/RI/PMI delay		8
Maximum number of HARQ transmission		1
Measurement channel		As specified in Table A.4-4, TBS.4-1

6.2.3.1.2 CQI reporting under fading conditions

6.2.3.1.2.1 Minimum requirement for wideband CQI reporting

The purpose of the requirements is to verify that the UE is tracking the channel variations and selecting the largest transport format possible according to the prevailing channel state for the frequency non-selective scheduling.

The reporting accuracy of CQI under frequency non-selective fading conditions is determined by the reporting variance, the relative increase of the throughput obtained when the transport format is indicated by the reported CQI compared to the throughput obtained when a fixed transport format is configured according to the reported median CQI, and a minimum BLER using the transport formats indicated by the reported CQI. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

For the parameters specified in Table 6.2.3.1.2.1-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) A CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least α % of the time where α % is specified in Table 6.2.3.1.2.1-2;
- b) The ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be $\geq \gamma$, where γ is specified in Table 6.2.3.1.2.1-2;
- c) When transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater than or equal to 0.02.

Table 6.2.3.1.2.1-1: Wideband CQI reporting test under frequency non-selective fading conditions

	Parameter	Unit	Test 1	Test 2
Bandwidth		MHz	1	0
Subcarrier spacing		kHz	1	5
Duplex Mode			FC	DD
SNR		dB	3 4	9 10
Propagation channel			TDLA	\30-5
Antenna configuration			2>	
Correlation configu			XP I	
Beamforming Mod			As specified in	
J	CSI-RS resource Type		Peri	
	Number of CSI-RS ports (X)		4	1
	CDM Type		FD-C	DM2
ZP CSI-RS	Density (ρ)		1	
	First subcarrier index in the PRB		D	. 5. 4
configuration	used for CSI-RS (k ₀)		Row	7 5,4
	First OFDM symbol in the PRB used			`
	for CSI-RS (I ₀)		9	1
	CSI-RS	slot	5/	/1
	periodicity and offset	SIOL	3/	1
	CSI-RS resource Type		Peri	odic
	Number of CSI-RS ports (X)		2	2
	CDM Type		FD-C	DM2
NZP CSI-RS for	Density (ρ)		1	
CSI acquisition	First subcarrier index in the PRB		Dow (2 (6)
CSI acquisition	used for CSI-RS (k ₀ , k ₁)		Row	5,(6,-)
	First OFDM symbol in the PRB used		1	2
	for CSI-RS (I ₀)		13	
	NZP CSI-RS-timeConfig	slot	5/	/1
	periodicity and offset	SIOL		
	CSI-IM resource Type		Peri	odic
	CSI-IM RE pattern		()
CSI-IM	CSI-IM Resource Mapping			
configuration	(Ксы-ім,Ісы-ім)		(4,	9)
garaner.				
	CSI-IM timeConfig	slot	5/	/1
D (0 (" T	periodicity and offset		5	P
ReportConfigType			Peri	
CQI-table			Tab	
reportQuantity	Ol IM		cri-RI-P	
	ChannelMeasurements		Not con	
	InterferenceMeasurements		Not con	
cqi-FormatIndicato			Wide	
pmi-FormatIndicat	or	DD	Wide	
Sub-band Size		RB	3	
csi-ReportingBand			1111	
CSI-Report period		slot	5/	
aperiodicTriggerin				nfigured
	Codebook Type		typel-Sin	
Cadabast	Codebook Mode		1	l
Codebook	(CodebookConfig-		Not con	nfigured
configuration	N1,CodebookConfig-N2) CodebookSubsetRestriction			
			000 N/	
RI Restriction				
Physical channel for CSI report			PUC	
CQI/RI/PMI delay Maximum number of HARQ transmission		ms	8	
iviaximum number	OI HAKŲ TRANSMISSION		As an acifical in To	
Measurement cha	nnel		As specified in Ta	
		l	1	l

Table 6.2.3.1.2.1-2: Minimum requirements

Parameters	Test 1	Test 2
α[%]	5	5
γ	1.05	1.05

6.2.3.1.2.2 Minimum requirement for sub-band CQI reporting

The purpose of the requirements is to verify that the preferred sub-bands can be used for frequency-selective scheduling under the frequency-selective fading conditions.

The accuracy of sub-band channel CQI reporting under the frequency-selective fading conditions is determined by a double-sided percentile of the reported differential CQI offset level 0 per sub-band, and the relative increase of the throughput obtained when transmitting the transport format indicated by the corresponding reported sub-band CQI on a randomly selected sub-band among the sub-bands with the highest reported differential CQI offset level compared to the throughput when transmitting a fixed transport format according to the wideband CQI median on a randomly selected sub-band among all the sub-bands. To account for sensitivity of the input SNR the sub-band CQI reporting under frequency selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

For the parameters specified in Table 6.2.3.1.2.2-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) A sub-band differential CQI offset level of 0 shall be reported at least $\alpha\%$ of the time but less than $\beta\%$ of the time for each sub-band, where α and β are specified in Table 6.2.3.1.2.2-2;
- b) The ratio of the throughput obtained when transmitting the corresponding transport format on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level and that obtained when transmitting the transport format indicated by the reported wideband CQI median on a randomly selected sub-band among all the sub-bands shall be $\geq \gamma$, where γ is specified in Table 6.2.3.1.2.2-2;
- c) When transmitting the corresponding transport format on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level, the average BLER for the indicated transport format shall be greater than or equal to 0.02.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each TTI for FDD.

Table 6.2.3.1.2.2-1: Sub-band CQI reporting test under frequency-selective fading conditions

	Parameter	Unit	Test 1 Test 2
Bandwidth	Bandwidth		10
Subcarrier spacing		kHz	15
Duplex Mode			FDD
SNR			5 6 11 12
		dB	Two tap model specified in Annex
Propagation chan	inel		B.2.4 with $a=1$, $f_D = 5$ Hz, and
opaganon onan			τ _d =0.45μs
Antenna configura	ation		2×4
Correlation config			As per Annex B.1
Beamforming Mod			As specified in Annex B.4.1
Dearmorning Wo	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		4
	1 ()		FD-CDM2
	CDM Type		1 1
ZP CSI-RS	Density (ρ)		1
configuration	First subcarrier index in the PRB		Row 5,4
· ·	used for CSI-RS (k ₀)		,
	First OFDM symbol in the PRB used		9
	for CSI-RS (I ₀)		,
	CSI-RS	slot	5/1
	periodicity and offset		
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		2
	CDM Type		FD-CDM2
NZD COLDC for	Density (ρ)		1
NZP CSI-RS for	First subcarrier index in the PRB		D 0 (0)
CSI acquisition	used for CSI-RS (k ₀ , k ₁)		Row 3,(6,-)
	First OFDM symbol in the PRB used		10
	for CSI-RS (I ₀)		13
	NZP CSI-RS-timeConfig		
	periodicity and offset	slot	5/1
	CSI-IM resource Type		Periodic
	CSI-IM RE pattern		0
	CSI-IM Resource Mapping		, , ,
CSI-IM	(kcsi-im, lcsi-im)		(4, 9)
configuration	(NCSI-IM,ICSI-IM)		(4, 5)
	CSI-IM timeConfig		
	periodicity and offset	slot	5/1
ReportConfigType			Aperiodic
CQI-table	~		Table 2
reportQuantity			cri-RI-PMI-CQI
	rChannelMeasurements		
			Not configured
	rInterferenceMeasurements		Not configured
cqi-FormatIndicat			Subband
pmi-FormatIndica	tor		Wideband
Sub-band Size		RB	8
csi-ReportingBan			1111111
CSI-Report interv		slot	Not configured
Aperiodic Report	Slot Offset		5
CSI request			1 in slots i, where $mod(i, 5) = 1$,
Correquest			otherwise it is equal to 0
reportTriggerSize			1
			One State with one Associated
			Report Configuration
CSI-AperiodicTrig	gerStateList		Associated Report Configuration
	-		contains pointers to NZP CSI-RS
			and CSI-IM
aperiodicTriggerin	aperiodicTriggeringOffset		Not configured
. 55	Codebook Type		typel-SinglePanel
	Codebook Mode		1
Codebook	(CodebookConfig-		
configuration	N1,CodebookConfig-N2)		Not configured
Samgaration	CodebookSubsetRestriction		000001
	RI Restriction		N/A
			IN/A
Dhysical channel			ם ופרם
Physical channel CQI/RI/PMI delay	for CSI report	ms	PUSCH 8

Maximum number of HARQ transmission	1
Measurement channel	As specified in Table A.4-2, TBS.2-5

Table 6.2.3.1.2.2-2: Minimum requirements

Parameters	Test 1	Test 2
α [%]	2	2
β [%]	55	55
γ	1.05	1.05

6.2.3.2 TDD

6.2.3.2.1 CQI reporting definition under AWGN

6.2.3.2.1.1 Minimum requirement for CQI periodic reporting

The purpose of the requirements is to verify that the reported CQI values are in accordance with the CQI definition given in TS38.214 [12]. The reporting accuracy of CQI under AWGN condition is determined by the reporting variance and BLER performance using the transport format indicated by the reported CQI median. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

For the parameters specified in Table 6.2.3.2.1.1-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) The reported CQI value according to the reference channel shall be in the range of ± 1 of the reported median more than 90% of the time.
- b) If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, then the BLER using transport format indicated by (median CQI-1) shall be less than or equal to 0.1.

Table 6.2.3.2.1.1-1: CQI reporting definition test

	Parameter	Unit	Test 1	Test 2
Bandwidth	Bandwidth		40	
Subcarrier spacin			30	
Duplex Mode	Duplex Mode		TD	D
TDD UL-DL patte	rn		FR1.3	30-1
SNR		dB	5 6	11 12
Propagation chan	nel		AWC	SN .
Antenna configura	ation		2x4 with static cha Annex	
Beamforming Mod	del		As specified in	
G	CSI-RS resource Type		Perio	
	Number of CSI-RS ports (X)		4	
	CDM Type		FD-CI	DM2
ZP CSI-RS	Density (ρ)		1	
	First subcarrier index in the PRB		Daw	Γ Λ
configuration	used for CSI-RS (k ₀)		Row	5,4
	First OFDM symbol in the PRB used		0	
	for CSI-RS (I ₀)		9	
	CSI-RS		404	4
	periodicity and offset	slot	10/	1
	CSI-RS resource Type		Perio	dic
	Number of CSI-RS ports (X)		2	
	CDM Type		FD-CI	DM2
	Density (ρ)		1	
NZP CSI-RS for	Denoity (b)			
CSI acquisition	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 3	,(6,-)
	First OFDM symbol in the PRB used for CSI-RS (I ₀)		13	}
	NZP CSI-RS-timeConfig periodicity and offset	slot	10/	1
	CSI-IM resource Type		Perio	dic
	CSI-IM RE pattern		0	
CSI-IM configuration	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(4,	9)
	CSI-IM timeConfig periodicity and offset	slot	10/	1
ReportConfigType	9		Perio	dic
CQI-table			Table	e 2
reportQuantity			cri-RI-PI	/II-CQI
timeRestrictionFo	rChannelMeasurements		Not conf	igured
timeRestrictionFo	rInterferenceMeasurements		Not conf	igured
cqi-FormatIndicate	or		Wideb	
pmi-FormatIndica	tor		Wideb	and
Sub-band Size		RB	16	
csi-ReportingBand	d		1111	111
CSI-Report period		slot	10/	
aperiodicTriggerin			Not conf	
1 335	Codebook Type		typel-Sing	
	Codebook Mode		1	
Codebook configuration	(CodebookConfig- N1,CodebookConfig-N2)		Not conf	igured
·	CodebookSubsetRestriction		0100	
	RI Restriction		N/A	<i>H</i>
Physical channel	Physical channel for CSI report		PUC	CH
CQI/RI/PMI delay	·	ms	9.5	
	r of HARQ transmission	-	1	
Measurement cha			As specified in Tab	ole A.4-2, TBS.2-
<u> </u>			· ·	

6.2.3.2.1.2 Minimum requirement for CQI periodic reporting with Table 3

The purpose of the requirements is to verify that the reported CQI values are in accordance with the CQI definition given in TS38.214 [12]. The reporting accuracy of CQI under AWGN condition is determined by the reporting variance and BLER performance using the transport format indicated by the reported CQI median. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

For the parameters specified in Table 6.2.3.2.1.2-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) The reported CQI value according to the reference channel shall be in the range of ± 1 of the reported median more than 90% of the time.
- b) If the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 10⁻⁵, then the BLER using the transport format indicated by the (median CQI+1) shall be greater than 10⁻⁵. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 10⁻⁵, then the BLER using transport format indicated by (median CQI-1) shall be less than or equal to 10⁻⁵.
- c) The reported CQI value according to the reference channel shall be ≥ 1 .

Table 6.2.3.2.1.2-1: CQI reporting definition test

	Parameter		Test 1
Bandwidth	ndwidth MHz		40
Subcarrier spacin	g	kHz	30
Duplex Mode			TDD
TDD UL-DL patte	rn		FR1.30-1
SNR		dB	[-2] [-1]
Propagation chan	nel		AWGN
Antenna configura	ation		1x4 with static channel specified in Annex B.1
Beamforming Mod	del		As specified in Annex B.4.1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		4
	CDM Type		FD-CDM2
	Density (ρ)		1
ZP CSI-RS configuration	First subcarrier index in the PRB used for CSI-RS (k ₀)		Row 5,4
	First OFDM symbol in the PRB used for CSI-RS (I ₀)		9
	CSI-RS periodicity and offset	slot	10/1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		1
	CDM Type		No CDM
	Density (ρ)		3
NZP CSI-RS for			
CSI acquisition	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 1,(0,-)
	First OFDM symbol in the PRB used for CSI-RS (I ₀)		1
	NZP CSI-RS-timeConfig periodicity and offset	slot	10/1
	CSI-IM resource Type		Periodic
	CSI-IM RE pattern		0
CSI-IM configuration	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(4, 9)
	CSI-IM timeConfig periodicity and offset	slot	10/1

ReportConfigType			Periodic
CQI-table			Table 3
reportQuantity			cri-RI-PMI-CQI
timeRestrictionFor	ChannelMeasurements		Not configured
timeRestrictionFor	InterferenceMeasurements		Not configured
cqi-FormatIndicato	or		Wideband
pmi-FormatIndicate	or		Wideband
Sub-band Size		RB	16
csi-ReportingBand			1111111
CSI-Report period	icity and offset	slot	10/9
aperiodicTriggering	gOffset		Not configured
	Codebook Type		typel-SinglePanel
	Codebook Mode		1
Codebook configuration	(CodebookConfig- N1,CodebookConfig-N2)		Not configured
	CodebookSubsetRestriction		000001
	RI Restriction		N/A
Physical channel for CSI report			PUCCH
CQI/RI/PMI delay		ms	9.5
Maximum number of HARQ transmission			1
Measurement channel			As specified in Table A.4-4, TBS.4-2

6.2.3.2.2 CQI reporting under fading conditions

6.2.3.2.2.1 Minimum requirement for wideband CQI reporting

The purpose of the requirements is to verify that the UE is tracking the channel variations and selecting the largest transport format possible according to the prevailing channel state for the frequency non-selective scheduling.

The reporting accuracy of CQI under frequency non-selective fading conditions is determined by the reporting variance, the relative increase of the throughput obtained when the transport format is indicated by the reported CQI compared to the throughput obtained when a fixed transport format is configured according to the reported median CQI, and a minimum BLER using the transport formats indicated by the reported CQI. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

For the parameters specified in Table 6.2.3.2.2.1-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) A CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least $\alpha\%$ of the time where $\alpha\%$ is specified in Table 6.2.3.2.2.1-2;
- b) The ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be $\geq \gamma$, where γ is specified in Table 6.2.3.2.2.1-2;
- c) When transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater than or equal to 0.02.

Table 6.2.3.2.2.1-1: Wideband CQI reporting test under frequency non-selective fading conditions

	Parameter	Unit	Test 1 Test 2
Bandwidth		MHz	40
Subcarrier spacing		kHz	30
Duplex Mode			TDD
TDD UL-DL patter	rn		FR1.30-1
SNR		dB	3 4 9 10
Propagation chan			TDLA30-5
Antenna configura			2×4
Correlation config			XP High
Beamforming Mod			As specified in Annex B.4.1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		4 FD-CDM2
	CDM Type Density (p)		1 1
ZP CSI-RS	First subcarrier index in the PRB		l l
configuration	used for CSI-RS (k ₀)		Row 5,4
	First OFDM symbol in the PRB used for CSI-RS (I ₀)		9
	CSI-RS periodicity and offset	slot	10/1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		2
	CDM Type		FD-CDM2
NZP CSI-RS for	Density (ρ)		1
CSI acquisition	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 3,(6,-)
	First OFDM symbol in the PRB used for CSI-RS (I ₀)		13
	NZP CSI-RS-timeConfig periodicity and offset	slot	10/1
	CSI-IM resource Type		Periodic
	CSI-IM RE pattern		0
CSI-IM configuration	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(4, 9)
	CSI-IM timeConfig periodicity and offset	slot	10/1
ReportConfigType			Periodic
CQI-table			Table 2
reportQuantity			cri-RI-PMI-CQI
timeRestrictionFo	rChannelMeasurements		Not configured
	rInterferenceMeasurements		Not configured
cqi-FormatIndicate			Wideband
pmi-FormatIndica	tor		Wideband
Sub-band Size		RB	16
csi-ReportingBand			111111
CSI-Report periodicity and offset		slot	10/9
aperiodicTriggerin	<u> </u>		Not configured
	Codebook Type		typel-SinglePanel
Codebook	Codebook Mode (CodebookConfig-		1
configuration	N1,CodebookConfig-N2)		Not configured
	CodebookSubsetRestriction		000001
RI Restriction Physical channel for CSI report			N/A PUCCH
CQI/RI/PMI delay	ioi coi report	mo	9.5
	of HARQ transmission	ms	9.5
iviaxiiiiuiii iiuiiiDel	OF FIANG HAIISHIIISSIUH		As specified in Table A.4-2, TBS.2-
Measurement cha	nnel		3

Table 6.2.3.2.2.1-2: Minimum requirements

Parameters	Test 1	Test 2
α[%]	5	5
γ	1.05	1.05

6.2.3.2.2.2 Minimum requirement for sub-band CQI reporting

The purpose of the requirements is to verify that the preferred sub-bands can be used for frequency-selective scheduling under the frequency-selective fading conditions.

The accuracy of sub-band channel CQI reporting under the frequency-selective fading conditions is determined by a double-sided percentile of the reported differential CQI offset level 0 per sub-band, and the relative increase of the throughput obtained when transmitting the transport format indicated by the corresponding reported sub-band CQI on a randomly selected sub-band among the sub-bands with the highest reported differential CQI offset level compared to the throughput when transmitting a fixed transport format according to the wideband CQI median on a randomly selected sub-band among all the sub-bands. To account for sensitivity of the input SNR the sub-band CQI reporting under frequency selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

For the parameters specified in Table 6.2.3.2.2.2-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

- a) A sub-band differential CQI offset level of 0 shall be reported at least $\alpha\%$ of the time but less than $\beta\%$ of the time for each sub-band, where α and β are specified in Table 6.2.3.2.2.2-2;
- b) The ratio of the throughput obtained when transmitting the corresponding transport format on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level and that obtained when transmitting the transport format indicated by the reported wideband CQI median on a randomly selected sub-band among all the sub-bands shall be $\geq \gamma$, where γ is specified in Table 6.2.3.2.2.2-2;
- c) When transmitting the corresponding transport format on a randomly selected sub-band among the sub-bands with the highest differential CQI offset level, the average BLER for the indicated transport format shall be greater than or equal to 0.02.

The requirements only apply for sub-bands of full size and the random scheduling across the sub-bands is done by selecting a new sub-band in each available downlink transmission instance for TDD.

Table 6.2.3.2.2.1: Sub-band CQI reporting test under frequency-selective fading conditions

	Parameter	Unit	Test 1 Test 2
Bandwidth		MHz	40
Subcarrier spacin	g	kHz	30
Duplex Mode			TDD
TDD UL-DL patte	rn		FR1.30-1
SNR		dB	5 6 11 12
Propagation chan	nnel		Two tap model specified in Annex B.2.4 with $a=1$, $f_D=5$ Hz, and $\tau_d=0.1125\mu s$
Antenna configura	ation		2×4
Correlation config			As per Annex B.1
Beamforming Mod	del		As specified in Annex B.4.1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		4
	CDM Type		FD-CDM2
ZD COLDO	Density (ρ)		1
ZP CSI-RS configuration	First subcarrier index in the PRB used for CSI-RS (k ₀)		Row 5,4
	First OFDM symbol in the PRB used for CSI-RS (I ₀)		9
	CSI-RS periodicity and offset	slot	10/1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		2
	CDM Type		FD-CDM2
NZP CSI-RS for	Density (ρ)		1
CSI acquisition	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 3,(6,-)
	First OFDM symbol in the PRB used for CSI-RS (I ₀)		13
	NZP CSI-RS-timeConfig periodicity and offset	slot	10/1
	CSI-IM resource Type		Periodic
	CSI-IM RE pattern		0
CSI-IM configuration	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(4, 9)
	CSI-IM timeConfig periodicity and offset	slot	10/1
ReportConfigType	e		Aperiodic
CQI-table			Table 2
reportQuantity			cri-RI-PMI-CQI
	rChannelMeasurements		Not configured
timeRestrictionFo	orInterferenceMeasurements		Not configured
cqi-FormatIndicat			Subband
pmi-FormatIndica	tor		Wideband
Sub-band Size		RB	16
csi-ReportingBan			1111111
CSI-Report interv		slot	Not configured
Aperiodic Report	Slot Offset		8 1 in slots i, where mod(i, 10) = 1,
CSI request			otherwise it is equal to 0
reportTriggerSize CSI-AperiodicTrig			One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
aperiodicTriggerin	ngOffset		0
aponodio miggeni	Codebook Type		typel-SinglePanel
	Codebook Node		1
Codebook	(Codebook Config-		1
configuration	N1,CodebookConfig-N2)		Not configured
Johngaradon	CodebookSubsetRestriction		000001
1	RI Restriction		N/A
	TO RESUICION		14/73

CQI/RI/PMI delay	ms	9.5
Maximum number of HARQ transmission		1
Measurement channel		As specified in Table A.4-2, TBS.2-6

Table 6.2.2.1.2.2-2: Minimum requirements

Parameters	Test 1	Test 2
<i>α</i> [%]	2	2
β [%]	55	55
γ	1.05	1.05

6.2A Reporting of Channel Quality Indicator (CQI) for CA

6.2A.1 General

This clause includes the requirements for the reporting of channel quality indicator (CQI) with the UE configured for CA. The purpose is to verify that the CQI is correctly reported in accordance with the CQI definition given in TS 38.214 [12] for each CC with multiple cells configured for periodic reporting.

6.2A.2 1RX requirements

(Void)

6.2A.3 2RX requirements

6.2A.3.1 CQI reporting definition under AWGN conditions

6.2A.3.1.1 Minimum requirement for periodic CQI reporting

For each CA CQI reporting test defined in Table 6.2A.3.1.1-6, the test requirements and the test parameters are defined as below.

For each CC, the test parameters are specified in Table 6.2A.3.1.1-1. The additional parameters specified in Table 6.2A.3.1.1-2 are applicable for tests on FDD CC. The additional parameters specified in Table 6.2A.3.1.1-3 are applicable for tests on TDD CC.

For CA with 2 DL CC, for the SNR configuration specified in Table 6.2A.3.1.1-4, and using the downlink physical channels specified in Annex C.3.1 on each CC, the difference between the wideband CQI indices of PCell and SCell reported shall be such that

wideband
$$CQI_{PCell}$$
 – wideband $CQI_{SCell} \ge 2$

for more than 90% of the time.

For CA with 3 or more DL CC, for the SNR configuration specified in Table 6.2A.3.1.1-5, and using the downlink physical channels specified in Annex C.3.1 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell1 and SCell2, 3... reported shall be such that

wideband
$$CQI_{PCell}$$
 – wideband $CQI_{SCell1} \ge 2$

wideband CQI_{SCell1} – wideband $CQI_{SCell2, 3...} \ge 2$

for more than 90% of the time.

Table 6.2A.3.1.1-1: CA CQI reporting test parameters for FDD and TDD CC

	Parameter	Unit	Value
Propagation chan	nel		AWGN
Antenna configuration			1x2 with static channel specified in
Antenna comigura	ation		Annex B.1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		4
ZP CSI-RS	CDM Type		FD-CDM2
configuration	Density (ρ)		1
comiguration	First subcarrier index in the PRB used for CSI-RS (k ₀)		Row 5, 4
	First OFDM symbol in the PRB used for CSI-RS (I ₀)		9
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		1
NIZD COL DO (CDM Type		No CDM
NZP CSI-RS for	Density (p)		1
CSI acquisition	First subcarrier index in the PRB used for CSI-RS (k ₀)		Row 2, 6
	First OFDM symbol in the PRB used for CSI-RS (I ₀)		13
	CSI-IM resource Type		Periodic
CSI-IM	CSI-IM RE pattern		0
configuration	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(4, 9)
ReportConfigType	, ,		Periodic
CQI-table			Table 2
reportQuantity			cri-RI-PMI-CQI
timeRestrictionFo	rChannelMeasurements		Not configured
timeRestrictionFo	rInterferenceMeasurements		Not configured
cqi-FormatIndicator			Wideband
pmi-FormatIndicator			Wideband
Csi-ReportingBand			1111111
aperiodicTriggeringOffset			Not configured
Physical channel for CSI report			PUCCH
Maximum numbe	r of HARQ transmission		1
Measurement cha	annel		Derived as per section 5.1.3.2 of TS 38.214 [12]

Table 6.2A.3.1.1-2: Additional test parameters for FDD CC

	Parameter	Unit	Value
Duplex Mode			FDD
Subcarrier spacin	g	kHz	15
ZP CSI-RS	CSI-RS	slot	5/1
configuration	periodicity and offset	SIOL	3/1
NZP CSI-RS for	NZP CSI-RS-timeConfig	slot	5/1
CSI acquisition	periodicity and offset	Siot	3/1
CSI-IM	CSI-IM timeConfig	slot	5/1
configuration	periodicity and offset	3101	3/1
CSI-Report period	licity and offset	slot	5/0
CQI/RI/PMI delay		ms	8
			8 for 5MHz and 10MHz,
Sub-band Size		RB	16 for 15MHz, 20MHz and 25MHz,
			32 for 30MHz, 40MHz and 50MHz

Table 6.2A.3.1.1-3: Additional test parameters for TDD CC

	Parameter	Unit	Value
Duplex Mode	Duplex Mode		TDD
Subcarrier spacin	g	kHz	30
TDD UL-DL patte	rn		FR1.30-1
ZP CSI-RS configuration	CSI-RS periodicity and offset	slot	10/1
NZP CSI-RS for CSI acquisition	NZP CSI-RS-timeConfig periodicity and offset	slot	10/1
CSI-IM configuration	CSI-IM timeConfig periodicity and offset	slot	10/1
CSI-Report periodicity and offset		slot	10/9
CQI/RI/PMI delay		ms	9.5
Sub-band Size		RB	8 for 10MHz, 15MHz, 20MHz and 25MHz, 16 for 30MHz, 40MHz and 50MHz, 32 for 60MHz, 80MHz, 90MHz and 100MHz

Table 6.2A.3.1.1-4: SNR configurations for 2 DL CA

Parameter	PCell	SCell
SNR (dB)	10.0	4.0

Table 6.2A.3.1.1-5: SNR configurations for 3 or more DL CA

Parameter	PCell	SCell1	SCell2, 3
SNR (dB)	12.0	6.0	0.0

Table 6.2A.3.1.1-6: List of CA CQI reporting test

Test number CA duplex mode and SCS combination		CA duplex mode and SCS combination	
1 FDD 15 kHz + TDD 30 kHz		FDD 15 kHz + TDD 30 kHz	
2		FDD 15 kHz + FDD 15 kHz	
3 TDD 30 kHz + TDD 30 kHz		TDD 30 kHz + TDD 30 kHz	
Note 1:		The applicability of requirements for different CA duplex modes, SCSs, s defined in 6.1.1.5.1.	
Note 2: The applicability of requirements for different CA configurations and bandwidth combination sets is defined in 6.1.1.5.2.			

6.3 Reporting of Precoding Matrix Indicator (PMI)

The minimum performance requirements of PMI reporting are defined based on the precoding gain, expressed as the relative increase in throughput when the transmitter is configured according to the UE reported PMI compared to the case when the transmitter is using random precoding, respectively. When the transmitter uses random precoding, for each PDSCH allocation a precoder is randomly generated with equal propability of each applicable i_1 and i_2 combination and applied to the PDSCH. A fixed transport format (FRC) is configured for all requirements.

The requirements for transmission mode 1 with higher layer parameter *codebookType* set to 'typeI-SinglePanel' are specified in terms of the ratio:

$$\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$$

In the definition of γ , for 4TX, 8TX, 16TX, and 32TX PMI requirements, $t_{follow1,follow2}$ is 90 % of the maximum throughput obtained at $SNR_{follow1,follow2}$ using the precoders configured according to the UE reports, and $t_{rnd1,rnd2}$ is the throughput measured at $SNR_{follow1,follow2}$ with random precoding.

The requirements for transmission mode 1 with higher layer parameter *codebookType* set to 'typeII' or 'typeII-r16' are specified in terms of the ratio:

$$\gamma = \frac{t_{ue, follow1, follow2}}{t_{rnd1, rnd2}}$$

In the definition of γ , for 16TX PMI requirements, $t_{ue,follow1,follow2}$ is 90 % of the maximum throughput obtained at $SNR_{follow1,follow2}$ using the precoders configured according to the UE reports, and $t_{rnd1,rnd2}$ is the throughput measured at $SNR_{follow1,follow2}$ with random precoding.

6.3.1 1RX requirements

(Void)

6.3.2 2RX requirements

6.3.2.1 FDD

6.3.2.1.1 Single PMI with 4TX Typel-SinglePanel Codebook

For the parameters specified in Table 6.3.2.1.1-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.1.1-2.

Table 6.3.2.1.1-1: Test parameters (single layer)

Pai	rameter	Unit	Test 1
Bandwidth		MHz	10
Subcarrier spaci	ing	kHz	15
Duplex Mode			FDD
Propagation cha	innel		TDLA30-5
Antenna configu			High XP 4 x 2
Antenna conligu	iration		(N1,N2) = (2,1)
Beamforming Me	odel		As specified in Annex B.4.1
	CSI-RS resource		Periodic
	Type		renodic
	Number of CSI-RS		4
	ports (X)		7
	CDM Type		FD-CDM2
	Density (ρ)		1
ZP CSI-RS	First subcarrier		
configuration	index in the PRB		Row 5, (4,-)
Comigaration	used for CSI-RS		11000 0, (1,)
	(k_0, k_1)		
	First OFDM		
	symbol in the PRB		(9,-)
	used for CSI-RS		(0,)
	(l ₀ , l ₁)		
	CSI-RS	slot	5/1
	interval and offset		
	CSI-RS resource		Aperiodic
	Type		'
	Number of CSI-RS		4
	ports (X)		ED ODMO
	CDM Type		FD-CDM2
	Density (ρ)		1
NZD CCL DC	First subcarrier		
NZP CSI-RS for CSI	index in the PRB used for CSI-RS		Row 4, (0,-)
acquisition	(k ₀ , k ₁) First OFDM		
	symbol in the PRB		
	used for CSI-RS		(13,-)
	(l ₀ , l ₁)		
	CSI-RS		
	interval and offset		Not configured
	aperiodicTriggering		
	Offset		0
	CSI-IM resource		
	Type		Aperiodic
	CSI-IM RE pattern		Pattern 0
CSI-IM	CSI-IM Resource		. anom o
configuration	Mapping		(4,9)
	(kcsi-im,lcsi-im)		(1,2)
	CSI-IM timeConfig	-1-4	Net
	interval and offset	slot	Not configured
ReportConfigTyp			Aperiodic
CQI-table			Table 1
reportQuantity			cri-RI-PMI-CQI
timeRestrictionF	orChannelMeasure		Not configured
ments			Not configured
timeRestrictionF	orInterferenceMeasu		Not configured
rements			Ţ
	cqi-FormatIndicator		Wideband
pmi-FormatIndicator			Wideband
Sub-band Size		RB	8
csi-ReportingBand			1111111
	CSI-Report interval and offset		Not configured
	Aperiodic Report Slot Offset		4
CSI request	CSI request		1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0
reportTriggerSiz	e		1

CSI-AperiodicTriggerStateList			One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
	Codebook Type		typel-SinglePanel
	Codebook Mode		1
Codebook	(CodebookConfig- N1,CodebookConfi g-N2)		(2,1)
configuration	(CodebookConfig- O1,CodebookConfi g-O2)		(4,1)
	CodebookSubsetR estriction		11111111
	RI Restriction		0000001
Physical channe	I for CSI report		PUSCH
CQI/RI/PMI delay		ms	6
Maximum number of HARQ transmission			4
Measurement channel			R.PDSCH.1-6.1 FDD

Note 1: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (1 ms granularity) with equal probability of each applicable i₁, i₂ combination.

Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-3), this reported PMI cannot be applied at the gNB downlink before slot#(n+3).

Note 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.

Table 6.3.2.1.1-2: Minimum requirement

Parameter	Test 1
γ	1.3

6.3.2.1.2 Single PMI with 8TX TypeI-SinglePanel Codebook

For the parameters specified in Table 6.3.2.1.2-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.1.2-2.

Table 6.3.2.1.2-1: Test parameters (dual-layer)

Bandwidth	Pai	rameter	Unit	Test 1
Duplex Mode				I.
Propagation channel		ing	kHz	
Antenna configuration				
Beamforming Model	Propagation cha	annel		
Beamforming Model CSI-RS resource Type Number of CSI-RS ports (X) CDM Type Density (p) First subcarrier index in the PRB used for CSI-RS (b, h') CSI-RS resource Type Number of CSI-RS Configuration First Subcarrier index in the PRB used for CSI-RS (b, h') CSI-RS (b, h') CSI-RS First Subcarrier index in the PRB used for CSI-RS (b, h') CSI-RS First Subcarrier index in the PRB used for CSI-RS (b, h') CSI-RS First Subcarrier index in the PRB used for CSI-RS (b, h') CSI-RS First Subcarrier index in the PRB used for CSI-RS for CSI acquisition NZP CSI-RS for CSI acquisition NZP CSI-RS (b, k') CSI-RS (b, k') First OFDM symbol in the PRB used for CSI-RS (b, k') First OFDM Symbol in the PRB used for CSI-RS (b, k') CSI-RS (lo, h') CSI-RS (lo, h') CSI-RS (lo, h') CSI-RS (lo, h') CSI-MR resource Type CSI-IM Resource Type CSI-IM Resource Mapping (kcsi-Mc, Lcsi-M) CSI-IM TimeConfig interval and offset Not configured Table 1 reportConfigType Table 1 reportQuantity timeRestrictionForChannelMeasure ments Not configured Table 1 reportQuantity timeRestrictionForChannelMeasure ments Not configured	Antenna configu	ıration		
CSI-RS resource Type Periodic Type Density (p) Tirst subcarrier index in the PRB used for CSI-RS (b, h;) CSI-RS resource Type Aperiodic Number of CSI-RS (b, h;) First OFDM Symbol in the PRB used for CSI-RS (b, h;) CSI-RS resource Type Aperiodic Number of CSI-RS Acquisition Acqu				
Type	Beamforming M			As specified in Annex B.4.1
Number of CSI-RS ports (X) CDM Type FD-CDM2				Periodic
Donts (X) CDM Type Density (p) To-CDM2				
CDM Type Density (p) 1 Density (p) 1 First subcarrier index in the PRB used for CSI-RS (ko, kr) First OFDM symbol in the PRB used for CSI-RS (lo, lr) CSI-RS resource Type Number of CSI-RS ports (X) CDM Type CDM4 (FD2, TD2) Density (p) 1 First subcarrier index in the PRB used for CSI-RS ports (X) CDM Type CDM4 (FD2, TD2) Density (p) 1 First subcarrier index in the PRB used for CSI-RS acquisition NZP CSI-RS for CSI as interval and offset aperiodic Triggerin QOffset CSI-RS (ko, kr) First OFDM symbol in the PRB used for CSI-RS (ko, lr) CSI-RS interval and offset aperiodic Triggerin QOffset CSI-IM resource Type Aperiodic CSI-IM RE pattern Pattern Pattern 0 CSI-IM Resource Mapping (kcs)IIM Resource Mapping (kcs)IIM Resource Type Aperiodic ReportConfigType Aperiodic ReportConfigType Aperiodic ReportConfigType Aperiodic ReportConfigType Aperiodic ReportConfigType Aperiodic Table 1 reportQuantity timeRestrictionFortchannelMeasure ments timeRestrictionForChannelMeasure ments UnimeRestrictionForChannelMeasure ments UnimeRestrictionForInterferenceMeas urements QGI-FormatIndicator Wideband Dyb-band Size RB 8 CSI-ReportingBand 11111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset Slot Not configured 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0				4
Density (p) First subcarrier index in the PRB used for CSI-RS (ko, kr)				ED CDM2
ZP CSI-RS Configuration First subcarrier index in the PRB used for CSI-RS (ko, kt)				
index in the PRB used for CSI-RS (ko, k1) First OFDM symbol in the PRB used for CSI-RS (lo, l1) CSI-RS (lo, l1) CSI-RS (lo, l1) CSI-RS resource Type Number of CSI-RS ports (X) CDM Type Density (p) First subcarrier index in the PRB used for CSI-RS (ko, k1) First OFDM Symbol in the PRB used for CSI-RS ports (X) CDM Type Density (p) First subcarrier index in the PRB used for CSI-RS (ko, k1) First OFDM Symbol in the PRB used for CSI-RS (ko, k1) CSI-RS interval and offset aperiodic Triggerin gOffset CSI-IM resource Type CSI-IM RE pattern CSI-IM REsource Type CSI-IM Resource Mapping (kcsi-Mi-Csi-M) CSI-RB slot Not configured interval and offset aperiodic Triggerin goffset CSI-IM resource Type CSI-IM Sesource Mapping (kcsi-Mi-Csi-M) CSI-IM timeConfig interval and offset ReportConfigType CQI-table Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasure ments urements Videband Density (p) Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasure ments RB 8 CGI-FormatIndicator Wideband Density (p) Table 1 Table				'
used for CSI-RS (ko, kr) First OFDM symbol in the PRB used for CSI-RS (lo, lr) CSI-RS interval and offset CSI-RS resource Type Number of CSI-RS ports (X) CDM Type Density (p) First subcarrier index in the PRB used for CSI-RS acquisition NZP CSI-RS for CSI acquisition NZP CSI-RS (ko, kr) First OFDM symbol in the PRB used for CSI-RS (lo, lr) CSI-RS interval and offset aperiodicTriggerin qOffset CSI-IM resource Type CSI-IM RE pattern CSI-IM Resource CSI-IM Resource CSI-IM Immeconfig interval and offset solot ReportConfigType CSI-IM timeConfig interval and offset configuration ReportConfigType CQI-table ReportConfigType CQI-table ReportConfigTorChannelMeasure ments urements cqi-FormatIndicator Wideband Dyni-FormatIndicator SI-RB offset SI				
ReportConfiguration CSI-IM Resource Type CSI-IM Resource Type Aperiodic Tiggerin qOffset CSI-IM Resource Type Aperiodic Type Aperiodic Type Aperiodic Type Aperiodic Type CSI-RS (Io, It) CSI-IM Resource Type Aperiodic Tiggerin qOffset Aperiodic Tiggerin (CSI-IM Resource Type Aperiodic Tiggerin (Io, It) CSI-IM Resource Type Aperiodic Tiggerin qOffset Aperiodic Tiggerin (Io, It) CSI-IM Resource (Io, It) CSI-IM Resource Type Aperiodic Tiggerin qOffset Tiggerin qOffset Aperiodic Tiggerin qOffset Tigg	configuration			Row 5, (4,-)
First OFDM symbol in the PRB used for CSI-RS (lo, lr)				
Used for CSI-RS				
Used for CSI-RS				(0.)
CSI-RS interval and offset slot S/1				(9,-)
Interval and offset		(l ₀ , l ₁)		
Interval and offset CSI-RS resource Type Number of CSI-RS ports (X) CDM Type Density (p) First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁) First OFDM symbol in the PRB used for CSI-RS (l ₀ , l ₁) CSI-RS interval and offset aperiodicTriggerin gOffset CSI-IM resource Type CSI-IM RE pattern CSI-IM Resource Mapping (k _{CSI-IM} , l _{CSI-IM}) CSI-IM timeConfig interval and offset ReportConfigType CQI-table ReportQuantity timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements CSI-RB Row 8, (4,6) (5,-) (5,-) (5,-) (5,-) (6,-) (6,-) (6,-) (7,-) (1,-)		CSI-RS	clot	5/1
Type Number of CSI-RS ports (X) CDM Type Density (p) Tirst subcarrier index in the PRB used for CSI-RS (ko, kr) Tirst OFDM symbol in the PRB used for CSI-RS (lo, lt) CSI-RS interval and offset aperiodicTriggerin gOffset CSI-IM resource Type CSI-IM RE pattern CSI-IM CSI-IM Resource Mapping (kosI-IM-LCSI-IM) CSI-IM timeConfig interval and offset slot Not configured Type Aperiodic CSI-IM resource Type Not configured Table 1 Table 1 TeportQuantity TimeRestrictionForChannelMeasure ments TimeRestrictionForChannelMeasure ments TimeRestrictionForInterferenceMeas urements Cqi-FormatIndicator Wideband Type-FormatIndicator Wideband Sub-band Size Si-ReportingBand Till1111 CSI-Report interval and offset Aperiodic Report Slot Offset CSI request Tin slots i, where mod(i, 5) = 1, otherwise it is equal to 0			SIUL	3/1
Number of CSI-RS ports (X) CDM Type CDM4 (FD2, TD2)				Aperiodic
Density (P) CDM4 (FD2, TD2)		Туре		7 (portionio
Dotts (X) CDM Type Density (p) 1				8
Density (p)				
First subcarrier index in the PRB used for CSI-RS (ko, k1)				
NZP CSI-RS for CSI acquisition Index in the PRB used for CSI-RS (k ₀ , k ₁)				1
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	NZD COLDO			
acquisition (ko, k1) First OFDM symbol in the PRB used for CSI-RS (lo, l1) CSI-RS interval and offset aperiodicTriggerin gOffset CSI-IM resource Type CSI-IM RE pattern CSI-IM Resource Mapping (kcsi-IM, lcsi-IM) CSI-IM timeConfig interval and offset ginterval and offset Table 1 reportQuantity timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements timeRestrictionForInterferenceMeas urements sub-band Size csi-ReportingBand CSI request (ko, k1) First OFDM symbol (5,-) Slot Not configured Aperiodic Not configured Table 1 reportQuantity timeRestrictionForInterferenceMeas urements Not configured Viideband Sub-band Size Si-ReportingBand Tin In 111111 ScSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0				Row 8, (4,6)
First OFDM symbol in the PRB used for CSI-RS (lo, l₁) CSI-RS interval and offset aperiodicTriggerin gOffset CSI-IM resource Type CSI-IM RE pattern CSI-IM Resource Mapping (kcsi-im.lcsi-im) CSI-IM timeConfig interval and offset ReportConfigType ReportQuantity timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator Sub-band Size RB				
Symbol in the PRB used for CSI-RS (lo, l1) CSI-RS interval and offset aperiodicTriggerin gOffset CSI-IM resource Type CSI-IM RE pattern Pattern 0	acquisition			
used for CSI-RS (lo, l₁) CSI-RS interval and offset aperiodicTriggerin gOffset CSI-IM resource Type CSI-IM RE pattern CSI-IM Resource Mapping (kcsI-IM, lcSI-IM) CSI-IM timeConfig interval and offset ReportConfigType CQI-table Table 1 reportQuantity timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator pmi-FormatIndicator Sub-band Size RB RB RB RS csi-Report Slot Offset CSI request Not configured Sub-band Size RB S CSI Report Interval and offset Slot Not configured 1111111 Slots i, where mod(i, 5) = 1, otherwise it is equal to 0				(-)
CSI-RS interval and offset aperiodic Triggerin gOffset				(5,-)
CSI-RS interval and offset aperiodicTriggerin gOffset				
Interval and offset aperiodicTriggerin gOffset CSI-IM resource Type CSI-IM RE pattern Pattern 0		CSI-RS	alat	Not configured
GSI-IM resource Type CSI-IM RE pattern CSI-IM Resource Mapping (kcsi-im, lcsi-im) CSI-IM timeConfig interval and offset ReportConfigType CQI-table reportQuantity timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator pmi-FormatIndicator Sub-band Size CSI-Report interval and offset RB 8 csi-Report Slot Offset CSI request Aperiodic Not configured Not configured Wideband Wideband Table 1 Not configured Not configured Not configured Tourier			SIOL	Not configured
CSI-IM resource Type CSI-IM RE pattern Pattern 0		aperiodicTriggerin		0
CSI-IM COSI-IM RE pattern CSI-IM Resource Mapping (k _{CSI-IM} ,l _{CSI-IM}) CSI-IM timeConfig interval and offset Slot Not configured ReportConfigType Aperiodic CQI-table Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator Wideband pmi-FormatIndicator Wideband Sub-band Size RB 8 csi-Report interval and offset Slot Not configured Aperiodic Aperiodic Not configured Not configured Wideband Sub-band Size RB 8 csi-Report interval and offset Slot Not configured Aperiodic Report Slot Offset Slot Not configured 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0				Ů
CSI-IM RE pattern CSI-IM Resource Mapping (KcSI-IM, IcSI-IM) CSI-IM timeConfig interval and offset ReportConfigType CQI-table reportQuantity timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator pmi-FormatIndicator Sub-band Size csi-Report interval and offset CSI-IM Resource Mapping (4,9) (4,9) Not configured Not configured Not configured Not configured Wideband Wideband Sub-band Size RB 8 csi-ReportingBand CSI-Report interval and offset Aperiodic Report Slot Offset CSI request Table 1 Not configured Not configured Wideband Sub-band Size Size Size Size Size Size Size Size				Aperiodic
CSI-IM configuration CSI-IM Resource Mapping (k_CSI-IM, I_CSI-IM) CSI-IM timeConfig interval and offset ReportConfigType Aperiodic CQI-table Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator Wideband Sub-band Size RB 8 csi-ReportingBand 1111111 CSI-Report interval and offset Slot Offset CSI request 1slot Not configured 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0				·
configuration Mapping (kcsi-im, lcsi-im) CSI-IM timeConfig interval and offset ReportConfigType Aperiodic CQI-table reportQuantity timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator pmi-FormatIndicator Sub-band Size csi-ReportingBand CSI-Report interval and offset Aperiodic (4,9) Not configured Not configured Not configured Wideband Wideband Sub-band Size RB 8 csi-ReportingBand CSI-Report interval and offset Aperiodic Report Slot Offset CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0				Pattern 0
(kcsI-IM, IcsI-IM) CSI-IM timeConfig interval and offset slot Not configured ReportConfigType Aperiodic CQI-table Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasure ments Not configured timeRestrictionForInterferenceMeas urements Not configured cqi-FormatIndicator Wideband pmi-FormatIndicator Wideband Sub-band Size RB 8 csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0				(4.5)
CSI-IM timeConfig interval and offset slot Not configured ReportConfigType Aperiodic CQI-table Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasure ments Not configured timeRestrictionForInterferenceMeas urements Wideband cqi-FormatIndicator Wideband pmi-FormatIndicator Wideband Sub-band Size RB csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0	configuration			(4,9)
interval and offset Siot Not configured ReportConfigType Aperiodic CQI-table Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator Wideband pmi-FormatIndicator Wideband Sub-band Size RB 8 csi-ReportingBand 1111111 CSI-Report interval and offset Slot Not configured Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0				
ReportConfigType Aperiodic CQI-table Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasure ments Not configured timeRestrictionForInterferenceMeas urements Wideband cqi-FormatIndicator Wideband pmi-FormatIndicator Wideband Sub-band Size RB 8 csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0			slot	Not configured
CQI-table Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasure ments Not configured timeRestrictionForInterferenceMeas urements Not configured cqi-FormatIndicator Wideband pmi-FormatIndicator Wideband Sub-band Size RB 8 csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0	PoportConfigTy			Aporiodia
reportQuantity timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator pmi-FormatIndicator Sub-band Size csi-ReportingBand CSI-Report interval and offset Aperiodic Report Slot Offset CSI request Cri-RI-PMI-CQI Not configured Not configured Wideband Wideband 8 8 1111111 CSI-Report interval and offset Aperiodic Report Slot Offset 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0		PΘ		
timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-Formatlndicator pmi-Formatlndicator Sub-band Size csi-ReportingBand CSI-Report interval and offset Aperiodic Report Slot Offset CSI request Not configured Wideband Wideband 8 8 1111111 Not configured Not configured Tin slots i, where mod(i, 5) = 1, otherwise it is equal to 0				
ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator pmi-FormatIndicator Sub-band Size csi-ReportingBand CSI-Report interval and offset Aperiodic Report Slot Offset CSI request Not configured Wideband Wideband 8 8 1111111 Not configured Not configured 1111111 Not configured Not configured Not configured Not configured I in slots i, where mod(i, 5) = 1, otherwise it is equal to 0	timeRestrictionF	orChannelMeasure		
timeRestrictionForInterferenceMeas urements cqi-FormatIndicator pmi-FormatIndicator Sub-band Size csi-ReportingBand CSI-Report interval and offset Aperiodic Report Slot Offset CSI request Not configured Wideband 8 8 1111111 Not configured Not configured 1111111 Not configured 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0		2. 2		Not configured
urements Not configured cqi-FormatIndicator Wideband pmi-FormatIndicator Wideband Sub-band Size RB csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0				Nier C .
cqi-FormatIndicator Wideband pmi-FormatIndicator Wideband Sub-band Size RB 8 csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0		urements		Not configured
pmi-FormatIndicator Wideband Sub-band Size RB 8 csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0				Wideband
csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0				Wideband
CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0			RB	
Aperiodic Report Slot Offset CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0				
CSI request		CSI-Report interval and offset		
otherwise it is equal to 0	Aperiodic Repor			I.
reportTriggerSize 1	-	CSI request		
	reportTriggerSiz	e		1

CSI-AperiodicTriggerStateList			One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI- RS and CSI-IM
	Codebook Type		typel-SinglePanel
	Codebook Mode		1
Codebook	(CodebookConfig- N1,CodebookConfig-N2)		(4,1)
configuration	(CodebookConfig- O1,CodebookConfig-O2)		(4,1)
	CodebookSubsetR estriction		0x FFFF
	RI Restriction		0000010
Physical channe	Physical channel for CSI report		PUSCH
CQI/RI/PMI delay		ms	8
Maximum number of HARQ transmission			4
Measurement channel			R.PDSCH.1-6.2
Note 1: When Throughput is measured using random pre			random precoder selection, the

Note 1: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (1 ms granularity) with equal probability of each applicable i₁, i₂ combination.

Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-4), this reported PMI cannot be applied at the gNB downlink before slot#(n+4).

Note 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.

Table 6.3.2.1.2-2: Minimum requirement

Parameter	Test 1
γ	1.5

6.3.2.1.3 Multiple PMI with 16TX TypeI-SinglePanel Codebook

For the parameters specified in Table 6.3.2.1.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.1.3-2.

Table 6.3.2.1.3-1: Test parameters (dual-layer)

Pa	rameter	Unit	Test 1
Bandwidth		MHz	10
Subcarrier space	cing	kHz	15
Duplex Mode			FDD
Propagation ch	annel		TDLC300-5
Antenna configuration			High XP 16 x 2 (N1,N2) = (4,2)
Beamforming M	1odel		As specified in Annex B.4.1
	CSI-RS resource Type		Aperiodic
	Number of CSI- RS ports (X)		4
ZP CSI-RS	CDM Type		FD-CDM2
configuration	Density (ρ)		1
Ç	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 5, (4,-)

	T		_
	First OFDM symbol in the PRB used for CSI-RS (l ₀ , l ₁)		(9,-)
	CSI-RS interval and offset	slot	Not configured
	ZP CSI-RS trigger		1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0
	CSI-RS resource Type		Aperiodic
	Number of CSI- RS ports (X)		16
	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
NZP CSI-RS for CSI	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁ , k ₂ , k ₃)		Row 12, (2, 4, 6, 8)
acquisition	First OFDM symbol in the PRB used for CSI-RS (I ₀ , I ₁)		(5, -)
	CSI-RS interval and offset	slot	Not configured
	aperiodicTriggerin gOffset		0
	CSI-IM resource Type		Aperiodic
	CSI-IM RE pattern		Pattern 0
CSI-IM configuration	CSI-IM Resource Mapping		(4,9)
	(kcsi-im,lcsi-im) CSI-IM timeConfig interval and offset	slot	Not configured
ReportConfigTy	ре		Aperiodic
CQI-table			Table 1
reportQuantity			cri-RI-PMI-CQI
ments	ForChannelMeasure		Not configured
timeRestrictionI urements	ForInterferenceMeas		Not configured
cqi-FormatIndic	ator		Wideband
pmi-FormatIndi	cator		Subband
Sub-band Size		RB	8
csi-ReportingBa			1111111
CSI-Report inte		slot	Not configured
Aperiodic Repo	rt Slot Offset		5 1 in slots i, where mod(i, 5) = 1,
	reportTriggerSize		otherwise it is equal to 0 1
CSI-AperiodicTriggerStateList			One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
	Codebook Type		typel-SinglePanel
	Codebook Mode		1
Codebast	(CodebookConfig- N1,CodebookConfig-N2)		(4,2)
Codebook configuration	(CodebookConfig- O1,CodebookCon fig-O2)		(4,4)
	CodebookSubset Restriction		0x FFFF
	RI Restriction		0000010

Physical channel for CSI report			PUSCH
CQI/RI/PMI delay		ms	8
Maximum number of HARQ			4
transmission			4
Measurement channel			R.PDSCH.1-6.3
Note 1:	When Throughput is measured using random precoder selection, the		
Note 2:	precoder shall be updated in each slot (1 ms granularity) with equal probability of each applicable i ₁ , i ₂ combination. If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-4), this reported PMI cannot be applied at the gNB downlink before slot#(n+4).		
Note 3:	Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.		

Table 6.3.2.1.3-2: Minimum requirement

Parameter	Test 1
γ	2.5

6.3.2.1.4 Single PMI with 32TX TypeI-SinglePanel Codebook

For the parameters specified in Table 6.3.2.1.4-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.1.4-2.

Table 6.3.2.1.4-1: Test parameters (dual-layer)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Subcarrier spacing		kHz	15
Duplex Mode			FDD
Propagation channel			TDLA30-5
Antenna configuration			High XP 32 x 2 (N1,N2) = (4,4)
Beamforming M	Beamforming Model		As specified in Annex B.4.1
	CSI-RS resource Type		Aperiodic
	Number of CSI- RS ports (X)		4
	CDM Type		FD-CDM2
	Density (ρ)		1
ZP CSI-RS configuration	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 5, (4,-)
	First OFDM symbol in the PRB used for CSI-RS (lo, l1)		(9,-)
	CSI-RS interval and offset	slot	Not configured
	ZP CSI-RS trigger		1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0
	CSI-RS resource Type		Aperiodic
NZP CSI-RS	Number of CSI- RS ports (X)		32
for CSI	CDM Type		CDM4 (FD2, TD2)
acquisition	Density (ρ)		1
acquisition	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁ , k ₂ , k ₃)		Row 17, (2, 4, 6, 8)

	First OFDM symbol in the PRB used for CSI-RS		(5, 12)
	(I ₀ , I ₁) CSI-RS interval and offset	slot	Not configured
	aperiodicTriggerin gOffset		0
	CSI-IM resource Type		Aperiodic
	CSI-IM RE pattern		Pattern 0
CSI-IM	CSI-IM Resource		
configuration	Mapping (kcsi-im,lcsi-im)		(4,9)
	CSI-IM timeConfig interval and offset	slot	Not configured
ReportConfigTy	ре		Aperiodic
CQI-table			Table 1
reportQuantity			cri-RI-PMI-CQI
timeRestrictionForChannelMeasure ments			Not configured
timeRestrictionForInterferenceMeas urements			Not configured
cqi-FormatIndic	ator		Wideband
pmi-FormatIndio			Wideband
Sub-band Size		RB	8
csi-ReportingBa	and		111111
CSI-Report inte		slot	Not configured
Aperiodic Repo	rt Slot Offset	0.00	5
CSI request			1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0
reportTriggerSiz	ze		1
CSI-AperiodicTriggerStateList			One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
	Codebook Type		typeI-SinglePanel
	Codebook Mode		1
Codobook	(CodebookConfig- N1,CodebookConfig-N2)		(4,4)
Codebook configuration	(CodebookConfig- O1,CodebookCon fig-O2)		(4,4)
	CodebookSubset Restriction		0x FFFF
	RI Restriction		0000010
Physical channe			PUSCH
CQI/RI/PMI dela		ms	8
Maximum numb	er of HARQ		4
transmission			
Measurement c	hannel		R.PDSCH.1-6.3

Note 1: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (1 ms granularity) with equal probability of each applicable i₁, i₂ combination.

Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-4), this reported PMI cannot be applied at the gNB downlink before slot#(n+4).

Note 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.

Table 6.3.2.1.4-2: Minimum requirement

Parameter	Test 1
γ	5.0

6.3.2.1.5 Multiple PMI with 16TX TypeII Codebook

For the parameters specified in Table 6.3.2.1.5-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.1.5-2.

Table 6.3.2.1.5-1: Test parameters (dual-layer)

Bandwidth	Parameter		Unit	Test 1
Duplex Mode			MHz	
Propagation channel		cing	kHz	
Antenna configuration				
Beamforming Model	Propagation ch	annel		
Seamforming Model	Antenna config	uration		
Type Number of CSI-RS ports (X) CDM Type Density (p) First subcarrier index in the PRB used for CSI-RS (kg, k1) CSI-RS trigger CSI-RS trigger CSI-RS trigger Number of CSI-RS (kg, k1) CSI-RS (kg, k1) CSI-RS (kg, k1) CSI-RS (kg, k1, k2, k3) First subcarrier index in the PRB used for CSI-RS (kg, k1) CSI-RS (kg, k1, k2, k3) First Subcarrier index in the PRB used for CSI-RS (kg, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (kg, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (kg, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (kg, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (kg, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (kg, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (kg, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (kg, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (kg, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (kg, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (kg, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (kg, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (kg, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (kg, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (kg, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (kg, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (kg, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (kg, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (k1, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (k1, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (k1, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (k1, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (k1, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (k1, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (k1, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (k1, k1, k2,	Beamforming N	Model		
Number of CSI-RS ports (X)		CSI-RS resource		Aperiodic
Dorts (X)				Aponodio
CDM Type				4
Density (p)				FD-CDM2
First subcarrier index in the PRB used for CSI-RS (ko, kr) First OFDM symbol in the PRB used for CSI-RS (ko, kr)				i
In the PRB used for CSI-RS (ko, kr) First OFDM symbol in the PRB used for CSI-RS (b, hr)				·
CSI-RS (k ₀ , k ₁) First OFDM symbol in the PRB used for CSI-RS (l ₀ , l ₁) CSI-RS (l ₀ , l ₁) CSI-RS rinterval and offset sinterval and offset and offset sinterval sin	ZP CSI-RS			Row 5, (4,-)
in the PRB used for CSI-RS (lo, l-1) CSI-RS interval and offset slot interval sequence in	configuration			,
CSI-RS (l ₀ , h) CSI-RS interval and offset ZP CSI-RS trigger CSI-RS resource Type Number of CSI-RS ports (x) CDM Type Density (p) First subcarrier index in the PRB used for CSI-RS (l ₀ , k ₁ , k ₂ , k ₃) First OFDM symbol in the PRB used for CSI-RS (l ₀ , h ₁) CSI-RS interval and offset aperiodicTriggeringO ffset CSI-IM RE pattern CSI-IM Resource Mapping (k _{CSI-IM} (cSI-IM) CSI-IM timeConfig interval and offset sold ReportConfigType CQI-table ReportConfigType CQI-table ReportConfigType CQI-table ReportConfigured ReportConfigured RestrictionForChannelMeasurem ents CSI-RS CSI-RS CSI-Report interval and offset sold ReportConfigured RestrictionForChannelMeasurem ents CSI-RS CSI-RS CSI-Report interval and offset sold RestrictionForInterferenceMeasur ements Resi-ReportingBand Sub-band Size RB RS RS Solt Not configured Not configured RestrictionForInterferenceMeasur ements Resi-ReportingBand Sub-band Size RB RS RS Solt Not configured Not configured Sub-band Size RB RS RS Solt Not configured Not configured Not configured Sub-band Size RB RS Solt Not configured Not configured Sub-band Size RB RS Solt Not configured Sub-band Size RB Solt Not configured				
CSI-RS interval and offset ZP CSI-RS trigger ZP CSI-RS trigger CSI-RS resource Type Aperiodic NZP CSI-RS ports (X) CDM Type CDM4 (FD2, TD2) Density (p) 1 First subcarrier index in the PRB used for CSI-RS (k, k, k, kz, ks) First OFDM symbol in the PRB used for CSI-RS (lo, lı) CSI-RS (lo, lı) CSI-RS (lo, lı) CSI-IM resource Type Aperiodic CSI-IM RE pattern Pattern O CSI-IM Resource Mapping (kcsI-IM, ICSI-IM) CSI-IM timeConfig interval and offset and offset interval and offset and offset and offset and offset interval and offset aperiodic TriggeringO (fiset) CSI-IM resource Type Aperiodic CSI-IM Resource Mapping (kcsI-IM, ICSI-IM) CSI-IM timeConfig interval and offset interval interval interval and offset interval in				(9,-)
interval and offset ZP CSI-RS trigger CSI-RS resource Type Number of CSI-RS ports (X) CDM Type Density (p) Density (p) CSI-RS (lo, lt) CSI-RS (lo, lt) CSI-RS (lo, lt) CSI-RS (lo, lt) CSI-IM resource Type CSI-IM RE pattern Configuration CSI-IM timeConfig interval and offset ReportConfigType CSI-IM timeConfig interval and offset ReportConfigType CI-SI-IM resource TeportQuantity TimeRestrictionForChannelMeasurem ents cqi-FormatIndicator CSI-RB (lo, lt) CSI-RS (lo, lt) CSI-RS (lo, lt) CSI-IM resource Type CSI-IM resource Type CSI-IM resource Type Aperiodic CSI-IM resource Type Aperiodic Not configured				
Televisian doubset ZP CSI-RS trigger 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0			slot	Not configured
CSI-RS (Ingerior CSI-RS) for CSI acquisition NZP CSI-RS for CSI acquisition First subcarrier index in the PRB used for CSI-RS (Io, Ix), Ix, Ix, Ix, Ix, Ix, Ix, Ix, Ix, Ix, Ix				-
Type Number of CSI-RS ports (X) CDM Type CDM4 (FD2, TD2) Density (p) First subcarrier index in the PRB used for CSI-RS (ko, kt, k2, k3) First OFDM symbol in the PRB used for CSI-RS (lo, l1) CSI-RS (lo, l1) CSI-RS interval and offset aperiodic Triggering Offset CSI-IM CSI-IM Resource Type CSI-IM Resource Mapping (kssI-IM-ILCSI-IM) CSI-IM CSI-IM ImeConfig interval and offset SIot Not configured ReportConfigType Aperiodic CQI-table Table Table 1 reportQuantity Cri-RI-PMI-CQI timeRestrictionForInterferenceMeasure ents timeRestrictionForInterferenceMeasure ents cqi-FormatIndicator Wideband Size RB Si-Report Interval and offset SIot Not configured RB				otherwise it is equal to 0
NZP CSI-RS for CSI acquisition NZP CSI-RS for CSI acquisition NZP CSI-RS for CSI acquisition NZP CSI-RS (Ko, k1, k2, k3) First subcarrier index in the PRB used for CSI-RS (k0, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (k0, k1) Row 12, (2, 4, 6, 8) Row 12, (2, 4, 6, 8) CSI-RS (k0, k1) CSI-RS (k0, k1) Row 12, (2, 4, 6, 8) CSI-RS (k0, k1) Row 12, (2, 4, 6, 8) Row 12, (2, 4, 6,				Aperiodic
NZP CSI-RS for CSI acquisition NZP CSI-RS (lo, lx1, lx2, ks) First subcarrier index in the PRB used for CSI-RS (ko, kx1, kz, ks) First OFDM symbol in the PRB used for CSI-RS (lo, lx1) CSI-RS (lo, lx1) CSI-RS interval and offset aperiodic TriggeringO ffset CSI-IM resource Type CSI-IM Resource Mapping (kcsi-lm, lcsi-lm) CSI-IM first CSI-IM Resource Mapping (kcsi-lm, lcsi-lm) CSI-IM first CSI-IM Resource Mapping (kcsi-lm, lcsi-lm) CSI-IM first CSI-IM Resource Mapping (cSI-IM first CSI-IM f		Number of CSI-RS		16
Density (p) First subcarrier index in the PRB used for CSI-RS (ko, k1, k2, k3)				-
NZP CSI-RS for CSI acquisition First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁ , k ₂ , k ₃) First OFDM symbol in the PRB used for CSI-RS (l ₀ , l ₁) CSI-RS interval and offset aperiodicTriggeringO ffset CSI-IM resource Type CSI-IM Repattern CSI-IM Repattern CSI-IM Report Configuration CSI-IM timeConfig interval and offset Slot Not configured CSI-IM timeConfig interval and offset Slot Not configured Not configured CSI-IM timeConfig interval and offset Slot Not configured ReportConfigType Aperiodic CQI-table Table 1 Table				CDM4 (FD2, TD2)
in the PRB used for CSI-RS (ko, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (ko, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (ko, k1, k2, k3) First OFDM symbol in the PRE used (in k1) CSI-RS (ko, k1, k2, k3) First OFDM symbol in the PRE used (in k1) CSI-RS (ko, k1, k2, k3) First OFDM symbol in the PRE used (in k1) CSI-RS (ko, k1, k2, k3) First OFDM symbol in the PRE used (in k1, k2, k3) First OFDM symbol in the PRE used (in k1, k2, k3) First OFDM symbol in the PRE used (in k1, k2, k3) First OFDM symbol in the PRI used (in k1, k2, k3) First OFDM symbol in the PRI used (in k1, k2, k3) First OFDM symbol in the Preserve Aperiodic CSI-IM RE out of Side (in k1, k2, k3) First OFDM				1
for CSI acquisition In the PRB used for CSI-RS (k ₀ , k ₁ , k ₂ , k ₃) First OFDM symbol in the PRB used for CSI-RS (l ₀ , l ₁) CSI-RS interval and offset aperiodicTriggeringO ffset CSI-IM resource Type CSI-IM RE pattern CSI-IM RE pattern Pattern 0 CSI-IM Resource Mapping (k _{CSI-IM} , l _{CSI-IM}) CSI-IM timeConfig interval and offset ReportConfigType Aperiodic CQI-table Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasurem ents timeRestrictionForInterferenceMeasur ements cqi-FormatIndicator Wideband pmi-FormatIndicator Subband Sub-band Size RB 8 csi-Report interval and offset CSI-Report interval and offset SI Not configured Sub-band Size RB 8 Si-ReportingBand 1111111 CSI-Report interval and offset Slot Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0	NZP CSI-RS			D 40 (0 4 0 0)
First OFDM symbol in the PRB used for CSI-RS (Io, In) CSI-RS (Io, In) CSI-RS interval and offset aperiodicTriggeringO ffset CSI-IM resource Type CSI-IM Resource Mapping (KcSI-IM,IcSI-IM) CSI-IM timeConfig interval and offset and offset aperiodic ReportConfigType CSI-IM timeConfig interval and offset Table 1 reportQuantity timeRestrictionForChannelMeasurem ents timeRestrictionForInterferenceMeasur ements cqi-FormatIndicator pmi-FormatIndicator Sub-band Size RB RB RB RS Si-Report interval and offset SI of Not configured Not configured Not configured Not configured RB				Row 12, (2, 4, 6, 8)
in the PRB used for CSI-RS (lo, l₁) CSI-RS (lo, l₁) CSI-RS (interval and offset aperiodicTriggeringO ffset CSI-IM resource Type CSI-IM RE pattern CSI-IM Resource Mapping (kcsI-IM, IcSI-IM) CSI-IM timeConfig interval and offset ReportConfigType CQI-table ReportQuantity timeRestrictionForChannelMeasurem ents timeRestrictionForInterferenceMeasur ements cqi-FormatIndicator pmi-FormatIndicator Subband Sub-band Size RB RB RB RB RB RB RB RB RB R	acquisition			
CSI-RS (lo, l1) CSI-RS interval and offset aperiodic TriggeringO ffset CSI-IM resource Type Aperiodic CSI-IM RE pattern Pattern O CSI-IM Resource Mapping (4,9) (kcsi-IM, lcsi-IM) CSI-IM timeConfig interval and offset Aperiodic CQI-table Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasurem ents timeRestrictionForInterferenceMeasur ements cqi-FormatIndicator Wideband Sub-band Size RB Scsi-ReportInterval and offset SIot Not configured REPORTION OF COMPANY O				(5)
CSI-RS interval and offset aperiodicTriggeringO ffset CSI-IM resource Type CSI-IM RE pattern Pattern 0				(=, ,
Interval and offset aperiodicTriggeringO ffset CSI-IM resource Type CSI-IM RE pattern Pattern 0		CSI-RS	elot	Not configured
CSI-IM resource Type CSI-IM RE pattern Pattern 0			3101	140t comigarea
CSI-IM resource Type CSI-IM RE pattern Pattern 0 CSI-IM Resource Mapping (4,9) CSI-IM timeConfig interval and offset Siot Not configured ReportConfigType Aperiodic CQI-table Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasurem ents timeRestrictionForInterferenceMeasur ements cqi-FormatIndicator Wideband pmi-FormatIndicator Subband Sub-band Size RB 8 csi-Report interval and offset slot Not configured Aperiodic Aperiodic Not configured Not configured Wideband Sub-band Size RB 8 csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0				0
Type CSI-IM RE pattern CSI-IM Resource Mapping (kcsi-IM, Icsi-IM) CSI-IM timeConfig interval and offset ReportConfigType CQI-table reportQuantity timeRestrictionForChannelMeasurem ents timeRestrictionForInterferenceMeasur ements cqi-FormatIndicator pmi-FormatIndicator sub-band Size csi-Report interval and offset Aperiodic Not configured Not configured Not configured Not configured RB 8 csi-Report interval and offset Aperiodic Not configured Not configured Sub-band Size RB 8 csi-Report interval and offset Aperiodic Report Slot Offset CSI request Table 1 Table 1 Table 1 Table 1 Not configured Not configured Not configured Not configured Sub-band Sub-band Size RB 8 Tin slots i, where mod(i, 5) = 1, otherwise it is equal to 0				
CSI-IM Resource Mapping (kcsI-IM, lcsI-IM) CSI-IM timeConfig interval and offset ReportConfigType Aperiodic CQI-table reportQuantity timeRestrictionForChannelMeasurem ents timeRestrictionForInterferenceMeasur ements cqi-FormatIndicator Sub-band Size CSI-IM Resource (4,9) Not configured Not configured Not configured Not configured Not configured RB 8 csi-ReportingBand CSI-Report interval and offset Aperiodic Report Slot Offset CSI request CSI-IM Resource (4,9) (4,9) (4,9) Not configured Not configured Not configured Not configured Not configured Sub-band Size Sibtal Not configured Not configured 11111111 Not configured 11111111 CSI-Report interval and offset Slot Not configured Aperiodic Report Slot Offset Tin slots i, where mod(i, 5) = 1, otherwise it is equal to 0				Aperiodic
configuration Mapping (kcsi-im,lcsi-im) CSI-IM timeConfig interval and offset ReportConfigType Aperiodic CQI-table reportQuantity timeRestrictionForChannelMeasurem ents timeRestrictionForInterferenceMeasur ements cqi-FormatIndicator pmi-FormatIndicator Sub-band Size csi-ReportingBand CSI-Report interval and offset Aperiodic (4,9) Not configured Not configured Not configured Wideband Sub-band Sub-band Size RB 8 csi-ReportingBand 1111111 CSI-Report interval and offset Aperiodic Report Slot Offset CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0		CSI-IM RE pattern		Pattern 0
(Kcsi-IM, Icsi-IM) CSI-IM timeConfig interval and offset slot Not configured ReportConfigType Aperiodic CQI-table Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasurem ents Not configured timeRestrictionForInterferenceMeasur ements Wideband cqi-FormatIndicator Wideband pmi-FormatIndicator Subband Sub-band Size RB 8 csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0	CSI-IM	CSI-IM Resource		
CSI-IM timeConfig interval and offset slot Not configured ReportConfigType Aperiodic CQI-table Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasurem ents Not configured timeRestrictionForInterferenceMeasur ements Wideband cqi-FormatIndicator Wideband pmi-FormatIndicator Subband Sub-band Size RB 8 csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0	configuration			(4,9)
Interval and offset Slot Not configured				
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CQI-table Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasurem ents Not configured timeRestrictionForInterferenceMeasur ements Wideband cqi-FormatIndicator Wideband pmi-FormatIndicator Subband Sub-band Size RB 8 csi-ReportingBand 11111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0	ReportConfigT			Aperiodic
reportQuantity timeRestrictionForChannelMeasurem ents timeRestrictionForInterferenceMeasur ements cqi-FormatIndicator pmi-FormatIndicator Sub-band Size csi-ReportingBand CSI-Report interval and offset Aperiodic Report Slot Offset CSI request Cri-RI-PMI-CQI Not configured Not configured Wideband Subband Subband 1111111 CSI-Report interval and offset Aperiodic Report Slot Offset 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0				
ents timeRestrictionForInterferenceMeasur ements cqi-FormatIndicator pmi-FormatIndicator Sub-band Size csi-ReportingBand CSI-Report interval and offset Aperiodic Report Slot Offset CSI request Not configured Wideband Sub-band Sub-ba				cri-RI-PMI-CQI
timeRestrictionForInterferenceMeasur ements cqi-FormatIndicator pmi-FormatIndicator Sub-band Size Csi-ReportingBand CSI-Report interval and offset Aperiodic Report Slot Offset CSI request Not configured Wideband Sub-band Sub				Not configured
cqi-FormatIndicator Wideband pmi-FormatIndicator Subband Sub-band Size RB csi-ReportingBand 11111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0				Not configured
pmi-FormatIndicator Subband Sub-band Size RB 8 csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0				Wideband
Sub-band Size CSI-ReportingBand CSI-Report interval and offset Aperiodic Report Slot Offset CSI request RB 8 1111111 Not configured 5 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0	pmi-FormatIndicator			
csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0			RB	
CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0	csi-ReportingBand			1111111
CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0	CSI-Report interval and offset		slot	
otherwise it is equal to 0	Aperiodic Report Slot Offset			-
	reportTriggerSi	ze		4

CSI-AperiodicTriggerStateList			One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
	Codebook Type		typell
	L (numberOfBeams)		2
	N _{PSK} (phaseAlphabetSize)		8
	subbandAmplitude		True
Codebook configuration	(CodebookConfig- N1,CodebookConfig- N2)		(4,2)
Configuration	(CodebookConfig- O1,CodebookConfig- O2)		(4,4)
	CodebookSubsetRes		0x 7FF
	triction		FFFF FFFF FFFF
	RI Restriction (typeII- RI-Restriction)		10
Physical channel for CSI report			PUSCH
CQI/RI/PMI delay		ms	8
Maximum number of HARQ transmission			4
Measurement channel			R.PDSCH.1-6.3
Note 1: When Throughput is measured using random precoder selection, the			

Note 1: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (1 ms granularity) with equal probability of each applicable i₁, i₂ combination. The random precoder generation shall follow 'typeI-SinglePanel' codebook configuration as specified in table 6.3.2.1.3-1.

Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-4), this reported PMI cannot be applied at the gNB downlink before slot#(n+4).

Note 3: Randomization of the dual-cluster beam directions shall be used as specified in Annex B.2.3.2.3A. The value of relative power ratio (p) shall be fixed as 1 during the test.

Table 6.3.2.1.5-2: Minimum requirement

Parameter	Test 1
γ	[1.9]

6.3.2.1.6 Multiple PMI with 16TX Enhanced Type II Codebook

For the parameters specified in Table 6.3.2.1.6-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.1.6-2.

Table 6.3.2.1.6-1: Test parameters (dual-layer)

CSI-RS resource Type Number of CSI-RS ports (X) CDM Type Density (p) First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁ , k ₂ , k ₃) First OFDM symbol in the PRB used for CSI-RS (l ₀ , l ₁) CSI-RS interval and offset aperiodicTriggeringO ffset CSI-IM resource Type CSI-IM RE pattern CSI-IM Resource Mapping (KCSI-IM REsource Mapping (KCSI-IM ImeConfig interval and offset Slot Not configured ReportConfigType Aperiodic ReportConfigType CQI-table reportQuantity timeRestrictionForChannellMeasurem ents CSI-RS resource Aperiodic ReportConfigured Otherwise it is equal to 0 Aperiodic Aperiodic Row 12, (2, 4, 6, 8) Row 12,	Parameter		Unit	Test 1
Duplex Mode	Bandwidth	-		10
Propagation channel		cing	kHz	
Antenna configuration				
Rantenna configuration (N1,N2) = (4,2)	Propagation ch	annel		
Beamforming Model	Antenna config	uration		
Type	Beamforming N			
Number of CSI-RS ports (X)				Aperiodic
CDM Type		Number of CSI-RS		4
Density (p)				ED CDM2
First subcarrier index in the PRB used for CSI-RS (ko, k1) First OFDM symbol in the PRB used for CSI-RS (ko, k1) CSI-RS (ko, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (ko, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (ko, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (ko, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (ko, k1, k2, k3) CSI-RS (ko, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (ko, k1, k2, k3)				
First OFDM symbol in the PRB used for CSI-RS (lo, l₁) CSI-RS interval and offset ZP CSI-RS trigger CSI-RS trigger CSI-RS resource Type Number of CSI-RS ports (X) CDM Type Density (p) First subcarrier index in the PRB used for CSI-RS (ko, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (lo, l₁) CSI-RS (lo, l₁) CSI-RS interval and offset aperiodicTriggeringO ffset CSI-IM resource Type Aperiodic Not configured Not configured Aperiodic CSI-IM Resource Type CSI-IM Resource Mapping (kcsi-IM, Icsi-IM) CSI-IM timeConfig interval and offset ReportConfigType CQI-table ReportConfinered ReportConfinered Not configured Not configured Not configured		First subcarrier index in the PRB used for		
CSI-RS interval and offset Slot Not configured	Configuration	First OFDM symbol in the PRB used for		(9,-)
Interval and onset ZP CSI-RS trigger		CSI-RS	slot	Not configured
CSI-RS resource Type Number of CSI-RS ports (X) CDM Type Density (p) First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁ , k ₂ , k ₃) First OFDM symbol in the PRB used for CSI-RS (l ₀ , l ₁) CSI-RS interval and offset aperiodicTriggeringO ffset CSI-IM resource Type CSI-IM RE pattern CSI-IM Resource Mapping (KCSI-IM RE) CSI-IM Resource Mapping (KCSI-IM) CSI-IM timeConfig interval and offset slot ReportConfigType Aperiodic ReportConfigType CQI-table TeportQuantity timeRestrictionForChannelMeasurem ents CSI-RS (resource Aperiodic ReportConfigured otherwise it is equal to 0 Aperiodic Aperiodic Row 12, (2, 4, 6, 8) CSI-RS (l ₀ , l ₁) Slot Not configured Not configured Not configured			3101	1 in slots i, where mod(i, 5) = 1,
Type Number of CSI-RS ports (X) CDM Type Density (p) Tirst subcarrier index in the PRB used for CSI-RS (ko, k1, k2, k3) First OFDM symbol in the PRB used for CSI-RS (lo, l1) CSI-RS interval and offset aperiodicTriggeringO ffset CSI-IM resource Type CSI-IM Resource Type CSI-IM Resource Mapping (kCSI-IM, lCSI-IM) CSI-IM timeConfig interval and offset Slot Not configured Aperiodic CSI-IM Resource Mapping (kCSI-IM, lCSI-IM) CSI-IM timeConfig interval and offset ReportConfigType Aperiodic CQI-table TeportQuantity timeRestrictionForChannelMeasurem ents In Aperiodic In Aperiodic A				
NZP CSI-RS for CSI acquisition NZP CSI-RS for CSI acquisition NZP CSI-RS (k ₀ , k ₁ , k ₂ , k ₃) First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁ , k ₂ , k ₃) First OFDM symbol in the PRB used for CSI-RS (l ₀ , l ₁) CSI-RS (l ₀ , l ₁) CSI-RS interval and offset aperiodicTriggeringO ffset CSI-IM resource Type CSI-IM RE pattern CSI-IM RE pattern CSI-IM Resource Mapping (k _{CSI-IM} , l _{CSI-IM}) CSI-IM timeConfig interval and offset slot Not configured ReportConfigType ReportConfigType CQI-table ReportQuantity timeRestrictionForChannelMeasurem ents Not configured Not configured		Type		Aperiodic
NZP CSI-RS for CSI acquisition NZP CSI-RS for CSI acquisition NZP CSI-RS for CSI acquisition NZP CSI-RS (k ₀ , k ₁ , k ₂ , k ₃) First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁ , k ₂ , k ₃) First OFDM symbol in the PRB used for CSI-RS (l ₀ , l ₁) CSI-RS interval and offset aperiodicTriggeringO ffset CSI-IM resource Type CSI-IM RE pattern CSI-IM RE pattern CSI-IM Resource Mapping (k _{CSI-IM} ,l _{CSI-IM}) CSI-IM timeConfig interval and offset along interval and offset slot ReportConfigType CQI-table ReportQuantity timeRestrictionForChannelMeasurem ents Not configured Not configured				16
NZP CSI-RS for CSI acquisition First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁ , k ₂ , k ₃) First OFDM symbol in the PRB used for CSI-RS (l ₀ , l ₁) CSI-RS interval and offset aperiodicTriggeringO ffset CSI-IM resource Type CSI-IM RE pattern Pattern 0				CDM4 (FD2, TD2)
for CSI acquisition In the PRB used for CSI-RS (k ₀ , k ₁ , k ₂ , k ₃) First OFDM symbol in the PRB used for CSI-RS (l ₀ , l ₁) CSI-RS interval and offset aperiodicTriggeringO ffset CSI-IM resource Type CSI-IM RE pattern Pattern 0				1
First OFDM symbol in the PRB used for CSI-RS (Io, I1) CSI-RS interval and offset aperiodicTriggeringO ffset CSI-IM resource Type CSI-IM RE pattern CSI-IM Resource Mapping (kcsi-IM, Icsi-IM) CSI-IM timeConfig interval and offset ReportConfigType ReportQuantity TimeRestrictionForChannelMeasurem ents First OFDM symbol in the PRB used for (5, -) (5, -) (5, -) (5, -) Not configured	for CSI	in the PRB used for		Row 12, (2, 4, 6, 8)
CSI-RS interval and offset aperiodicTriggeringO ffset OSI-IM resource Type Aperiodic CSI-IM RE pattern Pattern O CSI-IM Resource Mapping (k_CSI-IM, l_CSI-IM) CSI-IM timeConfig interval and offset Aperiodic Not configured ReportConfigType Aperiodic CQI-table Table 1 reportQuantity Cri-RI-PMI-CQI timeRestrictionForChannelMeasurem ents Interval and offset Not configured Not configured Not configured	acquisition	First OFDM symbol in the PRB used for		(5, -)
aperiodicTriggeringO ffset CSI-IM resource Type CSI-IM RE pattern CSI-IM Resource Mapping (k _{CSI-IM,} l _{CSI-IM}) CSI-IM timeConfig interval and offset ReportConfigType CQI-table TeportQuantity TimeRestrictionForChannelMeasurem ents aperiodic Aperiodic Aperiodic Aperiodic CqI-table Table 1 TeportQuantity Not configured		CSI-RS	slot	Not configured
Type CSI-IM RE pattern CSI-IM Resource Mapping (k _{CSI-IM, IcSI-IM}) CSI-IM timeConfig interval and offset ReportConfigType CQI-table reportQuantity Type Aperiodic Aperiodic Aperiodic Not configured Table 1 reportQuantity timeRestrictionForChannelMeasurem ents Not configured		aperiodicTriggeringO		0
CSI-IM RE pattern Pattern 0 CSI-IM Resource Mapping (4,9) CSI-IM Resource Mapping (4,9) CSI-IM timeConfig interval and offset Slot Not configured ReportConfigType Aperiodic CQI-table Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasurem ents timeRestrictionForInterferenceMeasur Not configured				Aperiodic
CSI-IM Resource Mapping (KCSI-IM, ICSI-IM) CSI-IM timeConfig interval and offset ReportConfigType Aperiodic CQI-table Table 1 reportQuantity timeRestrictionForChannelMeasurem ents CSI-IM Resource (4,9) Not configured Not configured Not configured				Pattern 0
CSI-IM timeConfig interval and offset Slot Not configured		Mapping		(4,9)
CQI-table Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasurem ents Not configured timeRestrictionForInterferenceMeasur Not configured			slot	Not configured
reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasurem ents timeRestrictionForInterferenceMeasur Not configured				
timeRestrictionForChannelMeasurem ents Not configured Not configured				
ents Not configured timeRestrictionForInterferenceMeasur Not configured				cri-RI-PMI-CQI
I NOT CONTIGUISED	ents			Not configured
CHICHG	timeRestrictionForInterferenceMeasur ements			Not configured
cqi-FormatIndicator Wideband	cqi-FormatIndicator			Wideband
pmi-FormatIndicator Subband		•		
Sub-band Size RB 4			RB	
csi-ReportingBand 1111111				
	CSI-Report interval and offset		slot	
	Aperiodic Report Slot Offset CSI request			1 in slots i, where $mod(i, 5) = 1$,
reportTriggerSize 1	reportTriggerSi	ze		1

			One State with one Associated
CSI-AperiodicT	riggerStateList		Report Configuration Associated Report
CSI-Aperiodic i	nggerstateList		Configuration contains pointers
			to NZP CSI-RS and CSI-IM
	Codobook Type		
	Codebook Type		typell-r16
	paramCombination-		6
	r16		$(L = 4, p_v = 1/2, \beta = 1/2)$
	R(numberOfPMISub		
	bandsPerCQISubban		1
	d-r16)		
	(CodebookConfig-		
Codebook configuration	N1,CodebookConfig-		(4,2)
	N2)		, · · ,
	(CodebookConfig-		
	O1,CodebookConfig-		(4,4)
	O2)		(, ,
	CodebookSubsetRes		0x 7FF
	triction		FFFF FFFF FFFF
	RI Restriction (typeII-		0010
RI-Restriction-r16)			0010
Physical channel for CSI report			PUSCH
CQI/RI/PMI delay		ms	8
Maximum number of HARQ			,
transmission			4
Measurement channel			R.PDSCH.1-6.3
Note 1: When Throughput is measured using random precoder selection, the			
precoder shall be updated in each slot (1 ms granularity) with equal			

Note 1: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (1 ms granularity) with equal probability of each applicable i₁, i₂ combination. The random precoder generation shall follow 'typel-SinglePanel' codebook configuration as specified in table 6.3.2.1.3-1.

Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-4), this reported PMI cannot be applied at the gNB downlink before slot#(n+4).

Note 3: Randomization of the dual-cluster beam directions shall be used as specified in AnnexB.2.3.2.3A. The value of relative power ratio (p) shall be fixed as 1 during the test.

Table 6.3.2.1.6-2: Minimum requirement

Parameter	Test 1
γ	[2.2]

6.3.2.2 TDD

6.3.2.2.1 Single PMI with 4TX Typel-SinglePanel Codebook

For the parameters specified in Table 6.3.2.2.1-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.2.1-2.

Table 6.3.2.2.1-1: Test parameters (single layer)

Parameter		Unit	Test 1
Bandwidth		MHz	40
	rier spacing	kHz	30
Dup	lex Mode		TDD
TDD DL-U	L configuration		FR1.30-1 as specified in Annex A
Propaga	ation channel		TDLA30-5
	configuration		High XP 4 x 2
			(N1,N2) = (2,1)
Beamfo	rming Model CSI-RS resource		As specified in Annex B.4.1
	Type		Periodic
	Number of CSI-		,
	RS ports (X)		4
	CDM Type		FD-CDM2
	Density (ρ)		1
ZP CSI-RS	First subcarrier index in the PRB		
configuration	used for CSI-RS		Row 5, (4,-)
	(k ₀ , k ₁)		
	First OFDM		
	symbol in the PRB		(0.)
	used for CSI-RS		(9,-)
	(l ₀ , l ₁)		
	CSI-RS	slot	10/1
	interval and offset	0.01	10,1
	CSI-RS resource Type		Aperiodic
	Number of CSI-		,
	RS ports (X)		4
	CDM Type		FD-CDM2
	Density (ρ)		1
NIZD OOL DO	First subcarrier		
NZP CSI-RS for CSI	index in the PRB		Row 4, (0,-)
acquisition	used for CSI-RS (k ₀ , k ₁)		
acquisition	First OFDM		
	symbol in the PRB		(40.)
	used for CSI-RS		(13,-)
	(l ₀ , l ₁)		
	CSI-RS	slot	Not configured
	interval and offset aperiodicTriggerin		3
	gOffset		0
	CSI-IM resource		Apariadia
	Туре		Aperiodic
	CSI-IM RE pattern		Pattern 0
CSI-IM	CSI-IM Resource		(4.0)
configuration	Mapping		(4,9)
	(kcsi-im,lcsi-im) CSI-IM timeConfig		
interval and offset		slot	Not configured
ReportConfigTy			Aperiodic
CQI-table			Table 1
reportQuantity			cri-RI-PMI-CQI
timeRestrictionForChannelMeasure ments			Not configured
timeRestrictionForInterferenceMeas			-
urements			Not configured
cqi-FormatIndicator			Wideband
pmi-FormatIndicator			Wideband
Sub-band Size		RB	16
csi-ReportingBand			1111111
CSI-Report interval and offset		slot	Not configured
Aperiodic Repo	rt Slot Offset		8
CSI request			1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0

reportTriggerS	Size		1
CSI-Aperiodic	TriggerStateList		One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
	Codebook Type		typel-SinglePanel
	Codebook Mode		1
Codebook	(CodebookConfig- N1,CodebookConf ig-N2)		(2,1)
configuration (CodebookConfig- O1,CodebookCon fig-O2)			(4,1)
CodebookSubset Restriction			11111111
	RI Restriction		0000001
Physical channel for CSI report			PUSCH
CQI/RI/PMI delay		ms	5.5
Maximum number of HARQ transmission			4
Measurement channel			R.PDSCH.2-8.1 TDD
pre pro	Note 1: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity) with equal probability of each applicable i ₁ , i ₂ combination.		
	ote 2: If the UE reports in an available uplink reporting instance at slot #n based on PMI estimation at a downlink slot not later than slot#(n-4),		

Note 2: If the UE reports in an available uplink reporting instance at slot #n based on PMI estimation at a downlink slot not later than slot#(n-4), this reported PMI cannot be applied at the gNB downlink before slot#(n+4).

Note 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.

Table 6.3.2.2.1-2: Minimum requirement

Parameter	Test 1
γ	1.3

6.3.2.2.2 Single PMI with 8TX TypeI-SinglePanel Codebook

For the parameters specified in Table 6.3.2.2.2-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.2.2-2.

Table 6.3.2.2.2-1: Test parameters (dual-layer)

Parameter		Unit	Test 1
Bandwidth		MHz	40
	rier spacing lex Mode	kHz	30 TDD
	L configurations		FR1.30-1 as specified in Annex
	ation channel		A TDLA30-5
	configuration		High XP 8 x 2
	rming Model		(N1,N2) = (4,1) As specified in Annex B.4.1
Deamio	CSI-RS resource		
	Туре		Periodic
	Number of CSI- RS ports (X)		4
	CDM Type		FD-CDM2
	Density (ρ)		1
ZP CSI-RS	First subcarrier		
configuration	index in the PRB		Row 5, (4,-)
3	used for CSI-RS		, (, , ,
	(k ₀ , k ₁) First OFDM		
	symbol in the PRB		
	used for CSI-RS		(9,-)
	(l ₀ , l ₁)		
	CSI-RS	_	
	interval and offset	slot	10/1
	CSI-RS resource		A mania dia
	Type		Aperiodic
	Number of CSI-		8
	RS ports (X)		
	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
NZD OOL DO	First subcarrier		
NZP CSI-RS for CSI	index in the PRB		Row 8, (4,6)
acquisition	used for CSI-RS		
acquisition	(k ₀ , k ₁) First OFDM		
	symbol in the PRB		
	used for CSI-RS		(5,-)
	(l ₀ , l ₁)		
	CSI-RS	olot	Not configured
	interval and offset	slot	Not configured
	aperiodicTriggerin		0
	gOffset CSI-IM resource		
	Type		Aperiodic
	CSI-IM RE pattern		Pattern 0
CSI-IM	CSI-IM Resource		
configuration	Mapping		(4,9)
	(kcsi-im,lcsi-im)		
	CSI-IM timeConfig	slot	Not configured
Donort ConfigTy	interval and offset		
ReportConfigType CQI-table			Aperiodic Table 1
reportQuantity			cri-RI-PMI-CQI
timeRestrictionForlChannelMeasur			
ements			Not configured
timeRestrictionForInterferenceMeas			Not configured
urements			-
cqi-FormatIndicator			Wideband
pmi-FormatIndicator			Wideband
Sub-band Size		RB	16
csi-ReportingBand		slot	1111111 Not configured
	CSI-Report interval and offset Aperiodic Report Slot Offset		Not configured 8
	it dot dilagt		1 in slots i, where mod(i, 10) =
CSI request			1, otherwise it is equal to 0

Note 3:

reportTrigge	erSize		1
CSI-Aperiod	dicTriggerStateList		One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
	Codebook Type		typel-SinglePanel
	Codebook Mode		1
Cadabaak	(CodebookConfig- N1,CodebookConfig-N2)		(4,1)
Codebook configuratio	n (CodebookConfig- O1,CodebookCon fig-O2)		(4,1)
	CodebookSubset Restriction		0x FFFF
	RI Restriction		0000010
Physical channel for CSI report			PUSCH
CQI/RI/PMI delay		ms	6.5
	umber of HARQ		4
	transmission		D DDCCULO CO TDD
	Measurement channel R.PDSCH.2-8.2 TDD		
p	ote 1: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity) with equal probability of each applicable i ₁ , i ₂ combination.		
b tl	If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-6), this reported PMI cannot be applied at the gNB downlink before slot#(n+6).		

Table 6.3.2.2.2: Minimum requirement

Randomization of the principle beam direction shall be used as

Parameter	Test 1
γ	1.5

6.3.2.2.3 Multiple PMI with 16TX TypeI-SinglePanel Codebook

specified in Annex B.2.3.2.3.

For the parameters specified in Table 6.3.2.2.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.2.3-2.

Table 6.3.2.2.3-1: Test parameters (dual-layer)

Parameter		Unit	Test 1
Bandwidth		MHz	40
Subcarrier spacing		kHz	30
Dup	lex Mode		TDD
TDD DL-UL configurations			FR1.30-1 as specified in Annex A
Propaga	ation channel		TDLC300-5
Antenna configuration			High XP 16 x 2 (N1,N2) = (4,2)
Beamfo	rming Model		As specified in Annex B.4.1
	CSI-RS resource Type		Aperiodic
ZP CSI-RS configuration	Number of CSI- RS ports (X)		4
	CDM Type		FD-CDM2
	Density (ρ)		1

			_
	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 5, (4,-)
	First OFDM symbol in the PRB used for CSI-RS (I ₀ , I ₁)		(9,-)
	CSI-RS interval and offset	slot	Not configured
	ZP CSI-RS trigger		1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0
	CSI-RS resource Type		Aperiodic
	Number of CSI- RS ports (X)		16
	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
NZP CSI-RS for CSI acquisition	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁ , k ₂ , k ₃)		Row 12, (2, 4, 6, 8)
acquisition	First OFDM symbol in the PRB used for CSI-RS (lo, l1)		(5, -)
	CSI-RS interval and offset	slot	Not configured
	aperiodicTriggerin gOffset		0
	CSI-IM resource Type		Aperiodic
	CSI-IM RE pattern		Pattern 0
CSI-IM configuration	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(4,9)
	CSI-IM timeConfig interval and offset	slot	Not configured
ReportConfigType			Aperiodic
CQI-table	•		Table 1
reportQuantity			cri-RI-PMI-CQI
	ForIChannelMeasur		Not configured
timeRestrictionI urements	ForInterferenceMeas		Not configured
cqi-FormatIndic	ator		Wideband
pmi-FormatIndi			Subband
Sub-band Size		RB	16
	csi-ReportingBand		1111111
CSI-Report inte		slot	Not configured
Aperiodic Report Slot Offset			8
CSI request			1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0
reportTriggerSize			1
CSI-AperiodicTriggerStateList			One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
	Codebook Type		typel-SinglePanel
	Codebook Mode		1
Codebook configuration	(CodebookConfig- N1,CodebookConfig-N2)		(4,2)
	(CodebookConfig- O1,CodebookCon fig-O2)		(4,4)

	CodebookSubset Restriction		0x FFFF
	RI Restriction		0000010
Physical channel for CSI report			PUSCH
CQI/RI/P	MI delay	ms	6.5
Maximum number of HARQ transmission			4
Measurement channel			R.PDSCH.2-8.3 TDD
Note 1: When Throughput is meast precoder shall be updated probability of each applicat Note 2: If the UE reports in an avail		in each slo ble i ₁ , i ₂ cor ilable uplinl at a downlin	k reporting instance at slot#n nk slot not later than slot#(n-6),
Note 3:	()		

Table 6.3.2.2.3-2: Minimum requirement

Parameter	Test 1
γ	2.5

6.3.2.2.4 Single PMI with 32TX Typel-SinglePanel Codebook

For the parameters specified in Table 6.3.2.2.4-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.2.4-2.

Table 6.3.2.2.4-1: Test parameters (dual-layer)

Pai	rameter	Unit	Test 1
Bandwidth		MHz	40
Subcar	rier spacing	kHz	30
Dup	lex Mode		TDD
TDD DL-UI	L configurations		FR1.30-1 as specified in Annex A
Propaga	ation channel		TDLA30-5
Antenna	configuration		High XP 32 x 2 (N1,N2) = (4,4)
Beamfo	rming Model		As specified in Annex B.4.1
	CSI-RS resource Type		Aperiodic
	Number of CSI- RS ports (X)		4
	CDM Type		FD-CDM2
	Density (ρ)		1
ZP CSI-RS configuration	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 5, (4,-)
	First OFDM symbol in the PRB used for CSI-RS (l ₀ , l ₁)		(9,-)
	CSI-RS interval and offset	slot	Not configured
	ZP CSI-RS trigger		1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0
NZP CSI-RS for CSI acquisition	CSI-RS resource Type		Aperiodic
	Number of CSI- RS ports (X)		32

	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
	First subcarrier		·
	index in the PRB		-
	used for CSI-RS		Row 17, (2, 4, 6, 8)
	(k_0, k_1, k_2, k_3)		
	First OFDM		
	symbol in the PRB		(5.40)
	used for CSI-RS		(5, 12)
	(l ₀ , l ₁)		
	CSI-RS		
	interval and offset	slot	Not configured
	aperiodicTriggerin		0
	gOffset		0
	CSI-IM resource		A
	Туре		Aperiodic
	CSI-IM RE pattern		Pattern 0
CSI-IM	CSI-IM Resource		
configuration	Mapping		(4,9)
	(kcsi-im,lcsi-im)		
	CSI-IM timeConfig	-1-4	Not configured
	interval and offset	slot	Not configured
ReportConfigTy	rpe		Aperiodic
CQI-table			Table 1
reportQuantity			cri-RI-PMI-CQI
timeRestriction	ForlChannelMeasur		Not configured
ements			Hot cormgared
	ForInterferenceMeas		Not configured
	urements		
cqi-FormatIndic			Wideband
pmi-FormatIndio	cator		Wideband
Sub-band Size	d	RB	16
csi-ReportingBa		-1-4	1111111
CSI-Report inte		slot	Not configured
Aperiodic Repo	rt Slot Oliset		8
CSI request			1 in slots i, where mod(i, 10) =
reportTriggerSiz	70		1, otherwise it is equal to 0
report riggersiz	26		One State with one Associated
			Report Configuration
CSI-AperiodicT	rinnarStatal ist		Associated Report
OOI-Aperiodic I	nggerotateList		Configuration contains pointers
			to NZP CSI-RS and CSI-IM
	Codebook Type		typel-SinglePanel
	Codebook Mode		1
Codebook configuration	(CodebookConfig-		
	N1,CodebookConf		(4,4)
	ig-N2)		(', ',
	(CodebookConfig-		
	O1,CodebookCon		(4,4)
	fig-O2)		
	CodebookSubset		0., 5555
	Restriction		0x FFFF
	RI Restriction		0000010

Physical channel for CSI report			PUSCH
CQI/RI/P	MI delay	ms	6.5
	n number of HARQ		4
transmiss	sion		7
Measure	ment channel		R.PDSCH.2-8.3 TDD
Note 1: Note 2:	precoder shall be updated in each slot (0.5 ms granularity) with equal probability of each applicable i ₁ , i ₂ combination.		
this reported PMI cannot be applied at the gNB downlink before slot#(n+6). Note 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.			t the gNB downlink before

Table 6.3.2.2.4-2: Minimum requirement

Parameter	Test 1
γ	5.0

6.3.2.2.5 Multiple PMI with 16TX TypeII Codebook

For the parameters specified in Table 6.3.2.2.5-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.2.5-2.

Table 6.3.2.2.5-1: Test parameters (dual-layer)

Parameter		Unit	Test 1
Bandwidth		MHz kHz	40
	Subcarrier spacing		30
Duplex Mode	Duplex Mode		TDD
TDD DL-UL o	TDD DL-UL configurations		FR1.30-1 as specified in Annex A
Propagation of	channel		TDLA30-5
Antenna conf	iguration		XP Medium 16 x 2
Beamforming			(N1,N2) = (4,2) As specified in Annex B.4.1
Dearmonning	CSI-RS resource Type		Aperiodic
	Number of CSI-RS		4
	ports (X)		·
	CDM Type		FD-CDM2
	Density (ρ)		1
	First subcarrier index		5 - (1)
ZP CSI-RS	in the PRB used for		Row 5, (4,-)
configuratio	CSI-RS (k ₀ , k ₁)		
n	First OFDM symbol in		(0.)
	the PRB used for CSI-		(9,-)
	RS (I ₀ , I ₁) CSI-RS		
	interval and offset	slot	Not configured
			1 in slots i, where mod(i, 10) =
	ZP CSI-RS trigger		1, otherwise it is equal to 0
	CSI-RS resource Type		Aperiodic
	Number of CSI-RS		
	ports (X)		16
	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
	First subcarrier index		
NZP CSI-	in the PRB used for		Row 12, (2, 4, 6, 8)
RS for CSI	CSI-RS (k ₀ , k ₁ , k ₂ , k ₃)		
acquisition	First OFDM symbol in		(- · ·
	the PRB used for CSI-		(5, -)
	RS (I ₀ , I ₁)		
	CSI-RS	slot	Not configured
	interval and offset aperiodicTriggeringOff		
	set		0
	CSI-IM resource Type		Aperiodic
	CSI-IM RE pattern		Pattern 0
CSI-IM	CSI-IM Resource		1 ditorri c
configuratio	Mapping		(4,9)
n	(kcsi-im,lcsi-im)		(1,5)
	CSI-IM timeConfig	slot	Not configured
5 .0	interval and offset	3101	<u> </u>
ReportConfig	туре		Aperiodic
CQI-table			Table 1
reportQuantit	y nEarlChannalMassura		cri-RI-PMI-CQI
timeRestrictionForlChannelMeasurem ents			Not configured
timeRestrictionForInterferenceMeasur			
ements			Not configured
cqi-FormatIndicator			Wideband
pmi-FormatIndicator			Subband
Sub-band Size		RB	16
csi-ReportingBand			1111111
CSI-Report interval and offset		slot	Not configured
Aperiodic Report Slot Offset			8
CSI request			1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0
reportTrigger	Size		1, otherwise it is equal to 0

CSI-AperiodicTriggerStateList			One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
	Codebook Type		typell
	L (numberOfBeams)		2
	N _{PSK} (phaseAlphabetSize)		8
	subbandAmplitude		True
Codebook configuratio n	(CodebookConfig- N1,CodebookConfig- N2)		(4,2)
	(CodebookConfig- O1,CodebookConfig- O2)		(4,4)
	CodebookSubsetRestri		0x 7FF
	ction		FFFF FFFF FFFF
	RI Restriction (typeII- RI-Restriction)		10
Physical char	nnel for CSI report		PUSCH
CQI/RI/PMI delay		ms	6.5
Maximum number of HARQ transmission			4
Measurement channel			R.PDSCH.2-8.3 TDD
precoder shall be updated in		each slot (ndom precoder selection, the (0.5 ms granularity) with equal bination. The random precoder

generation shall follow 'typel-SinglePanel' codebook configuration as specified in table 6.3.2.2.3-1.

Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-6), this reported PMI cannot be applied at the gNB downlink before slot#(n+6).

Randomization of the dual-cluster beam directions shall be used as Note 3: specified in Annex B.2.3.2.3A. The value of relative power ratio (p) shall be fixed as 1 during the test.

Table 6.3.2.2.5-2: Minimum requirement

Parameter	Test 1
	[1.9]

6.3.2.2.6 Multiple PMI with 16Tx Enhanced Type II Codebook

For the parameters specified in Table 6.3.2.2.6-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.2.6-2.

Table 6.3.2.2.6-1: Test parameters (dual-layer)

Parameter		Unit	Test 1
Bandwidth		MHz kHz	40
	Subcarrier spacing		30
Duplex Mode			TDD
TDD DL-UL configurations			FR1.30-1 as specified in Annex A
Propagation of	channel		TDLA30-5
Antonna conf	iguration		XP Medium 16 x 2
Antenna conf			(N1,N2) = (4,2)
Beamforming	CSI-RS resource Type		As specified in Annex B.4.1 Aperiodic
	Number of CSI-RS		Apendaic
	ports (X)		4
	CDM Type		FD-CDM2
	Density (ρ)		1
	First subcarrier index		
ZP CSI-RS	in the PRB used for		Row 5, (4,-)
configuratio	CSI-RS (k ₀ , k ₁)		
n	First OFDM symbol in		
	the PRB used for CSI-		(9,-)
	RS (I ₀ , I ₁)		
	CSI-RS	slot	Not configured
	interval and offset	0.00	
	ZP CSI-RS trigger		1 in slots i, where mod(i, 10) =
			1, otherwise it is equal to 0
	CSI-RS resource Type Number of CSI-RS		Aperiodic
			16
	ports (X) CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
	First subcarrier index		!
NZP CSI-	in the PRB used for		Row 12, (2, 4, 6, 8)
RS for CSI	CSI-RS (k ₀ , k ₁ , k ₂ , k ₃)		11.500 12, (2, 1, 0, 0)
acquisition	First OFDM symbol in		
'	the PRB used for CSI-		(5, -)
	RS (I ₀ , I ₁)		
	CSI-RS	slot	Not configured
	interval and offset	SIUL	Not configured
	aperiodicTriggeringOff set		0
	CSI-IM resource Type		Aperiodic
	CSI-IM RE pattern		Pattern 0
CSI-IM	CSI-IM Resource		i alloni s
configuratio	Mapping		(4,9)
n	(kcsi-im,lcsi-im)		
	CSI-IM timeConfig	slot	Not configured
	interval and offset	SIUL	Ţ.
ReportConfig	Туре		Aperiodic
CQI-table			Table 1
reportQuantit			cri-RI-PMI-CQI
timeRestrictionForlChannelMeasurem ents			Not configured
timeRestrictionForInterferenceMeasur			Not configured
ements			Not configured
cqi-FormatIndicator			Wideband
pmi-FormatIndicator			Subband
Sub-band Size		RB	8
csi-ReportingBand			1111111
CSI-Report interval and offset		slot	Not configured
Aperiodic Report Slot Offset			8
CSI request			1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0
reportTrigger	Size		1
Toportringgoroizo			•

CSI-AperiodicTriggerStateList			One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
	Codebook Type		typell-r16
	paramCombination-r16		6 (L =4, $p_v = 1/2$, $\beta = 1/2$)
	R(numberOfPMISubba ndsPerCQISubband- r16)		1
Codebook configuratio	(CodebookConfig- N1,CodebookConfig- N2)		(4,2)
n	(CodebookConfig- O1,CodebookConfig- O2)		(4,4)
	CodebookSubsetRestri ction		0x 7FF FFFF FFFF FFFF
	RI Restriction (typell- RI-Restriction-r16)		0010
Physical char	nnel for CSI report		PUSCH
CQI/RI/PMI d		ms	6.5
Maximum number of HARQ transmission			4
Measurement channel			R.PDSCH.2-8.3 TDD
precoder shall be updated in		each slot (indom precoder selection, the (0.5 ms granularity) with equal bination. The random precoder
1		a. 1 b 1	

generation shall follow 'typeI-SinglePanel' codebook configuration as specified in table 6.3.2.2.3-1.

Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-6), this reported PMI cannot be applied at the gNB downlink before slot#(n+6).

Note 3: Randomization of the dual-cluster beam directions shall be used as specified in Annex B.2.3.2.3A. The value of relative power ratio (p) shall be fixed as 1 during the test.

Table 6.3.2.2.6-2: Minimum requirement

Parameter	Test 1
γ	[2.2]

6.3.3 4RX requirements

6.3.3.1 **FDD**

6.3.3.1.1 Single PMI with 4TX TypeI-SinglePanel Codebook

For the parameters specified in Table 6.3.3.1.1-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.1.1-2.

Table 6.3.3.1.1-1: Test parameters (single layer)

Bandwidth	Parameter		Unit	Test 1
Duplex Mode	Bandwidth		MHz	10
Propagation channel	Subcarrier space	ing	kHz	15
Antenna configuration	Duplex Mode			
Beamforming Mode	Propagation cha	annel		
Beamforming Model	Antenna configu	ıration		
CSI-RS resource Type Periodic				
Type	Beamforming M			As specified in Annex B.4.1
Number of CSI-R Sports (X) CDM Type				Periodic
RS ports (X)				
CDM Type				4
Density (p)				ED CDM2
First subcarrier index in the PRB used for CSI-RS (ko, kr)				FD-CDIVI2
Index in the PRB used for CSI-RS ((o, k))				'
Used for CSI-RS (k0, k1) First OFDM symbol in the PRB used for CSI-RS (l0, l1) CSI-RS interval and offset Type Number of CSI-RS (SO, k1) First Subcarrier index in the PRB used for CSI-RS (k0, k1) Tirst subcarrier index in the PRB used for CSI-RS (k0, k1) First Subcarrier index in the PRB used for CSI-RS (k0, k1) First OFDM symbol in the PRB used for CSI-RS (l0, l1) CS				
(Ko, k1) First OFDM symbol in the PRB used for CSI-RS (Io, I1) CSI-RS resource Type Aperiodic	configuration			Row 5, (4,-)
First OFDM symbol in the PRB used for CSI-RS (lo, lr)				
Symbol in the PRB used for CSI-RS (lo, h)				
Used for CSI-RS				(0.)
CSI-RS interval and offset Slot S/1				(9,-)
CSI-RS interval and offset Slot S/1		(I_0, I_1)		
Interval and offset			olot	E/1
Type		interval and offset	SIOL	5/1
Type				Aperiodic
RS ports (X)		Туре		преполе
RS ports (X)				4
Density (p)				-
First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁) First OFDM symbol in the PRB used for CSI-RS (l ₀ , l ₁) CSI-RS interval and offset aperiodic Triggerin gOffset CSI-IM resource Type Aperiodic CSI-IM RE pattern Pattern 0 CSI-IM Resource Mapping (k _{CSI-IM} cSI-IM) CSI-IM ImeConfig interval and offset aperiodic Triggerin goffset ReportConfigType Aperiodic ReportQuantity SIot Not configured ReportQuantity TimeRestrictionForChannelMeasure ments ImeRestrictionForChannelMeasure ments ImeRestrictionForInterferenceMeas urements Sub-band Size RB 8 Siot Not configured Aperiodic Cri-RI-PMI-CQI Table 1 Cri-RI-PMI-CQI Wideband Wideband Sub-band Size RB 8 Siot Not configured ReportConfigType Aperiodic Cri-RI-PMI-CQI Wideband Wideband Sub-band Size RB 8 Siot Not configured Cri-RI-PMI-CQI Wideband Mideband 1111111 CSI-Report interval and offset Slot Not configured Aperiodic Report Slot Offset 4 CSI request				
NZP CSI-RS for CSI acquisition Since the PRB used for CSI-RS (ko, k₁)				1
Second content of the content of t	NZD COLDO			
acquisition Rist OFDM Symbol in the PRB Used for CSI-RS ([0, I+) ([0, I+) CSI-RS ([0, I+) ([0,				Row 4, (0,-)
First OFDM symbol in the PRB used for CSI-RS (lo, l1) CSI-RS interval and offset aperiodicTriggerin gOffset CSI-IM resource Type Aperiodic CSI-IM Resource Mapping (kosi-im,losi-im) CSI-IM timeConfig interval and offset ReportConfigType Aperiodic CQI-table Table 1 reportQuantity TimeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator Wideband Sub-band Size RB 8 csi-Report interval and offset SI ot Not configured RB (kosi-im,losi-im) CSI-IM timeConfig interval and offset Si ot Not configured ReportConfigType Aperiodic CQI-table Table 1 reportQuantity Cri-RI-PMI-CQI timeRestrictionForChannelMeasure Mot configured timeRestrictionForInterferenceMeas Undeband pmi-FormatIndicator Wideband Sub-band Size RB 8 csi-ReportingBand 11111111 CSI-Report interval and offset Slot Offset 4 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0				
symbol in the PRB used for CSI-RS (lo, lr) CSI-RS interval and offset aperiodicTriggerin gOffset CSI-IM resource Type CSI-IM RE pattern CSI-IM Resource Mapping (kcsi-im, lcsi-im) CSI-IM timeConfig interval and offset ReportConfigType Aperiodic CQI-table TeportQuantity Cri-RI-PMI-CQI timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements timeRestrictionForInterferenceMeas urements cqi-FormatIndicator Wideband Sub-band Size RB 8 csi-Report Slot Offset 4 CSI request (13,-) Not configured 1111111 CSI-Report interval and offset slot Not configured 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0	acquisition			
Used for CSI-RS (lo, l1) CSI-RS interval and offset aperiodicTriggerin gOffset CSI-IM resource Type CSI-IM RE pattern CSI-IM Resource Mapping (kcsi-Im,lcsi-Im) (CSI-IM timeConfig interval and offset ReportConfigType CQI-table ReportQuantity TimeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator Sub-band Size RB RB RB RS CSI-Report Slot Offset Aperiodic RB				4.5
CSI-RS interval and offset aperiodic Triggerin gOffset CSI-IM resource Type CSI-IM RE pattern Pattern 0				(13,-)
CSI-RS interval and offset aperiodicTriggerin gOffset CSI-IM resource Type CSI-IM RE pattern Pattern 0				
CSI-IM CSI-IM resource Type CSI-IM Resource Type CSI-IM Resource CSI-IM Resource CSI-IM Resource Mapping (4,9) (4,9)			olot	Not configured
CSI-IM resource Type CSI-IM RE pattern Pattern 0 CSI-IM Resource Mapping (4,9) CSI-IM Resource Mapping (kcsi-iM, lcsi-iM) CSI-IM timeConfig interval and offset Silot Not configured ReportConfigType Aperiodic CQI-table Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator Wideband pmi-FormatIndicator Wideband Sub-band Size RB 8 csi-Report interval and offset Slot Not configured Aperiodic Report Slot Offset 4 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0		interval and offset	SIOL	Not configured
CSI-IM resource Type CSI-IM RE pattern CSI-IM Resource Mapping (kcsi-iM, lcsi-iM) CSI-IM timeConfig interval and offset ReportConfigType Aperiodic CQI-table TeportQuantity TemeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements timeRestrictionForInterferenceMeas urements cqi-FormatIndicator pmi-FormatIndicator Sub-band Size csi-ReportingBand CSI-Report interval and offset Aperiodic ReportConfigured Table 1 Table 1 TreportQuantity Not configured Not configured Wideband Wideband Wideband Sub-band Size RB 8 8 csi-ReportingBand CSI-Report interval and offset Aperiodic Report Slot Offset CSI request Aperiodic Aperiodic Report Slot Offset 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0		aperiodicTriggerin		0
CSI-IM CONFIGURATION CSI-IM RE pattern CSI-IM Resource Mapping (kcsi-im, lcsi-im) CSI-IM timeConfig interval and offset ReportConfigType CQI-table reportQuantity timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator pmi-FormatIndicator pmi-FormatIndicator Sub-band Size csi-Report interval and offset CSI request Table 1 reportQuantity cri-RI-PMI-CQI Not configured Not configured Not configured Wideband Wideband 1111111 CSI-Report interval and offset Aperiodic CSI request Aperiodic I in slots i, where mod(i, 5) = 1, otherwise it is equal to 0				Ů
CSI-IM RE pattern CSI-IM Resource Mapping (KcSI-IM,IcSI-IM) CSI-IM timeConfig interval and offset ReportConfigType CQI-table reportQuantity timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator pmi-FormatIndicator Sub-band Size csi-Report interval and offset CSI request ReportConfigType Aperiodic Not configured Not configured Not configured Not configured Table 1 Not configured Not configured Not configured Not configured Table 1 ReportConfigType Aperiodic Report Slot Offset At 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0				Aperiodic
CSI-IM Resource Mapping (KcSI-IM,IcSI-IM) CSI-IM timeConfig interval and offset ReportConfigType Aperiodic CQI-table Table 1 reportQuantity Cri-RI-PMI-CQI timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator Wideband pmi-FormatIndicator Wideband Sub-band Size RB 8 csi-Report interval and offset Slot Not configured Aperiodic Report Slot Offset 4 CSI request CSI-IM Resource (4,9) (4,9) (4,9) (4,9)				
configuration Mapping (kcsi-im,lcsi-im) CSI-IM timeConfig interval and offset ReportConfigType CQI-table reportQuantity timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator Sub-band Size csi-Report interval and offset CSI request Mapping (kcsi-im,lcsi-im) (kcsi-im,lcsi-im) (kcsi-im,lcsi-im) slot slot Not configured Not configured Not configured Wideband Wideband 1111111 CSI-Report interval and offset Aperiodic Report Slot Offset 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0				Pattern 0
CSI-IM, ICSI-IM) CSI-IM timeConfig interval and offset Slot Not configured				(4.5)
CSI-IM timeConfig interval and offset slot Not configured ReportConfigType Aperiodic CQI-table Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasure ments Not configured timeRestrictionForInterferenceMeas urements Not configured cqi-FormatIndicator Wideband pmi-FormatIndicator Wideband Sub-band Size RB 8 csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 4 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0	configuration			(4,9)
Interval and offset Siot Not configured				
ReportConfigType Aperiodic CQI-table Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasure ments Not configured timeRestrictionForInterferenceMeas urements Not configured cqi-FormatIndicator Wideband pmi-FormatIndicator Wideband Sub-band Size RB csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 4 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0			slot	Not configured
CQI-table Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasure ments Not configured timeRestrictionForInterferenceMeas urements Not configured cqi-FormatIndicator Wideband pmi-FormatIndicator Wideband Sub-band Size RB 8 csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 4 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0	ReportConfigTy			Aperiodic
reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasure ments Not configured timeRestrictionForInterferenceMeas urements cqi-FormatIndicator pmi-FormatIndicator Sub-band Size RB Scsi-ReportingBand CSI-Report interval and offset Aperiodic Report Slot Offset CSI request CSI request Not configured Wideband Wideband Sub-band Size RB Scsi-ReportingBand T111111 CSI-Report interval and offset Aperiodic Report Slot Offset 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0				
timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator pmi-FormatIndicator Sub-band Size Csi-ReportingBand CSI-Report interval and offset Aperiodic Report Slot Offset CSI request Not configured Wideband Wideband Sub-band Size RB 8 1111111 CSI-Report interval and offset Aperiodic Report Slot Offset 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0				
ments Not configured timeRestrictionForInterferenceMeas urements Not configured cqi-FormatIndicator Wideband pmi-FormatIndicator Wideband Sub-band Size RB 8 csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 4 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0				
urements Not configured cqi-FormatIndicator Wideband pmi-FormatIndicator Wideband Sub-band Size RB csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 4 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0				Not configured
urements Not configured cqi-FormatIndicator Wideband pmi-FormatIndicator Wideband Sub-band Size RB csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 4 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0	timeRestrictionForInterferenceMeas			Not southwared
cqi-FormatIndicator Wideband pmi-FormatIndicator Wideband Sub-band Size RB 8 csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 4 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0			<u> </u>	inot configured
Sub-band Size CSi-ReportingBand CSI-Report interval and offset Aperiodic Report Slot Offset CSI request RB 8 1111111 Not configured 4 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0	cqi-FormatIndic	ator		Wideband
csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 4 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0	pmi-FormatIndio			Wideband
CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 4 CSI request 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0	Sub-band Size			_
Aperiodic Report Slot Offset CSI request 4 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0		csi-ReportingBand		
CSI request			slot	
otherwise it is equal to 0	Aperiodic Repo	rt Slot Offset		-
reportTriggerSize 1	<u> </u>			
	reportTriggerSiz	ze		1

CSI-AperiodicTriggerStateList			One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
	Codebook Type		typel-SinglePanel
	Codebook Mode		1
Codebook	(CodebookConfig- N1,CodebookConfig-N2)		(2,1)
configuration	(CodebookConfig- O1,CodebookCon fig-O2)		(4,1)
	CodebookSubset Restriction		11111111
	RI Restriction		0000001
Physical chann	el for CSI report		PUSCH
CQI/RI/PMI del	CQI/RI/PMI delay		6
Maximum number of HARQ transmission			4
Measurement channel			R.PDSCH.1-6.1 FDD
• .		in each slo	random precoder selection, the ot (1 ms granularity) with equal

probability of each applicable i_1 , i_2 combination.

Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-3), this reported PMI cannot be applied at the gNB downlink before

Note 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.

Table 6.3.3.1.1-2: Minimum requirement

Parameter	Test 1
γ	1.3

6.3.3.1.2 Single PMI with 8TX TypeI-SinglePanel Codebook

For the parameters specified in Table 6.3.3.1.2-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.1.2-2.

Bandwidth		2-1: Test parameters	Unit	Test 1
Subcarrier spacing		(dual-layer) Parameter		40
Duplex Mode		ina		
Propagation channel		ing	KIIZ	
Antenna configuration		annel		
Sampton Samp				
Beamforming Model	Antenna configu	uration		
CSI-RS resource Type	Beamforming M	odel		As specified in Annex B.4.1
	g			
RS ports (X)		Type		Periodic
RS ports (X)		Number of CSI-		4
Density (p)				
First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)				FD-CDM2
index in the PRB used for CSI-RS ((k ₀ , k ₁)) First OFDM symbol in the PRB used for CSI-RS ((b, l ₁)) CSI-RS (b, l ₁) CSI-RS (b, l ₁) CSI-RS resource Type Number of CSI-RS (b, l ₁) Density (p) First subcarrier index in the PRB used for CSI-RS (b, l ₁) Density (p) First subcarrier index in the PRB used for CSI-RS acquisition NZP CSI-RS (k ₀ , k ₁) First OFDM symbol in the PRB used for CSI-RS (b, l ₁) CSI-RS acquisition CSI-RS (b, l ₁) CSI-RS interval and offset aperiodic Triggerin qOffset CSI-IM RE pattern CSI-IM Resource Mapping (kCSI-IM Resource Mapping (kCSI-IM Resource Mapping CSI-IM Resource Mapping CSI-IM timeConfig interval and offset aperiodic Triggerin qOffset CSI-IM Resource Mapping CI-I-IM COI Table 1 Tab				1
used for CSI-RS (k ₀ , kr) First OFDM symbol in the PRB used for CSI-RS (l ₀ , l ₁) CSI-RS interval and offset index in the PRB used for CSI-RS (l ₀ , l ₁) CSI-RS resource Type Aperiodic Number of CSI-RS (Number of CSI-RS (Num	ZP CSI-RS			
Used for CSI-RS ((k ₀ , k ₁)	configuration			Row 5, (4,-)
First OFDM symbol in the PRB used for CSI-RS (lo, l₁) CSI-RS (lo, l₁) CSI-RS (lo, l₁) CSI-RS (lo, l₁) CSI-RS (source Type Aperiodic Type CDM4 (FD2, TD2)				
Symbol in the PRB used for CSI-RS (lo, l·1) CSI-RS interval and offset Inter				
Used for CSI-RS				
CSI-RS interval and offset slot S/1				(9,-)
CSI-RS interval and offset cSI-RS resource Type Number of CSI-RS ports (X) CDM Type Density (p) Tirst subcarrier index in the PRB used for CSI-RS (ko, k1) First OFDM symbol in the PRB used for CSI-RS (lo, l1) CSI-RS interval and offset aperiodicTriggerin gOffset CSI-IM Resource Type CSI-IM Resource Type CSI-IM Resource Mapping (kcsi-IM, lcsi-IM) CSI-IM timeConfig interval and offset surements understand offset aurements understand offset surements understand offset surements understand offset surements RB (SI-P) RB (SI-P				
Interval and offset			-1-4	E/A
Type		interval and offset	SIOT	5/1
Number of CSI-RS ports (X) CDM Type Density (p) First subcarrier index in the PRB used for CSI-RS (ko, kt) First OFDM symbol in the PRB used for CSI-RS (lo, lt) CSI-RS interval and offset aperiodicTriggerin gOffset CSI-IM resource Type CSI-IM RE pattern CSI-IM Resource Mapping (kcsI-IM, IcsI-IM) CSI-IM timeConfig interval and offset SIot CSI-IM resource Type CSI-IM Resource Mapping (kcsI-IM, IcsI-IM) CSI-IM timeConfig interval and offset TimeRestrictionForChannelMeasure ments timeRestrictionForChannelMeasure ments timeRestrictionForChannelMeasure ments cqi-FormatIndicator SI-RB SIot Not configured Not configured Not configured Not configured Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasure ments cqi-FormatIndicator Wideband Sub-band Size RB S SIOT Not configured Not configured SIOT Not configured TimeRestrictionForChannelMeasure ments Not configured SIOT Not configured TimeRestrictionForThaterferenceMeas urements Cqi-FormatIndicator Wideband Sub-band Size RB S SIOT Not configured TimeRestrictionForInterferenceMeas urements SIOT Not configured TimeRestrictionFormatIndicator Wideband SIOT Not configured TimeRestrictionFormatIndicator Wideband SIOT Not configured TimeRestrictionFormatIndicator Wideband SIOT Not configured TimeRestrictionForChannelMeasure Mideband SIOT Not configured TimeRestrictionForChannelMeasure Mideband SIOT Not configured TimeRestrictionForChannelMeasure Mideband TimeRestrictionForChannelMeasure Mideband SIOT Not configured TimeRestrictionForChannelMeasure Mideband TimeRestrictionForChannelMeasure Mideband TimeRestrictionForChannelMeasure TimeRestric		CSI-RS resource		Apariadia
RS ports (X)		Type		Apenduc
RS ports (x) CDM Type Density (p) First subcarrier index in the PRB used for CSI-RS (ko, k₁) First OFDM symbol in the PRB used for CSI-RS (lo, l₁) CSI-RS interval and offset aperiodicTriggerin gOffset CSI-IM resource Type CSI-IM RE pattern CSI-IM REsource Mapping (kosi-im, losi-im) CSI-IM resource Type CSI-IM resource Toffig interval and offset interval and offset seportConfigType ReportConfigType CQI-table ReportConfigType Aperiodic Table 1 Table 1 Table 1 Table 1 Table 1 Tori-RI-PMI-CQI TimeRestrictionForChannelMeasure Mot configured Tori-RI-PMI-CQI TimeRestrictionForThaterferenceMeas Urements Urements Urements Row 8, (4,6) Not configured Aperiodic Not configured Videband Not configured Table 1 Table 1 Table 1 Table 1 Table 1 Tori-RI-PMI-CQI TimeRestrictionForChannelMeasure Mot configured Videband Videband Sub-band Size Si-ReportingBand CSI-Report interval and offset Aperiodic Report Slot Offset Si in slots i, where mod(i, 5) = 1,				8
Density (p)				
First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)				` .
NZP CSI-RS for CSI acquisition				1
for CSI acquisition Second Street Second	NZD COLDC			
acquisition (ko, k1) First OFDM Symbol in the PRB used for CSI-RS (lo, l1)				Row 8, (4,6)
First OFDM symbol in the PRB used for CSI-RS (lo, l₁) CSI-RS interval and offset aperiodicTriggerin gOffset CSI-IM resource Type CSI-IM RE pattern CSI-IM Resource Mapping (kcsi-iii, lcsi-iii) CSI-IM timeConfig interval and offset ReportConfigType CQI-table reportQuantity timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements timeRestrictionForInterferenceMeas urements timeRestrictionForInterferenceMeas urements cqi-FormatIndicator Sub-band Size RB RB RB RB RB RB RB RCSI request (5,-) Not configured				
symbol in the PRB used for CSI-RS (lo, l1) CSI-RS interval and offset aperiodicTriggerin gOffset CSI-IM resource Type CSI-IM RE pattern CSI-IM RE pattern CSI-IM Resource Mapping (kcsi-iiii, lcsi-iii) CSI-IM timeConfig interval and offset and offset seportConfigType ReportConfigType ReportConfigType ReportQuantity timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements timeRestrictionForInterferenceMeas urements cqi-FormatIndicator pmi-FormatIndicator Sub-band Size RB RB RB RB RB RB RB RB RB R	acquisition			
used for CSI-RS (lo, l1) CSI-RS interval and offset aperiodicTriggerin gOffset CSI-IM resource Type CSI-IM RE pattern CSI-IM Resource Mapping (kcsI-IM, lcsI-IM) CSI-IM timeConfig interval and offset ReportConfigType ReportQuantity Table 1 reportQuantity timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements timeRestrictionForInterferenceMeas urements cqi-FormatIndicator pmi-FormatIndicator pmi-FormatIndicator Sub-band Size csi-ReportingBand CSI request CSI request Not configured Not configured RB				<i>i</i>
CSI-RS interval and offset slot Not configured				(5,-)
CSI-RS interval and offset aperiodicTriggerin gOffset				
CSI-IM resource Aperiodic		CSI-RS	alat	Not configured
GOffset CSI-IM resource Type CSI-IM RE pattern CSI-IM Resource Configuration CSI-IM Resource Mapping (kcsi-im, lcsi-im) CSI-IM timeConfig interval and offset ReportConfigType CQI-table Table 1 reportQuantity timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator pmi-FormatIndicator Sub-band Size csi-Report interval and offset Aperiodic Not configured Not configured Not configured Wideband Wideband Sub-band Size CSI-Report interval and offset Aperiodic Report Slot Offset CSI-request CSI-request Aperiodic Aperiodic Not configured Not configured 1111111 Not configured 11 in slots i, where mod(i, 5) = 1,			SIOL	Not configured
GOTISET CSI-IM resource Type CSI-IM RE pattern CSI-IM Resource CSI-IM Resource CSI-IM Resource CONFIGURATION CSI-IM Resource CONFIGURATION CSI-IM Resource Mapping (kcsi-im, csi-im) CSI-IM timeConfig interval and offset ReportConfigType Aperiodic CQI-table Table 1 reportQuantity timeRestrictionForChannelMeasure ments timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator pmi-FormatIndicator Sub-band Size RB 8 csi-ReportingBand CSI-Report interval and offset Aperiodic Not configured Wideband Sub-band Size RB 8 Csi-Report interval and offset Aperiodic Report Slot Offset 5 CSI request Aperiodic Not configured Aperiodic Report Slot Offset 5 1 in slots i, where mod(i, 5) = 1,				0
Type CSI-IM RE pattern CSI-IM Resource Mapping (kcsi-im,lcsi-im) CSI-IM timeConfig interval and offset ReportConfigType CQI-table reportQuantity timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator sub-band Size csi-Report interval and offset Type CSI-IM RE pattern Pattern 0 Pattern 0 Aperiodic (4,9) Not configured Not configured Not configured Not configured Wideband Wideband Sub-band Size RB 8 csi-ReportingBand CSI-Report interval and offset Aperiodic Report Slot Offset CSI request Pattern 0 Pattern 0 Pattern 0 Pattern 0 Not configured Not configured Not configured Videband Sub-band Size RB 8 CSI-Report interval and offset Aperiodic Report Slot Offset Sol request 1 in slots i, where mod(i, 5) = 1,				Ŭ
CSI-IM RE pattern CSI-IM Resource Mapping (kcsi-IM, lcsi-IM) CSI-IM timeConfig interval and offset ReportConfigType CQI-table reportQuantity timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator pmi-FormatIndicator Sub-band Size csi-Report interval and offset CSI-IM RE pattern Pattern 0 (4,9) (4,9) Not configured Not configured Not configured Not configured Wideband Wideband Sub-band Size RB 8 csi-ReportingBand CSI-Report interval and offset Aperiodic Report Slot Offset SI request 1 in slots i, where mod(i, 5) = 1,				Aperiodic
CSI-IM Resource Mapping (kcsi-im,lcsi-im) ReportConfigType Slot Not configured ReportQuantity Table 1 reportQuantity timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator Wideband Sub-band Size RB 8 csi-Report interval and offset Slot Offset Slot Offset Slot Offset Slot Not configured CSI-Indicator Slot Offset Slot Not configured CSI-request Slot Offset Slot Not configured (4,9) (4,9) (4,9) (4,9) (4,9) Not configured Slot Not configured Not configured Slot Not configured Slot Not configured Not configured Not configured		CCLIM DE nottore		·
configuration Mapping (kcsi-iM,lcsi-iM) CSI-IM timeConfig interval and offset ReportConfigType Aperiodic CQI-table Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator Wideband pmi-FormatIndicator Wideband Sub-band Size RB 8 csi-ReportingBand 1111111 CSI-Report interval and offset Slot Not configured Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1,	CSI-IM			Pattern U
CSI-Report Interval and offset Slot Not configured				(4.9)
ReportConfigType Aperiodic CQI-table Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator Wideband Sub-band Size RB 8 csi-Report interval and offset Aperiodic Report Slot Offset CSI request Not configured	Johngaradon			(7,3)
Interval and offset Siot Not configured				
ReportConfigType Aperiodic CQI-table Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasure ments Not configured timeRestrictionForInterferenceMeas urements Not configured cqi-FormatIndicator Wideband pmi-FormatIndicator Wideband Sub-band Size RB 8 csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1,			slot	Not configured
CQI-table Table 1 reportQuantity cri-RI-PMI-CQI timeRestrictionForChannelMeasure ments Not configured timeRestrictionForInterferenceMeas urements Not configured cqi-FormatIndicator Wideband pmi-FormatIndicator Wideband Sub-band Size RB 8 csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1,				Aperiodic
timeRestrictionForChannelMeasure ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator pmi-FormatIndicator Sub-band Size csi-ReportingBand CSI-Report interval and offset Aperiodic Report Slot Offset Not configured Wideband Wideband 8 8 1111111 CSI-Report interval and offset Aperiodic Report Slot Offset 1 in slots i, where mod(i, 5) = 1,				Table 1
ments timeRestrictionForInterferenceMeas urements cqi-FormatIndicator pmi-FormatIndicator Sub-band Size csi-ReportingBand CSI-Report interval and offset Aperiodic Report Slot Offset timeRestrictionForInterferenceMeas Not configured Wideband Wideband RB 8 csi-ReportingBand 1111111 CSI-Report interval and offset Aperiodic Report Slot Offset 1 in slots i, where mod(i, 5) = 1,	reportQuantity			cri-RI-PMI-CQI
timeRestrictionForInterferenceMeas urements cqi-FormatIndicator pmi-FormatIndicator Sub-band Size csi-ReportingBand CSI-Report interval and offset Aperiodic Report Slot Offset CSI request Not configured Wideband Wideband 1111111 Results Slot Not configured Not configured To in slots i, where mod(i, 5) = 1,	timeRestrictionForChannelMeasure			Not configured
urements Not configured cqi-FormatIndicator Wideband pmi-FormatIndicator Wideband Sub-band Size RB csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1,				1401 Coringuled
cqi-FormatIndicator pmi-FormatIndicator Sub-band Size Csi-ReportingBand CSI-Report interval and offset Aperiodic Report Slot Offset CSI request CSI request Wideband Wideband 1111111 RB 8 11111111 Not configured Not configured 1 in slots i, where mod(i, 5) = 1,				Not configured
pmi-FormatIndicator Sub-band Size RB Signature CSI-Report interval and offset Aperiodic Report Slot Offset CSI request Wideband 8 1111111 Not configured Not configured 5 1 in slots i, where mod(i, 5) = 1,				~
Sub-band Size CSI-ReportingBand CSI-Report interval and offset Aperiodic Report Slot Offset CSI request RB 8 1111111 Not configured 5 1 in slots i, where mod(i, 5) = 1,	•			
csi-ReportingBand 1111111 CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1,				
CSI-Report interval and offset slot Not configured Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1,				•
Aperiodic Report Slot Offset 5 CSI request 1 in slots i, where mod(i, 5) = 1,			elot	
1 in slots i, where $mod(i, 5) = 1$,			2101	
		TOOLONGE		9
	CSI request			

reportTrig	ggerSiz	ze		1
CSI-Aper	iodicT	riggerStateList		One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
		Codebook Type		typel-SinglePanel
		Codebook Mode		1
Codeboo	l _z	(CodebookConfig- N1,CodebookConfig-N2)		(4,1)
configura		(CodebookConfig- O1,CodebookCon fig-O2)		(4,1)
		CodebookSubset Restriction		0x FFFF
		RI Restriction		0000010
Physical	channe	el for CSI report		PUSCH
CQI/RI/P			ms	8
	Maximum number of HARQ transmission			4
Measurer	ment c	hannel		R.PDSCH.1-6.2 FDD
Note 1:	Whe	n Throughput is meas	ured using	random precoder selection, the
	precoder shall be updated in each probability of each applicable i ₁ , i ₂		ole i ₁ , i ₂ cor	mbination.
Note 2:	Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-4 this reported PMI cannot be applied at the gNB downlink before slot#(n+4).		nk slot not later than slot#(n-4), at the gNB downlink before	
Note 3:	ote 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.			direction shall be used as

Table 6.3.3.1.2-2: Minimum requirement

Parameter	Test 1
γ	1.5

6.3.3.1.3 Multiple PMI with 16TX TypeI-SinglePanel Codebook

For the parameters specified in Table 6.3.3.1.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.1.3-2.

Table 6.3.3.1.3-1: Test parameters (dual-layer)

Pai	rameter	Unit	Test 1
Bandwidth		MHz	10
Subcarrier space	ing	kHz	15
Duplex Mode			FDD
Propagation cha	annel		TDLC300-5
Antenna configu	ıration		High XP 16 x 4
Antenna comigi	uration		(N1,N2) = (4,2)
Beamforming M	Beamforming Model		As specified in Annex B.4.1
	CSI-RS resource Type		Aperiodic
ZP CSI-RS configuration	Number of CSI- RS ports (X)		4
	CDM Type		FD-CDM2
	Density (ρ)		1

	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 5, (4,-)
	First OFDM symbol in the PRB used for CSI-RS (l ₀ , l ₁)		(9,-)
	CSI-RS interval and offset	slot	Not configured
	ZP CSI-RS trigger		1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0
	CSI-RS resource Type		Aperiodic
	Number of CSI- RS ports (X)		16
	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
	First subcarrier		'
NZP CSI-RS for CSI acquisition	index in the PRB used for CSI-RS (k ₀ , k ₁ , k ₂ , k ₃)		Row 12, (2, 4, 6, 8)
	First OFDM symbol in the PRB used for CSI-RS (l ₀ , l ₁)		(5, -)
	CSI-RS interval and offset	slot	Not configured
	aperiodicTriggerin gOffset		0
	CSI-IM resource Type		Aperiodic
	CSI-IM RE pattern		Pattern 0
CSI-IM configuration	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(4,9)
	CSI-IM timeConfig interval and offset	slot	Not configured
ReportConfigTy	rpe		Aperiodic
CQI-table	•		Table 1
reportQuantity			cri-RI-PMI-CQI
	ForChannelMeasure		
ments			Not configured
timeRestrictionF urements	orInterferenceMeas		Not configured
cqi-FormatIndic	ator		Wideband
pmi-FormatIndio			Subband
Sub-band Size		RB	8
csi-ReportingBa	and		1111111
	CSI-Report interval and offset		Not configured
Aperiodic Report Slot Offset			5
CSI request			1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0
reportTriggerSiz	ze		1
			One State with one Associated
			Report Configuration
CSI-AperiodicT	riggerStateList		Associated Report
			Configuration contains pointers to NZP CSI-RS and CSI-IM
	Codebook Type		typel-SinglePanel
	Codebook Mode		1
	(CodebookConfig-		
Codebook configuration	N1,CodebookConf ig-N2)		(4,2)
	(CodebookConfig- O1,CodebookCon		(4.4)
	fig-O2)		(4,4)
1	<u> </u>		

	CodebookSubset Restriction		0x FFFF
	RI Restriction		0000010
Physical channel for CSI report			PUSCH
CQI/RI/P	'MI delay	ms	8
Maximun transmiss	n number of HARQ sion		4
Measurement channel			R.PDSCH.1-6.3 FDD
Note 1: Note 2:	precoder shall be updated probability of each applical If the UE reports in an ava	in each slo ble i ₁ , i ₂ cor ilable uplinl at a downlin	k reporting instance at slot#n k slot not later than slot#(n-4),
Note 3:	Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.		

Table 6.3.3.1.3-2: Minimum requirement

Parameter	Test 1
γ	3.0

6.3.3.1.4 Single PMI with 32TX TypeI-SinglePanel Codebook

For the parameters specified in Table 6.3.3.1.4-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.1.4-2.

Table 6.3.3.1.4-1: Test parameters (dual-layer)

Pai	rameter	Unit	Test 1
Bandwidth		MHz	10
Subcarrier spacing		kHz	15
Duplex Mode			FDD
Propagation cha	annel		TDLA30-5
Antenna configuration			High XP 32 x 4 (N1,N2) = (4,4)
Beamforming M	lodel		As specified in Annex B.4.1
	CSI-RS resource Type		Aperiodic
	Number of CSI- RS ports (X)		4
	CDM Type		FD-CDM2
	Density (ρ)		1
ZP CSI-RS configuration	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 5, (4,-)
	First OFDM symbol in the PRB used for CSI-RS (I ₀ , I ₁)		(9,-)
	CSI-RS interval and offset	slot	Not configured
	ZP CSI-RS trigger		1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0
NZP CSI-RS for CSI	CSI-RS resource Type		Aperiodic
	Number of CSI- RS ports (X)		32
acquisition	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1

	F: /		
	First subcarrier		
	index in the PRB		Row 17, (2, 4, 6, 8)
	used for CSI-RS		, , , , ,
	(k ₀ , k ₁ , k ₂ , k ₃)		
	First OFDM		
	symbol in the PRB		(5, 12)
	used for CSI-RS		
	(l ₀ , l ₁)		
	CSI-RS	slot	Not configured
	interval and offset		3
	aperiodicTriggerin		0
	gOffset		-
	CSI-IM resource		Aperiodic
	Type		•
	CSI-IM RE pattern		Pattern 0
CSI-IM	CSI-IM Resource		
configuration	Mapping		(4,9)
	(kcsi-im,lcsi-im)		
	CSI-IM timeConfig	slot	Not configured
	interval and offset	0.00	-
ReportConfigTy	pe		Aperiodic
CQI-table			Table 1
reportQuantity			cri-RI-PMI-CQI
timeRestrictionF	orChannelMeasure		Not configured
ments			140t configured
timeRestrictionF	ForInterferenceMeas		Not configured
urements			-
cqi-FormatIndic	ator		Wideband
pmi-FormatIndio	cator		Wideband
Sub-band Size		RB	8
csi-ReportingBand			1111111
csi-ReportingBa	and		1111111
csi-ReportingBa		slot	Not configured
	rval and offset	slot	
CSI-Report inte Aperiodic Repo	rval and offset	slot	Not configured
CSI-Report inte	rval and offset	slot	Not configured 5
CSI-Report inte Aperiodic Repo	rval and offset rt Slot Offset	slot	Not configured 5 1 in slots i, where mod(i, 5) = 1,
CSI-Report inte Aperiodic Repo CSI request	rval and offset rt Slot Offset	slot	Not configured 5 1 in slots i, where mod(i, 5) = 1,
CSI-Report inte Aperiodic Repo CSI request	rval and offset rt Slot Offset	slot	Not configured 5 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0 1 One State with one Associated
CSI-Report inte Aperiodic Repo CSI request	rval and offset rt Slot Offset ze	slot	Not configured 5 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0 1
CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz	rval and offset rt Slot Offset ze	slot	Not configured 5 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration
CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz	rval and offset rt Slot Offset ze	slot	Not configured 5 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report
CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz	rval and offset rt Slot Offset ze	slot	Not configured 5 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers
CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz	rval and offset rt Slot Offset ze riggerStateList	slot	Not configured 5 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz	rval and offset rt Slot Offset ze riggerStateList Codebook Type	slot	Not configured 5 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz	rval and offset rt Slot Offset ze riggerStateList Codebook Type Codebook Mode	slot	Not configured 5 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz CSI-AperiodicTri	rval and offset rt Slot Offset ze riggerStateList Codebook Type Codebook Mode (CodebookConfig-	slot	Not configured 5 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typeI-SinglePanel 1
CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz CSI-AperiodicTri Codebook	rval and offset rt Slot Offset ze riggerStateList Codebook Type Codebook Mode (CodebookConfig- N1,CodebookConf	slot	Not configured 5 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typeI-SinglePanel 1
CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz CSI-AperiodicTri	rval and offset rt Slot Offset ze riggerStateList Codebook Type Codebook Mode (CodebookConfig- N1,CodebookConfig- ig-N2)	slot	Not configured 5 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typeI-SinglePanel 1
CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz CSI-AperiodicTri Codebook	rval and offset rt Slot Offset ze riggerStateList Codebook Type Codebook Mode (CodebookConfig-N1,CodebookConfig-N2) (CodebookConfig-O1,CodebookConfig-O1,CodebookConfig-O2)	slot	Not configured 5 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typeI-SinglePanel 1 (4,4)
CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz CSI-AperiodicTri Codebook	rval and offset rt Slot Offset ze riggerStateList Codebook Type Codebook Mode (CodebookConfig- N1,CodebookConfig- N2) (CodebookConfig- O1,CodebookConfig- O1,CodebookConfig- O1,CodebookConfig-	slot	Not configured 5 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typel-SinglePanel 1 (4,4)
CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz CSI-AperiodicTri Codebook	rval and offset rt Slot Offset ze riggerStateList Codebook Type Codebook Mode (CodebookConfig-N1,CodebookConfig-N2) (CodebookConfig-O1,CodebookConfig-O1,CodebookConfig-O2)	slot	Not configured 5 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typeI-SinglePanel 1 (4,4)
CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz CSI-AperiodicTri Codebook	rval and offset rt Slot Offset ze riggerStateList Codebook Type CodebookConfig- N1,CodebookConfig- N2) (CodebookConfig- O1,CodebookCon fig-O2) CodebookSubset	slot	Not configured 5 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typel-SinglePanel 1 (4,4)
CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz CSI-AperiodicTri Codebook	rval and offset rt Slot Offset ze riggerStateList Codebook Type CodebookConfig- N1,CodebookConfig- N2) (CodebookConfig- O1,CodebookConfig- O1,CodebookConfig- O2) CodebookSubset Restriction RI Restriction	slot	Not configured 5 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typeI-SinglePanel 1 (4,4) (4,4)
CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz CSI-AperiodicTri Codebook configuration	rval and offset rt Slot Offset ze riggerStateList Codebook Type Codebook Mode (CodebookConfig-N1,CodebookConfig-N2) (CodebookConfig-O1,CodebookConfig-O2) CodebookSubset Restriction RI Restriction el for CSI report	slot	Not configured 5 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typel-SinglePanel 1 (4,4) (4,4) 0x FFFF 00000010
CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz CSI-AperiodicTri Codebook configuration	rval and offset rt Slot Offset ze riggerStateList Codebook Type Codebook Mode (CodebookConfig- N1,CodebookConfig- N2) (CodebookConfig- O1,CodebookConfig- O1,CodebookConfig- O2) CodebookSubset Restriction RI Restriction el for CSI report		Not configured 5 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typeI-SinglePanel 1 (4,4) 0x FFFF 00000010 PUSCH 8
CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz CSI-AperiodicTr Codebook configuration Physical channe CQI/RI/PMI dela	rval and offset rt Slot Offset ze riggerStateList Codebook Type Codebook Mode (CodebookConfig- N1,CodebookConfig- N2) (CodebookConfig- O1,CodebookConfig- O1,CodebookConfig- O2) CodebookSubset Restriction RI Restriction el for CSI report		Not configured 5 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typeI-SinglePanel 1 (4,4) (4,4) 0x FFFF 00000010 PUSCH
CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz CSI-AperiodicTr Codebook configuration Physical channe CQI/RI/PMI dela Maximum numb	rval and offset rt Slot Offset ze riggerStateList Codebook Type Codebook Mode (CodebookConfig- N1,CodebookConfig- O1,CodebookConfig- O1,CodebookConfig- O2) CodebookSubset Restriction RI Restriction el for CSI report ay per of HARQ		Not configured 5 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typeI-SinglePanel 1 (4,4) 0x FFFF 00000010 PUSCH 8

Note 1: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (1 ms granularity) with equal probability of each applicable i₁, i₂ combination.

Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-4), this reported PMI cannot be applied at the gNB downlink before slot#(n+4).

Note 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.

Table 6.3.3.1.4-2: Minimum requirement

Parameter	Test 1
γ	7.0

6.3.3.1.5 Multiple PMI with 16TX TypeII Codebook

For the parameters specified in Table 6.3.3.1.5-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.1.5-2.

Table 6.3.3.1.5-1: Test parameters (dual-layer)

Р	arameter	Unit	Test 1
Bandwidth		MHz	10
Subcarrier spacing		kHz	15
Duplex Mode			FDD
Propagation channel			TDLA30-5
Antenna configuration			XP Medium 16 x 4 (N1,N2) = (4,2)
Beamforming N	Model		As specified in Annex B.4.1
	CSI-RS resource		Aperiodic
	Type Number of CSI-RS		4
	ports (X)		-
	CDM Type		FD-CDM2
	Density (ρ)		1
ZP CSI-RS configuration	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 5, (4,-)
	First OFDM symbol in the PRB used for CSI-RS (I ₀ , I ₁)		(9,-)
	CSI-RS interval and offset	slot	Not configured
	ZP CSI-RS trigger		1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0
	CSI-RS resource Type		Aperiodic
	Number of CSI-RS ports (X)		16
	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
	First subcarrier index		·
NZP CSI-RS for CSI acquisition	in the PRB used for CSI-RS (k ₀ , k ₁ , k ₂ , k ₃)		Row 12, (2, 4, 6, 8)
acquisition	First OFDM symbol in the PRB used for CSI-RS (I ₀ , I ₁)		(5, -)
	CSI-RS interval and offset	slot	Not configured
	aperiodicTriggeringO ffset		0
	CSI-IM resource Type		Aperiodic
	CSI-IM RE pattern		Pattern 0
CSI-IM configuration	CSI-IM Resource Mapping (Kcsi-im,lcsi-im)		(4,9)
	CSI-IM timeConfig interval and offset	slot	Not configured
ReportConfigT			Aperiodic
CQI-table			Table 1
reportQuantity			cri-RI-PMI-CQI
timeRestrictionForChannelMeasurem ents			Not configured
timeRestriction ements	timeRestrictionForInterferenceMeasur		Not configured
cqi-FormatIndicator			Wideband
pmi-FormatIndicator			Subband
Sub-band Size		RB	8
csi-ReportingB			1111111
	erval and offset	slot	Not configured
Aperiodic Report Slot Offset CSI request			5 1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0
reportTriggerS	ize		1
reportringgeroize			1

CSI-AperiodicTriggerStateList			One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
	Codebook Type		typell
	L (numberOfBeams)		2
	N _{PSK} (phaseAlphabetSize)		8
	subbandAmplitude		True
Codebook configuration	(CodebookConfig- N1,CodebookConfig- N2)		(4,2)
	(CodebookConfig- O1,CodebookConfig- O2)		(4,4)
	CodebookSubsetRes		0x 7FF
	triction		FFFF FFFF FFFF
	RI Restriction (typeII- RI-Restriction)		10
Physical channel for CSI report			PUSCH
CQI/RI/PMI delay		ms	8
Maximum number of HARQ transmission			4
Measurement channel			R.PDSCH.1-6.3
Note 1: When Throughput is measured using		ed using ra	andom precoder selection, the

Note 1: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (1 ms granularity) with equal probability of each applicable i₁, i₂ combination. The random precoder generation shall follow 'typeI-SinglePanel' codebook configuration as specified in table 6.3.3.1.3-1.

Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-4), this reported PMI cannot be applied at the gNB downlink before slot#(n+4).

Note 3: Randomization of the dual-cluster beam directions shall be used as specified in Annex B.2.3.2.3A. The value of relative power ratio (p) shall be fixed as 1 during the test.

Table 6.3.3.1.5-2: Minimum requirement

Parameter	Test 1
γ	[1.9]

6.3.3.1.6 Multiple PMI with 16Tx Enhanced Type II Codebook

For the parameters specified in Table 6.3.3.1.6-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.1.6-2.

Table 6.3.3.1.6-1: Test parameters (dual-layer)

Parameter		Unit	Test 1
Bandwidth		MHz	10
Subcarrier spacing		kHz	15
Duplex Mode			FDD
Propagation channel			TDLA30-5
Antenna configuration			XP Medium 16 x 4 (N1,N2) = (4,2)
Beamforming Model			As specified in Annex B.4.1
	CSI-RS resource		Aperiodic
	Type		, iponodio
	Number of CSI-RS ports (X)		4
	CDM Type		FD-CDM2
	Density (ρ)		1
	First subcarrier index		
ZP CSI-RS configuration	in the PRB used for CSI-RS (k ₀ , k ₁)		Row 5, (4,-)
garamer.	First OFDM symbol		
	in the PRB used for		(9,-)
	CSI-RS (I ₀ , I ₁)		
	CSI-RS	slot	Not configured
	interval and offset	0.00	Ţ.
	ZP CSI-RS trigger		1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0
	CSI-RS resource Type		Aperiodic
	Number of CSI-RS		16
	ports (X)		
	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
NZP CSI-RS	First subcarrier index		5 (5)
for CSI	in the PRB used for		Row 12, (2, 4, 6, 8)
acquisition	CSI-RS (k ₀ , k ₁ , k ₂ , k ₃)		
	First OFDM symbol in the PRB used for		(5, -)
	CSI-RS (I ₀ , I ₁)		(3, -)
	CSI-RS		
	interval and offset	slot	Not configured
	aperiodicTriggeringO		0
	ffset		0
	CSI-IM resource Type		Aperiodic
	CSI-IM RE pattern		Pattern 0
CSI-IM	CSI-IM Resource		
configuration	Mapping		(4,9)
	(k _{CSI-IM} ,I _{CSI-IM})		
	CSI-IM timeConfig interval and offset	slot	Not configured
ReportConfigT	,		Aperiodic
CQI-table	ReportConfigType		Table 1
reportQuantity			cri-RI-PMI-CQI
timeRestrictionForChannelMeasurem			
ents			Not configured
timeRestrictionForInterferenceMeasur ements			Not configured
cqi-FormatIndicator			Wideband
pmi-FormatIndicator		RB	Subband
	Sub-band Size		4
csi-ReportingB			1111111
	erval and offset	slot	Not configured
Aperiodic Repo	ort Slot Offset		5 1 in slots i, where mod(i, 5) = 1,
CSI request	CSI request		otherwise it is equal to 0
reportTriggerS	ize		1

CSI-AperiodicTriggerStateList			One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
	Codebook Type		typeII-r16
	paramCombination-		6
	r16		$(L = 4, p_v = 1/2, \beta = 1/2)$
Codebook configuration	R(numberOfPMISub bandsPerCQISubban d-r16)		1
	(CodebookConfig- N1,CodebookConfig- N2)		(4,2)
	(CodebookConfig- O1,CodebookConfig- O2)		(4,4)
	CodebookSubsetRes		0x 7FF
	triction		FFFF FFFF FFFF
	RI Restriction (typeII- RI-Restriction-r16)		0010
Physical channel for CSI report			PUSCH
CQI/RI/PMI delay		ms	8
Maximum number of HARQ			4
transmission			·
Measurement channel			R.PDSCH.1-6.3
Note 1: When Throughput is measured using random precoder selection, the			

Note 1: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (1 ms granularity) with equal probability of each applicable i₁, i₂ combination. The random precoder generation shall follow 'typeI-SinglePanel' codebook configuration as specified in table 6.3.3.1.3-1.

Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-4), this reported PMI cannot be applied at the gNB downlink before slot#(n+4).

Note 3: Randomization of the dual-cluster beam directions shall be used as specified in Annex B.2.3.2.3A. The value of relative power ratio (p) shall be fixed as 1 during the test.

Table 6.3.3.1.6-2: Minimum requirement

Parameter	Test 1
γ	[2.2]

6.3.3.2 TDD

6.3.3.2.1 Single PMI with 4TX Typel-SinglePanel Codebook

For the parameters specified in Table 6.3.3.2.1-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.2.1-2.

Table 6.3.3.2.1-1: Test parameters (single layer)

Pai	rameter	Unit	Test 1
Bandwidth			10
Subcarrier spac	ing	kHz	15
Duplex Mode			FDD
Propagation cha	annel		TDLA30-5
Antenna configu	ıration		High XP 8 x 4
			(N1,N2) = (4,1)
Beamforming M			As specified in Annex B.4.1
	CSI-RS resource		Periodic
	Type Number of CSI-RS		
	ports (X)		4
	CDM Type		FD-CDM2
	Density (ρ)		1 D-0DIVIZ
	First subcarrier		
ZP CSI-RS	index in the PRB		5 5 (4)
configuration	used for CSI-RS		Row 5, (4,-)
	(k_0, k_1)		
	First OFDM		
	symbol in the PRB		(0.)
	used for CSI-RS		(9,-)
	(l ₀ , l ₁)		
	CSI-RS	slot	5/1
	interval and offset	0.01	G, .
	CSI-RS resource		Aperiodic
	Type Number of CSI-RS		·
			8
	ports (X) CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
	First subcarrier		I I
NZP CSI-RS	index in the PRB		
for CSI	used for CSI-RS		Row 8, (4,6)
acquisition	(k ₀ , k ₁)		
'	First OFDM		
	symbol in the PRB		(F.)
	used for CSI-RS		(5,-)
	(l ₀ , l ₁)		
	CSI-RS	slot	Not configured
	interval and offset	0.01	. tot cogarca
	aperiodicTriggerin		0
	gOffset		
	CSI-IM resource Type		Aperiodic
	CSI-IM RE pattern		Pattern 0
CSI-IM	CSI-IM Resource		1 attern 0
configuration	Mapping		(4,9)
Comigaration	(k _{CSI-IM} ,l _{CSI-IM})		(4,0)
	CSI-IM timeConfig		
	interval and offset	slot	Not configured
ReportConfigTy			Aperiodic
CQI-table			Table 1
reportQuantity			cri-RI-PMI-CQI
	orChannelMeasure		Not configured
ments			. ist somigatod
	orInterferenceMeas		Not configured
urements			-
cqi-FormatIndicator			Wideband
	pmi-FormatIndicator		Wideband
	Sub-band Size		8 1111111
csi-ReportingBa		slot	Not configured
Aperiodic Report		ગાળા	5
CSI request	t Giot Onset		1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0
reportTriggerSiz	'Δ		1
reportinggeroiz		<u> </u>	1

CSI-AperiodicTr	riggerStateList		One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI- RS and CSI-IM
	Codebook Type		typel-SinglePanel
	Codebook Mode		1
Codebook	(CodebookConfig- N1,CodebookConfig-N2)		(4,1)
configuration	(CodebookConfig- O1,CodebookConfig-O2)		(4,1)
	CodebookSubsetR estriction		0x FFFF
	RI Restriction		0000010
Physical channe	el for CSI report		PUSCH
CQI/RI/PMI delay		ms	8
Maximum number of HARQ transmission			4
Measurement channel			R.PDSCH.1-6.2 FDD

Note 1: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (1 ms granularity) with equal probability of each applicable i₁, i₂ combination.

If the UE reports in an available uplink reporting instance at slot#n

Note 2: based on PMI estimation at a downlink slot not later than slot#(n-4), this reported PMI cannot be applied at the gNB downlink before slot#(n+4). Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.

Note 3:

in Annex B.2.3.2.3.			
Pai	rameter	Unit	Test 1
Bandwidth		MHz	40
Subcarrier spac	ing	kHz	30
Duplex Mode			TDD
TDD DL-UL con	figuration		FR1.30-1 as specified in Annex A
Propagation cha	nnel		TDLA30-5
Antenna configu	ıration		High XP 4 x 4 (N1,N2) = (2,1)
Beamforming M	odel		As specified in Annex B.4.1
-	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		4
	CDM Type		FD-CDM2
	Density (ρ)		1
ZP CSI-RS configuration	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 5, (4,-)
	First OFDM symbol in the PRB used for CSI-RS (lo, l1)		(9,-)
	CSI-RS interval and offset	slot	10/1
	CSI-RS resource Type		Aperiodic
NZP CSI-RS	Number of CSI-RS ports (X)		4
for CSI	CDM Type		FD-CDM2
acquisition	Density (ρ)		1
	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 4, (0,-)

		ı	_
	First OFDM symbol in the PRB		
	used for CSI-RS		(13,-)
	(l ₀ , l ₁)		
	CSI-RS interval and offset		Not configured
	aperiodicTriggerin		0
	gOffset CSI-IM resource		
	Type		Aperiodic
	CSI-IM RE pattern		Pattern 0
CSI-IM	CSI-IM Resource		
configuration	Mapping		(4,9)
	(kcsi-im,lcsi-im)		
	CSI-IM timeConfig interval and offset	slot	Not configured
ReportConfigTy	pe		Aperiodic
CQI-table	-		Table 1
reportQuantity			cri-RI-PMI-CQI
timeRestrictionF ments	ForChannelMeasure		Not configured
timeRestrictionForInterferenceMeas urements			Not configured
cqi-FormatIndicator			Wideband
pmi-FormatIndicator			Wideband
Sub-band Size		RB	16
	csi-ReportingBand		1111111
CSI-Report inte		slot	Not configured
Aperiodic Repo			8
CSI request			1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0
reportTriggerSize			1
CSI-AperiodicTi			One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI- RS and CSI-IM
	Codebook Type		typel-SinglePanel
	Codebook Mode		1
	(CodebookConfig- N1,CodebookConf ig-N2)		(2,1)
Codebook configuration	(CodebookConfig- O1,CodebookConfig-O2)		(4,1)
	CodebookSubsetR estriction		11111111
	RI Restriction		0000001
Physical channel for CSI report			PUSCH
CQI/RI/PMI delay		ms	5.5
Maximum number of HARQ transmission			4
Measurement c	hannel		R.PDSCH.2-8.1 TDD
Note 1: When Throughout is measu		ired using	

Note 1: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity) with equal probability of each applicable i₁, i₂ combination.

probability of each applicable i₁, i₂ combination.

Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-4), this reported PMI cannot be applied at the gNB downlink before slot#(n+4).

Note 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.

Table 6.3.3.2.1-2: Minimum requirement

Parameter	Test 1
γ	1.3

6.3.3.2.2 Single PMI with 8TX TypeI-SinglePanel Codebook

For the parameters specified in Table 6.3.3.2.2-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.2.2-2.

Table 6.3.3.2.2-1: Test parameters (dual-layer)

Pai	rameter	Unit	Test 1
Bandwidth		MHz	40
Subcarrier space	ing	kHz	30
Duplex Mode			TDD
TDD DL-UL cor	figurations		FR1.30-1 as specified in Annex A
Propagation cha	annel		TDLA30-5
Antenna configu	ıration		High XP 8 x 4
•			(N1,N2) = (4,1)
Beamforming M	CSI-RS resource		As specified in Annex B.4.1
	Type		Periodic
	Number of CSI-		4
	RS ports (X)		
	CDM Type Density (ρ)		FD-CDM2
	First subcarrier		'
ZP CSI-RS	index in the PRB		5 5 (1)
configuration	used for CSI-RS		Row 5, (4,-)
	(k_0, k_1)		
	First OFDM		
	symbol in the PRB used for CSI-RS		(9,-)
	(l ₀ , l ₁)		
	CSI-RS		10/1
	interval and offset	slot	10/1
	CSI-RS resource		Aperiodic
	Type		7 (201100110
	Number of CSI- RS ports (X)		8
	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
	First subcarrier		
NZP CSI-RS for CSI	index in the PRB		Row 8, (4,6)
	used for CSI-RS		1.0.0 0, (1,0)
acquisition	(k ₀ , k ₁) First OFDM		
	symbol in the PRB		/- \
	used for CSI-RS		(5,-)
	(l ₀ , l ₁)		
	CSI-RS	slot	Not configured
	interval and offset aperiodicTriggerin		
	gOffset		0
	CSI-IM resource		Aperiodic
	Туре		·
CCLIM	CSI-IM RE pattern		Pattern 0
CSI-IM configuration	CSI-IM Resource Mapping		(4,9)
Comiguration	(kcsi-im,lcsi-im)		(4,9)
	CSI-IM timeConfig	slot	Not configured
	interval and offset	SIOL	Not configured
ReportConfigTy	pe		Aperiodic
CQI-table reportQuantity			Table 1 cri-RI-PMI-CQI
timeRestrictionForChannnelMeasur			
ements			Not configured
timeRestrictionForInterferenceMeas			Not configured
urements			
cqi-FormatIndicator			Wideband
	pmi-FormatIndicator		Wideband
Sub-band Size csi-ReportingBa	and	RB	16 1111111
CSI-Report inte	rval and offset	slot	Not configured
Aperiodic Repo		0.00	8
CSI request			1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0

Note 3:

reportTriggerS	ize		1
CSI-Aperiodic	TriggerStateList		One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
	Codebook Type		typel-SinglePanel
	Codebook Mode		1
Cadabaak	(CodebookConfig- N1,CodebookConfig-N2)		(4,1)
Codebook configuration	(CodebookConfig- O1,CodebookCon fig-O2)		(4,1)
	CodebookSubset Restriction		0x FFFF
	RI Restriction		0000010
Physical chan	nel for CSI report		PUSCH
CQI/RI/PMI delay		ms	6.5
Maximum num	ber of HARQ		4
transmission			•
Measurement			R.PDSCH.2-8.2 TDD
	Note 1: When Throughput is measu		random precoder selection, the
Note 2: If the	based on PMI estimation at a downlink slot not later than slot#(n-6),		mbination. k reporting instance at slot#n nk slot not later than slot#(n-6),
this reported PMI cannot be applied at the gNB downlink before slot#(n+6).			at the givo downlink before

Table 6.3.3.2.2-2: Minimum requirement

Randomization of the principle beam direction shall be used as

Parameter	Test 1
γ	1.5

6.3.3.2.3 Multiple PMI with 16TX TypeI-SinglePanel Codebook

specified in Annex B.2.3.2.3.

For the parameters specified in Table 6.3.3.2.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.2.3-2.

Table 6.3.3.2.3-1: Test parameters (dual-layer)

Pa	rameter	Unit	Test 1
Bandwidth		MHz	40
Subcarrier space	cing	kHz	30
Duplex Mode			TDD
TDD DL-UL cor	nfigurations		FR1.30-1 as specified in Annex A
Propagation ch	annel		TDLC300-5
Antenna config	uration		High XP 16 x 4 (N1,N2) = (4,2)
Beamforming M	lodel		As specified in Annex B.4.1
	CSI-RS resource Type		Aperiodic
	Number of CSI- RS ports (X)		4
ZP CSI-RS	CDM Type		FD-CDM2
configuration	Density (ρ)		1
	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 5, (4,-)

	_		1
	First OFDM symbol in the PRB used for CSI-RS (l ₀ , l ₁)		(9,-)
	CSI-RS interval and offset	slot	Not configured
	ZP CSI-RS trigger		1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0
	CSI-RS resource Type		Aperiodic
	Number of CSI- RS ports (X)		16
	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		1
NZP CSI-RS for CSI	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁ , k ₂ , k ₃)		Row 12, (2, 4, 6, 8)
acquisition	First OFDM symbol in the PRB used for CSI-RS (I ₀ , I ₁)		(5, -)
	CSI-RS interval and offset	slot	Not configured
	aperiodicTriggerin gOffset		0
	CSI-IM resource Type		Aperiodic
	CSI-IM RE pattern		Pattern 0
CSI-IM configuration	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(4,9)
	CSI-IM timeConfig interval and offset	slot	Not configured
ReportConfigTy	/pe		Aperiodic
CQI-table			Table 1
reportQuantity			cri-RI-PMI-CQI
ements	ForChannnelMeasur		Not configured
timeRestrictionForInterferenceMeas urements			Not configured
	cqi-FormatIndicator		Wideband
pmi-FormatIndicator			Subband
Sub-band Size		RB	16
csi-ReportingBa			1111111
CSI-Report inte		slot	Not configured
Aperiodic Repo	rt Slot Offset		1 in slots i, where mod(i, 10) =
reportTriggerSiz	ze		1, otherwise it is equal to 0
CSI-AperiodicT			One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
	Codebook Type		typel-SinglePanel
	Codebook Mode		1
Codebaal	(CodebookConfig- N1,CodebookConfig-N2)		(4,2)
Codebook configuration	(CodebookConfig- O1,CodebookCon fig-O2)		(4,4)
	CodebookSubset Restriction		0x FFFF
	RI Restriction		0000010

Physical	channel for CSI report		PUSCH
CQI/RI/P	MI delay	ms	6.5
Maximum number of HARQ			4
transmiss	sion		4
Measure	ment channel		R.PDSCH.2-8.3 TDD
Note 1:	lote 1: When Throughput is measured using random precoder selection, the		
Note 2:	based on PMI estimation at a downlink slot not later than slot#(n-6), this reported PMI cannot be applied at the gNB downlink before		
Note 3:	slot#(n+6). lote 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.		

Table 6.3.3.2.3-2: Minimum requirement

Parameter	Test 1
γ	3.0

6.3.3.2.4 Single PMI with 32TX TypeI-SinglePanel Codebook

For the parameters specified in Table 6.3.3.2.4-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.2.4-2.

Table 6.3.3.2.4-1: Test parameters (dual-layer)

Parameter		Unit	Test 1
Bandwidth		MHz	40
Subcarrier spacing		kHz	30
Duplex Mode			TDD
TDD DL-UL configurations			FR1.30-1 as specified in Annex A
Propagation cha	annel		TDLA30-5
Antenna configu	uration		High XP 32 x 4 (N1,N2) = (4,4)
Beamforming M	lodel		As specified in Annex B.4.1
_	CSI-RS resource Type		Aperiodic
	Number of CSI- RS ports (X)		4
	CDM Type		FD-CDM2
	Density (ρ)		1
ZP CSI-RS configuration	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 5, (4,-)
	First OFDM symbol in the PRB used for CSI-RS (I ₀ , I ₁)		(9,-)
	CSI-RS interval and offset	slot	Not configured
	ZP CSI-RS trigger		1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0
NZP CSI-RS	CSI-RS resource Type		Aperiodic
for CSI acquisition	Number of CSI- RS ports (X)		32
acquisition	CDM Type		CDM4 (FD2, TD2)
	Density (ρ)		FD-CDM2 1 Row 5, (4,-) (9,-) Not configured 1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0 Aperiodic 32

	I		
	First subcarrier		
	index in the PRB		Row 17, (2, 4, 6, 8)
	used for CSI-RS		
	(k ₀ , k ₁ , k ₂ , k ₃) First OFDM		
	symbol in the PRB		
	used for CSI-RS		(5, 12)
	(I ₀ , I ₁) CSI-RS		
	interval and offset	slot	Not configured
	aperiodicTriggerin		
	gOffset		0
	CSI-IM resource		
	Туре		Aperiodic
	CSI-IM RE pattern		Pattern 0
CSI-IM	CSI-IM Resource		i duo c
configuration	Mapping		(4,9)
3	(kcsi-im,lcsi-im)		(1,5)
	CSI-IM timeConfig		
	interval and offset	slot	Not configured
ReportConfigTy			Aperiodic
CQI-table			Table 1
reportQuantity			cri-RI-PMI-CQI
	orChannnelMeasur		
ements			Not configured
timeRestrictionF	ForInterferenceMeas		N
urements			Not configured
cqi-FormatIndic	ator		Wideband
pmi-FormatIndicator			Wideband
pini-i omiamian			
Sub-band Size		RB	16
Sub-band Size		RB	
	and	RB slot	16
Sub-band Size csi-ReportingBa	and rval and offset		16 1111111 Not configured 8
Sub-band Size csi-ReportingBa CSI-Report inte Aperiodic Repo	and rval and offset		16 1111111 Not configured
Sub-band Size csi-ReportingBa	and rval and offset		16 1111111 Not configured 8
Sub-band Size csi-ReportingBa CSI-Report inte Aperiodic Repo	and rval and offset rt Slot Offset		16 1111111 Not configured 8 1 in slots i, where mod(i, 10) =
Sub-band Size csi-ReportingBa CSI-Report inte Aperiodic Repo CSI request	and rval and offset rt Slot Offset		16 1111111 Not configured 8 1 in slots i, where mod(i, 10) =
Sub-band Size csi-ReportingBa CSI-Report inte Aperiodic Repo CSI request	and rval and offset rt Slot Offset		16 1111111 Not configured 8 1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0
Sub-band Size csi-ReportingBa CSI-Report inte Aperiodic Repo CSI request	and rval and offset rt Slot Offset		16 1111111 Not configured 8 1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report
Sub-band Size csi-ReportingBa CSI-Report inte Aperiodic Repo CSI request reportTriggerSize	and rval and offset rt Slot Offset		16 1111111 Not configured 8 1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers
Sub-band Size csi-ReportingBa CSI-Report inte Aperiodic Repo CSI request reportTriggerSize	rval and offset rt Slot Offset ze riggerStateList		16 1111111 Not configured 8 1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
Sub-band Size csi-ReportingBa CSI-Report inte Aperiodic Repo CSI request reportTriggerSize	rval and offset rt Slot Offset ze riggerStateList Codebook Type		16 1111111 Not configured 8 1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers
Sub-band Size csi-ReportingBa CSI-Report inte Aperiodic Repo CSI request reportTriggerSize	rval and offset rt Slot Offset re riggerStateList Codebook Type Codebook Mode		16 1111111 Not configured 8 1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
Sub-band Size csi-ReportingBa CSI-Report inte Aperiodic Repo CSI request reportTriggerSize	rval and offset rt Slot Offset re riggerStateList Codebook Type Codebook Mode (CodebookConfig-		16 111111 Not configured 8 1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typeI-SinglePanel 1
Sub-band Size csi-ReportingBa CSI-Report inte Aperiodic Repo CSI request reportTriggerSize	rval and offset rt Slot Offset re riggerStateList Codebook Type Codebook Mode (CodebookConfig- N1,CodebookConf		16 1111111 Not configured 8 1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
Sub-band Size csi-ReportingBa CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz	rval and offset rt Slot Offset re riggerStateList Codebook Type Codebook Mode (CodebookConfig-N1,CodebookConfig-N2)		16 111111 Not configured 8 1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typeI-SinglePanel 1
Sub-band Size csi-ReportingBa CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz CSI-AperiodicT	riggerStateList Codebook Type Codebook Mode (CodebookConfig-N1,CodebookConfig-N2) (CodebookConfig-N2)		16 111111 Not configured 8 1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typel-SinglePanel 1 (4,4)
Sub-band Size csi-ReportingBa CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz	riggerStateList Codebook Type Codebook Mode (CodebookConfig-N1,CodebookConfig-N2) (CodebookConfig-O1,		16 111111 Not configured 8 1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typeI-SinglePanel 1
Sub-band Size csi-ReportingBa CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz CSI-AperiodicT	riggerStateList Codebook Type Codebook Mode (CodebookConfig-N1,CodebookConfig-N2) (CodebookConfig-O1,CodebookConfig-O1,CodebookConfig-O2)		16 111111 Not configured 8 1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typel-SinglePanel 1 (4,4)
Sub-band Size csi-ReportingBa CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz CSI-AperiodicT	ryal and offset rt Slot Offset regerStateList Codebook Type Codebook Mode (CodebookConfig-N1,CodebookConfig-N2) (CodebookConfig-O1,CodebookConfig-O2) CodebookSubset		16 111111 Not configured 8 1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typel-SinglePanel 1 (4,4)
Sub-band Size csi-ReportingBa CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz CSI-AperiodicT	riggerStateList Codebook Type CodebookConfig-N1,CodebookConfig-N2) (CodebookConfig-O1,CodebookConfig-O2) CodebookSubset Restriction		16 111111 Not configured 8 1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typel-SinglePanel 1 (4,4) (4,4)
Sub-band Size csi-ReportingBa CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz CSI-AperiodicT	riggerStateList Codebook Type Codebook Mode (CodebookConfig-N1,CodebookConfig-N2) (CodebookConfig-O1,CodebookConfig-O2) CodebookSubset Restriction RI Restriction		16 111111 Not configured 8 1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typel-SinglePanel 1 (4,4) (4,4) 0x FFFF 000000010
Sub-band Size csi-ReportingBa CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz CSI-AperiodicT Codebook configuration	rval and offset rt Slot Offset re riggerStateList Codebook Type Codebook Mode (CodebookConfig-N1,CodebookConfig-N2) (CodebookConfig-O1,CodebookConfig-O2) CodebookSubset Restriction RI Restriction	slot	16 111111 Not configured 8 1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typel-SinglePanel 1 (4,4) (4,4) 0x FFFF 00000010 PUSCH
Sub-band Size csi-ReportingBa CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz CSI-AperiodicT Codebook configuration Physical channe CQI/RI/PMI dela	rval and offset rt Slot Offset re riggerStateList Codebook Type Codebook Mode (CodebookConfig-N1,CodebookConfig-N2) (CodebookConfig-O1,CodebookConfig-O2) CodebookSubset Restriction RI Restriction el for CSI report		16 111111 Not configured 8 1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typel-SinglePanel 1 (4,4) (4,4) 0x FFFF 000000010
Sub-band Size csi-ReportingBa CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz CSI-AperiodicT Codebook configuration Physical channe CQI/RI/PMI dela Maximum numb	rval and offset rt Slot Offset re riggerStateList Codebook Type Codebook Mode (CodebookConfig-N1,CodebookConfig-N2) (CodebookConfig-O1,CodebookConfig-O2) CodebookSubset Restriction RI Restriction el for CSI report	slot	16 111111 Not configured 8 1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typel-SinglePanel 1 (4,4) (4,4) 0x FFFF 00000010 PUSCH
Sub-band Size csi-ReportingBa CSI-Report inte Aperiodic Repo CSI request reportTriggerSiz CSI-AperiodicT Codebook configuration Physical channe CQI/RI/PMI dela	rval and offset rt Slot Offset ze riggerStateList Codebook Type Codebook Mode (CodebookConfig- N1,CodebookConfig- O1,CodebookConfig- O1,CodebookConfig- O1,CodebookSubset Restriction RI Restriction el for CSI report ay per of HARQ	slot	16 111111 Not configured 8 1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0 1 One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM typel-SinglePanel 1 (4,4) (4,4) 0x FFFF 000000010 PUSCH 6.5

Note 1: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity) with equal probability of each applicable i₁, i₂ combination.

Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-6), this reported PMI cannot be applied at the gNB downlink before slot#(n+6).

Note 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.

Table 6.3.3.2.4-2: Minimum requirement

Parameter	Test 1
γ	7.0

6.3.3.2.5 Multiple PMI with 16TX TypeII Codebook

For the parameters specified in Table 6.3.3.2.5-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.2.5-2.

Table 6.3.3.2.5-1: Test parameters (dual-layer)

Parameter		Unit	Test 1	
Bandwidth		MHz	40	
Subcarrier sp	acıng	kHz	30	
Duplex Mode			TDD	
TDD DL-UL o	onfigurations		FR1.30-1 as specified in Annex A	
Propagation of	channel		TDLA30-5	
			XP Medium 16 x 4	
Antenna conf	_		(N1,N2) = (4,2)	
Beamforming			As specified in Annex B.4.1	
	CSI-RS resource Type Number of CSI-RS		Aperiodic	
	ports (X)		4	
	CDM Type		FD-CDM2	
	Density (ρ)		1	
	First subcarrier index			
ZP CSI-RS	in the PRB used for		Row 5, (4,-)	
configuratio	CSI-RS (k ₀ , k ₁)			
n	First OFDM symbol in the PRB used for CSI-		(9,-)	
	RS (I ₀ , I ₁) CSI-RS			
	interval and offset	slot	Not configured	
	ZP CSI-RS trigger		1 in slots i, where mod(i, 10) =	
			1, otherwise it is equal to 0	
	CSI-RS resource Type Number of CSI-RS		Aperiodic	
	ports (X)		16	
	CDM Type		CDM4 (FD2, TD2)	
	Density (ρ)		1	
	First subcarrier index			
NZP CSI-	in the PRB used for		Row 12, (2, 4, 6, 8)	
RS for CSI	CSI-RS (k ₀ , k ₁ , k ₂ , k ₃)			
acquisition	First OFDM symbol in the PRB used for CSI-		(5, -)	
	RS (I ₀ , I ₁)		(6,)	
	CSI-RS	slot	Not configured	
	interval and offset	5101	Not configured	
	aperiodicTriggeringOff		0	
	set CSI-IM resource Type		Aperiodic	
	CSI-IM RE pattern		Pattern 0	
CSI-IM	CSI-IM Resource			
configuratio	Mapping		(4,9)	
n	(kcsi-im,lcsi-im)			
	CSI-IM timeConfig interval and offset	slot	Not configured	
ReportConfig			Aperiodic	
CQI-table	71		Table 1	
reportQuantit	у		cri-RI-PMI-CQI	
ents	nForlChannelMeasurem		Not configured	
timeRestriction ements	nForInterferenceMeasur		Not configured	
cqi-FormatInd			Wideband	
pmi-FormatIn			Subband	
Sub-band Siz		RB	16	
csi-Reporting	Band Iterval and offset	clo+	1111111 Not configured	
	oort Slot Offset	slot	Not configured 8	
CSI request	Seri Siot Silbot		1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0	
reportTrigger	Size		1, otherwise it is equal to 0	

CSI-AperiodicTriggerStateList			One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM	
Codebook Type			typell	
	L (numberOfBeams)		2	
	N _{PSK} (phaseAlphabetSize)		8	
	subbandAmplitude		True	
Codebook configuratio	(CodebookConfig- N1,CodebookConfig- N2)		(4,2)	
n	(CodebookConfig- O1,CodebookConfig- O2)		(4,4)	
	CodebookSubsetRestri ction		0x 7FF FFFF FFFF FFFF	
	RI Restriction (typeII- RI-Restriction)		10	
Physical char	nnel for CSI report		PUSCH	
CQI/RI/PMI d		ms	6.5	
Maximum number of HARQ transmission			4	
Measuremen	t channel		R.PDSCH.2-8.3 TDD	
Note 1: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity) with equal probability of each applicable i ₁ , i ₂ combination. The random precoder			0.5 ms granularity) with equal bination. The random precoder	
generation shall follow 'tymal SingleDane			Landahaak aanfiguration oo	

generation shall follow 'typeI-SinglePanel' codebook configuration as specified in table 6.3.3.2.3-1.

Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-6), this reported PMI cannot be applied at the gNB downlink before slot#(n+6).

Randomization of the dual-cluster beam directions shall be used as Note 3: specified in Annex B.2.3.2.3A. The value of relative power ratio (p) shall be fixed as 1 during the test.

Table 6.3.3.2.5-2: Minimum requirement

Parameter	Test 1	
γ	[1.8]	

6.3.3.2.6 Multiple PMI with 16Tx Enhanced Type II Codebook

For the parameters specified in Table 6.3.3.2.6-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.2.6-2.

Table 6.3.3.2.6-1: Test parameters (dual-layer)

Parameter		Unit MHz	Test 1	
Bandwidth			40	
Subcarrier sp		kHz	30	
Duplex Mode			TDD	
TDD DL-UL o	configurations		FR1.30-1 as specified in Annex A	
Propagation (channel		TDLA30-5	
Antenna conf	iguration		XP Medium 16 x 4	
			(N1,N2) = (4,2)	
Beamforming	CSI-RS resource Type		As specified in Annex B.4.1 Aperiodic	
	Number of CSI-RS		·	
	ports (X)		4	
	CDM Type		FD-CDM2	
	Density (ρ)		1	
	First subcarrier index			
ZP CSI-RS	in the PRB used for		Row 5, (4,-)	
configuratio	CSI-RS (k ₀ , k ₁)			
n	First OFDM symbol in the PRB used for CSI- RS (I ₀ , I ₁)		(9,-)	
	CSI-RS interval and offset	slot	Not configured	
	ZP CSI-RS trigger		1 in slots i, where mod(i, 10) =	
			1, otherwise it is equal to 0	
	CSI-RS resource Type Number of CSI-RS		Aperiodic	
	ports (X)		16	
	CDM Type		CDM4 (FD2, TD2)	
	Density (ρ)		1	
	First subcarrier index			
NZP CSI-	in the PRB used for		Row 12, (2, 4, 6, 8)	
RS for CSI acquisition	CSI-RS (k ₀ , k ₁ , k ₂ , k ₃) First OFDM symbol in			
acquisition	the PRB used for CSI-		(5, -)	
	RS (I ₀ , I ₁)		(0,)	
	CSI-RS	alat	Not configured	
	interval and offset	slot	Not configured	
	aperiodicTriggeringOff		0	
	Set CSI-IM resource Type		Aperiodic	
	CSI-IM RE pattern		Pattern 0	
CSI-IM	CSI-IM Resource		1 attern 0	
configuratio	Mapping		(4,9)	
n	(ксы-ім,Ісы-ім)		()/	
	CSI-IM timeConfig	slot	Not configured	
PenortConfig	interval and offset			
ReportConfig CQI-table	туре		Aperiodic Table 1	
reportQuantit	V		cri-RI-PMI-CQI	
timeRestriction	onForlChannelMeasurem			
ents			Not configured	
ements	onForInterferenceMeasur		Not configured	
cqi-FormatInd			Wideband	
pmi-FormatIn			Subband	
Sub-band Siz		RB	8	
csi-Reporting		-1-1	1111111	
	nterval and offset	slot	Not configured	
CSI request	port Slot Offset		1 in slots i, where mod(i, 10) =	
-	Sizo		1, otherwise it is equal to 0	
reportTrigger	OILE		1	

CSI-AperiodicTriggerStateList			One State with one Associated Report Configuration Associated Report Configuration pointers	
	Codebook Type		to NZP CSI-RS and CSI-IM typell-r16	
			6	
	paramCombination-r16		(L =4, $p_v = 1/2$, $\beta = 1/2$)	
	R(numberOfPMISubba ndsPerCQISubband- r16)		1	
Codebook configuratio	(CodebookConfig- N1,CodebookConfig- N2)		(4,2)	
n	(CodebookConfig- O1,CodebookConfig- O2)		(4,4)	
	CodebookSubsetRestri		0x 7FF	
	ction		FFFF FFFF FFFF	
	RI Restriction (typeII- RI-Restriction-r16)		0010	
Physical cha	nnel for CSI report		PUSCH	
CQI/RI/PMI	delay	ms	6.5	
Maximum nu	mber of HARQ		4	
transmission				
Measuremer			R.PDSCH.2-8.3 TDD	
pr	Note 1: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (0.5 ms granularity) with equal			
probability of each applicable i ₁ , i ₂ combination. The random				
	generation shall follow 'typeI-SinglePanel' codebook configuration as			
	pecified in table 6.3.3.2.3-1.			
	Note 2: If the UE reports in an available uplink reporting instance at slot#n bas on PMI estimation at a downlink slot not later than slot#(n-6), this			

Table 6.3.3.2.6-2: Minimum requirement

reported PMI cannot be applied at the gNB downlink before slot#(n+6).

Randomization of the dual-cluster beam directions shall be used as specified in Annex B.2.3.2.3A. The value of relative power ratio (p) shall

Parameter	Test 1	
γ	[2.2]	

6.4 Reporting of Rank Indicator (RI)

be fixed as 1 during the test.

The purpose of this test is to verify that the reported rank indicator accurately represents the channel rank. The accuracy of RI reporting is determined by the relative increase of the throughput obtained when transmitting based on the reported rank compared to the case for which a fixed rank is used for transmission.

6.4.1 1RX requirements

Note 3:

(Void)

6.4.2 2RX requirements

6.4.2.1 FDD

The minimum performance requirement in Table 6.4.2.1-2 is defined as

a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_1$;

b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be $\geq \gamma_2$;

For the parameters specified in Table 6.4.2.1-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.4.2.1-2.

Table 6.4.2.1-1: RI Test (FDD)

Parameter		Unit	Test 1	Test 2	Test 3
Bandwidth		MHz	10	10	10
Subcarrier sp	acing	kHz	15	15	15
Duplex Mode	g		FDD	FDD	FDD
SNR		dB	0	20	20
Propagation of	hannel		TDLA30-5	TDLA30-5	TDLA30-5
Antenna conf			ULA Low 2x2	ULA Low 2x2	ULA High 2x2
Beamforming	Madal		As defined in	As defined in	As defined in
beamorning	Model		Annex B.4.1	Annex B.4.1	Annex B.4.1
	CSI-RS resource Type		Periodic	Periodic	Periodic
	Number of CSI-RS ports (X)		4	4	4
	CDM Type		FD-CDM2	FD-CDM2	FD-CDM2
ZP CSI-RS	Density (ρ)		1	1	1
configuratio n	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 5, (4,-)	Row 5, (4,-)	Row 5, (4,-)
	First OFDM symbol in the PRB used for CSI-RS (I ₀ , I ₁)		(9,-)	(9,-)	(9,-)
	CSI-RS	slot	5/1	5/1	5/1
	periodicity and offset		Periodic	Periodic	Doriodio
	CSI-RS resource Type Number of CSI-RS ports (X)		Periodic 2	Periodic 2	Periodic 2
	CDM Type		FD-CDM2	FD-CDM2	FD-CDM2
NZP CSI-	Density (ρ)		1	1	1
RS for CSI	First subcarrier index in the		·	·	·
acquisition	PRB used for CSI-RS (k ₀ , k ₁)		Row 3 (6,-)	Row 3 (6,-)	Row 3 (6,-)
	First OFDM symbol in the PRB used for CSI-RS (I ₀ , I ₁)		(13,-)	(13,-)	(13,-)
	NZP CSI-RS-timeConfig periodicity and offset	slot	5/1	5/1	5/1
	CSI-IM resource Type		Periodic	Periodic	Periodic
CSI-IM	CSI-IM RE pattern		Pattern 0	Pattern 0	Pattern 0
configuratio	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(4,9)	(4,9)	(4,9)
n	CSI-IM timeConfig periodicity and offset	slot	5/1	5/1	5/1
ReportConfig			Periodic	Periodic	Periodic
CQI-table	7.		Table 2	Table 2	Table 2
reportQuantity	/		cri-RI-PMI-CQI	cri-RI-PMI- CQI	cri-RI-PMI- CQI
timeRestrictio	nForChannelMeasurements		not configured	not configured	not configured
timeRestrictio	nForInterferenceMeasurements		not configured	not configured	not configured
cqi-FormatInd	licator		Wideband	Wideband	Wideband
pmi-FormatIn			Wideband	Wideband	Wideband
Sub-band Siz	e	RB	8	8	8
csi-Reporting			1111111	1111111	1111111
CSI-Report pe	eriodicity and offset	slot	5/0	5/0	5/0
	Codebook Type		typel-	typel-	typel-
			SinglePanel	SinglePanel	SinglePanel
	Codebook Mode		1	1	1
Codebook	(CodebookConfig- N1,CodebookConfig-N2)		N/A	N/A	N/A
configuration	CodebookSubsetRestriction		010000 for	000011 for	000011 for
			fixed rank 2,	fixed rank 1,	fixed rank 1,
			010011 for	010011 for	010011 for
	PI Postriction		following rank	following rank N/A	following rank
Physical char	RI Restriction and I report		N/A PUCCH	PUCCH	N/A PUCCH
CQI/RI/PMI d	•	ms	8 8	8 8	8 8
	mber of HARQ transmission	1113	1	1	1
			Fixed RI = 2	Fixed RI = 1	Fixed RI = 1
RI Configurati	on		and follow RI	and follow RI	and follow RI
NOTE 1: Measurements channels are specified					

NOTE 1: Measurements channels are specified in Table A.4-2. TBS.2-1 is used for Rank 1 case. TBS.2-2 is used for Rank 2 case.

Table 6.4.2.1-2: Minimum requirement (FDD)

	Test 1	Test 2	Test 3
21	N/A	1.05	0.9
72	1.0	N/A	N/A

6.4.2.2 TDD

The minimum performance requirement in Table 6.4.2.2-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_1$;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be $\geq \gamma_2$;

For the parameters specified in Table 6.4.2.2-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.4.2.2-2.

Table 6.4.2.2-1: RI Test (TDD)

Parameter		Unit	Test 1	Test 2	Test 3
Bandwidth		MHz	40	40	40
Subcarrier spa	acing	kHz	30	30	30
Duplex Mode			TDD	TDD	TDD
TDD Slot Con	figuration		FR1.30-1	FR1.30-1	FR1.30-1
SNR		dB	0	20	20
Propagation of			TDLA30-5	TDLA30-5	TDLA30-5
Antenna confi	guration		ULA Low 2x2	ULA Low 2x2	ULA High 2x2
Beamforming	Model		As defined in	As defined in	As defined in
Boarmorning			Annex B.4.1	Annex B.4.1	Annex B.4.1
	CSI-RS resource Type		Periodic	Periodic	Periodic
	Number of CSI-RS ports (X)		4	4	4
	CDM Type		FD-CDM2	FD-CDM2	FD-CDM2
ZP CSI-RS	Density (ρ)		1	1	1
configuratio n	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 5, (4,-)	Row 5, (4,-)	Row 5, (4,-)
	First OFDM symbol in the PRB used for CSI-RS (I ₀ , I ₁)		(9,-)	(9,-)	(9,-)
	CSI-RS periodicity and offset	slot	10/1	10/1	10/1
	CSI-RS resource Type		Periodic	Periodic	Periodic
	Number of CSI-RS ports (X)		2	2	2
	CDM Type		FD-CDM2	FD-CDM2	FD-CDM2
NZP CSI-	Density (ρ)		1	1	1
RS for CSI acquisition	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 3 (6,-)	Row 3 (6,-)	Row 3 (6,-)
	First OFDM symbol in the PRB used for CSI-RS (I ₀ , I ₁)		(13,-)	(13,-)	(13,-)
	NZP CSI-RS-timeConfig periodicity and offset	slot	10/1	10/1	10/1
	CSI-IM resource Type		Periodic	Periodic	Periodic
001.104	CSI-IM RE pattern		Pattern 0	Pattern 0	Pattern 0
CSI-IM configuratio	CSI-IM Resource Mapping (kcsi-im, lcsi-im)		(4,9)	(4,9)	(4,9)
n	CSI-IM timeConfig periodicity and offset	slot	10/1	10/1	10/1
ReportConfig			Periodic	Periodic	Periodic
CQI-table			Table 2	Table 2	Table 2
reportQuantity	1		cri-RI-PMI-CQI	cri-RI-PMI- CQI	cri-RI-PMI- CQI
timeRestrictio	nForChannelMeasurements		not configured	not configured	not configured
timeRestrictio	nForInterferenceMeasurements		not configured	not configured	not configured
cqi-FormatInd			Wideband	Wideband	Wideband
pmi-FormatIn			Wideband	Wideband	Wideband
Sub-band Siz		RB	16	16	16
csi-Reportingl			1111111	1111111	1111111
CSI-Report pe	eriodicity and offset	slot	10/9	10/9	10/9
	Codebook Type		typel- SinglePanel	typel- SinglePanel	typel- SinglePanel
	Codebook Mode		1	1	11
Codebook	(CodebookConfig- N1,CodebookConfig-N2)		N/A	N/A	N/A
configuration	CodebookSubsetRestriction		010000 for fixed rank 2, 010011 for	000011 for fixed rank 1, 010011 for	000011 for fixed rank 1, 010011 for
	DI Postriotics		following rank	following rank	following rank
Dhysias! -!-	RI Restriction		N/A	N/A	N/A
	nel for CSI report	mac	PUCCH	PUCCH	PUCCH
CQI/RI/PMI de		ms	9.5 1	9.5 1	9.5
	nber of HARQ transmission		Fixed RI = 2	Fixed RI = 1	Fixed RI = 1
RI Configurati	RI Configuration		and follow RI	and follow RI	and follow RI

NOTE 1: Measurements channels are specified in Table A.4-2. TBS.2-3 is used for Rank 1 case. TBS.2-4 is used for Rank 2 case.

Table 6.4.2.2-2: Minimum requirement (TDD)

	Test 1	Test 2	Test 3
21	N/A	1.05	0.9
72	1.0	N/A	N/A

6.4.3 4RX requirements

6.4.3.1 FDD

The minimum performance requirement in Table 6.4.3.1-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_1$;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be $\geq \gamma_2$;

For the parameters specified in Table 6.4.3.1-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.4.3.1-2.

Table 6.4.3.1-1: RI Test (FDD)

	Parameter	Unit	Test 1	Test 2	Test 3	Test 4
Bandwidth		MHz	10	10	10	10
Subcarrier spa	acing	kHz	15	15	15	15
Duplex Mode			FDD	FDD	FDD	FDD
SNR		dB	-2	16	16	22
Propagation c			TDLA30-5	TDLA30-5	TDLA30-5	TDLA30-5
Antenna confi	guration		ULA Low 2x4	ULA Low 2x4	ULA High 2x4	ULA Low 4x4
Beamforming	Model		As defined in	As defined in	As defined in	As defined in
Deamlonning			Annex B.4.1	Annex B.4.1	Annex B.4.1	Annex B.4.1
	CSI-RS resource Type		Periodic	Periodic	Periodic	Periodic
	Number of CSI-RS ports (X)		4	4	4	4
	CDM Type		FD-CDM2	FD-CDM2	FD-CDM2	FD-CDM2
ZP CSI-RS	Density (ρ)		1	1	1	1
configuratio	First subcarrier index in the		Row 5, (4,-)	Row 5, (4,-)	Row 5, (4,-)	Row 5, (4,-)
n	PRB used for CSI-RS (k ₀ , k ₁)		10W 3, (+,-)	110W 3, (+,-)	110W 3, (+,-)	110W 3, (+,-)
	First OFDM symbol in the PRB		(9,-)	(9,-)	(9,-)	(9,-)
ļ	used for CSI-RS (I ₀ , I ₁)		(0,)	(0,)	(0,)	(0,)
	CSI-RS	slot	5/1	5/1	5/1	5/1
	periodicity and offset	0.01				- '
-	CSI-RS resource Type		Periodic	Periodic	Periodic	Periodic
	Number of CSI-RS ports (X)		2	2	2	4
NZP CSI-	CDM Type		FD-CDM2	FD-CDM2	FD-CDM2	FD-CDM2
RS for CSI	Density (ρ)		1	1	1	1
acquisition	First subcarrier index in the		Row 3 (6,-)	Row 3 (6,-)	Row 3 (6,-)	Row 4 (0,-)
aoquiomon	PRB used for CSI-RS (k ₀ , k ₁)		11011 0 (0,)	11011 0 (0,)	11011 0 (0,)	11011 1 (0,)
	First OFDM symbol in the PRB		(13,-)	(13,-)	(13,-)	(13,-)
-	used for CSI-RS (I ₀ , I ₁)		(.0,)	(, /	(10,)	(10,)
	NZP CSI-RS-timeConfig	slot	5/1	5/1	5/1	5/1
	periodicity and offset					
	CSI-IM resource Type		Periodic	Periodic	Periodic	Periodic
CSI-IM	CSI-IM RE pattern		Pattern 0	Pattern 0	Pattern 0	Pattern 0
configuratio	CSI-IM Resource Mapping		(4,9)	(4,9)	(4,9)	(4,9)
n Š	(KCSI-IM, ICSI-IM)		(, ,	(, ,	(, ,	. , ,
	CSI-IM timeConfig	slot	5/1	5/1	5/1	5/1
DanartCartin	periodicity and offset		Daviadia	Periodic	Daviadia	Daviadia
ReportConfig	туре		Periodic		Periodic	Periodic
CQI-table			Table 2	Table 2 cri-RI-PMI-	Table 2 cri-RI-PMI-	Table 2 cri-RI-PMI-
reportQuantity	<i>'</i>		cri-RI-PMI-CQI	CQI	CII-RI-PIVII- CQI	CII-RI-PIVII- CQI
				not	not	not
timeRestriction	nForChannelMeasurements		not configured	configured	configured	configured
				not	not	not
timeRestriction	nForInterferenceMeasurements		not configured	configured	configured	configured
cqi-FormatInd	icator		Wideband	Wideband	Wideband	Wideband
pmi-FormatIng			Wideband	Wideband	Wideband	Wideband
Sub-band Size		RB	8	8	8	8
csi-Reporting			1111111	1111111	1111111	1111111
	eriodicity and offset	slot	5/0	5/0	5/0	5/0
23. Hoport pe	Codebook Type	3.00	typel-	typel-	typel-	typel-
			SinglePanel	SinglePanel	SinglePanel	SinglePanel
	Codebook Mode		1	1	1	1
	(CodebookConfig-					· · · · · · · · · · · · · · · · · · ·
	N1,CodebookConfig-N2)		N/A	N/A	N/A	(2,1)
	CodebookSubsetRestriction		010000 for	000011 for	000011 for	
Codebook			fixed rank 2,	fixed rank 1,	fixed rank 1,	1111111
configuration			010011 for	010011 for	010011 for	11111111
		<u></u>	following rank	following rank	following rank	
	RI Restriction					00000010 for
						fixed Rank 2
			N/A	N/A	N/A	and
						00001111 for
					_,,	follow RI
	nel for CSI report		PUCCH	PUCCH	PUCCH	PUCCH
CQI/RI/PMI de		ms	8	8	8	8
Maximum nun	nber of HARQ transmission		1	1	1	1

RI Configuration	Fixed RI = 2	Fixed RI = 1	Fixed RI = 1	Fixed RI = 2		
Ri Configuration	and follow RI	and follow RI	and follow RI	and follow RI		
NOTE 1: Measurements channels are specified in Table A.4-2 and Table A.4-3. TBS.2-1 is used for Rank 1 case. TBS.2-2						
is used for Rank 2 case, TBS 3-1 is used for Rank 3 case, TBS 3-2 is used for Rank 4 case						

Table 6.4.3.1-2: Minimum requirement (FDD)

	Test 1	Test 2	Test 3	Test 4
21	N/A	1.05	0.9	N/A
72	0.9	N/A	N/A	0.9

6.4.3.2 TDD

The minimum performance requirement in Table 6.4.3.2-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_1$;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be $\geq \gamma_2$;

For the parameters specified in Table 6.4.3.2-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.4.3.2-2.

Table 6.4.3.2-1: RI Test (TDD)

	Parameter	Unit	Test 1	Test 2	Test 3	Test 4
Bandwidth		MHz	40	40	40	40
Subcarrier sp	acing	kHz	30	30	30	30
Duplex Mode			TDD	TDD	TDD	TDD
TDD Slot Con	figuration		FR1.30-1	FR1.30-1	FR1.30-1	FR1.30-1
SNR		dB	-2	16	16	22
Propagation of			TDLA30-5	TDLA30-5	TDLA30-5	TDLA30-5
Antenna confi	iguration		ULA Low 2x4	ULA Low 2x4	ULA High 2x4	ULA Low 4x4
Beamforming	Model		As defined in	As defined in	As defined in	As defined in
Doarmorning			Annex B.4.1	Annex B.4.1	Annex B.4.1	Annex B.4.1
-	CSI-RS resource Type		Periodic	Periodic	Periodic	Periodic
-	Number of CSI-RS ports (X)		4	4	4	4
70 001 00	CDM Type		FD-CDM2	FD-CDM2	FD-CDM2	FD-CDM2
ZP CSI-RS	Density (p)		1	1	1	1
configuratio	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 5, (4,-)	Row 5, (4,-)	Row 5, (4,-)	Row 5, (4,-)
n	First OFDM symbol in the PRB used for CSI-RS (I ₀ , I ₁)		(9,-)	(9,-)	(9,-)	(9,-)
	CSI-RS	slot	10/1	10/1	10/1	10/1
	periodicity and offset CSI-RS resource Type		Periodic	Periodic	Periodic	Periodic
	Number of CSI-RS ports (X)		2	2	2	4
	CDM Type		FD-CDM2	FD-CDM2	FD-CDM2	FD-CDM2
NZP CSI-	Density (ρ)		1	1	1	1
RS for CSI	First subcarrier index in the					
acquisition	PRB used for CSI-RS (k ₀ , k ₁)		Row 3 (6,-)	Row 3 (6,-)	Row 3 (6,-)	Row 4 (0,-)
·	First OFDM symbol in the PRB used for CSI-RS (I ₀ , I ₁)		(13,-)	(13,-)	(13,-)	(13,-)
	NZP CSI-RS-timeConfig periodicity and offset	slot	10/1	10/1	10/1	10/1
	CSI-IM resource Type		Periodic	Periodic	Periodic	Periodic
001.1114	CSI-IM RE pattern		Pattern 0	Pattern 0	Pattern 0	Pattern 0
CSI-IM configuratio n	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(4,9)	(4,9)	(4,9)	(4,9)
	CSI-IM timeConfig periodicity and offset	slot	10/1	10/1	10/1	10/1
ReportConfig	Туре		Periodic	Periodic	Periodic	Periodic
CQI-table			Table 2	Table 2	Table 2	Table 2
reportQuantity	y		cri-RI-PMI-CQI	cri-RI-PMI- CQI	cri-RI-PMI- CQI	cri-RI-PMI- CQI
timeRestrictio	nForChannelMeasurements		not configured	not configured	not configured	not configured
timeRestrictio	nForInterferenceMeasurements		not configured	not configured	not configured	not configured
cqi-FormatInd			Wideband	Wideband	Wideband	Wideband
pmi-FormatIn			Wideband	Wideband	Wideband	Wideband
Sub-band Siz		RB	16	16	16	16
csi-Reporting			1111111	1111111	1111111	1111111
CSI-Report pe	eriodicity and offset	slot	10/9	10/9	10/9	10/9
	Codebook Type		typel-	typel-	typel-	typel-
	Codebook Mode		SinglePanel	SinglePanel	SinglePanel	SinglePanel
	(CodebookConfig-			1	l l	I
	N1,CodebookConfig-N2)		N/A	N/A	N/A	(2,1)
	CodebookSubsetRestriction		010000 for	000011 for	000011 for	
Codebook			fixed rank 2,	fixed rank 1,	fixed rank 1,	1111111
configuration			010011 for	010011 for	010011 for	11111111
-			following rank	following rank	following rank	
	RI Restriction					00000010 for
						fixed Rank 2
			N/A	N/A	N/A	and 00001111 for follow RI
Physical channel for CSI report		 	DUOQU	DUCCU	PUCCH	PUCCH
Physical char	nnel for CSI report		PUCCH	PULLA	1 100.00	700.00
Physical char CQI/RI/PMI de		ms	PUCCH 9.5	PUCCH 9.5	9.5	9.5

PI Configuration			Fixed RI = 2	Fixed RI = 1	Fixed RI = 1	Fixed RI = 2		
	RI Configuration		and follow RI	and follow RI	and follow RI	and follow RI		
	NOTE 1: Measurements channels are specified in Table A.4-2 and Table A.4-3. TBS.2-3 is used for Rank 1 case. TBS.2-4							
	is used for Rank 2 case. TBS.3-3 is used for Rank 3 case. TBS.3-4 is used for Rank 4 case.							

Table 6.4.3.2-2: Minimum requirement (TDD)

	Test 1	Test 2	Test 3	Test 4
21	N/A	1.05	0.9	N/A
72	0.9	N/A	N/A	0.9

7 Demodulation performance requirements (Radiated requirements)

7.1 General

7.1.1 Applicability of requirements

7.1.1.1 General

The minimum performance requirements are applicable to the FR2 operating bands defined in TS 38.101-2 [7] with F_{DL_high} not exceeding 40000 MHz.

The minimum performance requirements in Clause 7 are mandatary for UE supporting NR operation, except test cases listed in Clause 7.1.1.3, 7.1.1.4.

7.1.1.2 Applicability of requirements for different number of RX antenna ports

UE shall support 2 RX ports for different RF operating bands. The UE requirements applicability is defined in Table 7.1.1.2-1.

Table 7.1.1.2-1: Requirements applicability

Supported RX antenna ports	Test type	Test list
UE supports 2RX	PDSCH	All tests in Clause 7.2.2
antenna ports	PDCCH	All tests in Clause 7.3.2
	PBCH	All tests in Clause 7.4.2

7.1.1.3 Applicability of requirements for optional UE features

The performance requirements in Table 7.1.1.3-1 shall apply for UEs which support optional UE features only.

Table 7.1.1.3-1: Requirements applicability for optional UE features

UE feature/capability [14]	Test	type	Test list	Applicability notes
SU-MIMO Interference Mitigation advanced receiver	FR2 TDD	PDSCH	Clause 7.2.2.2.1 (Test 3-1)	
Basic DL NR-NR CA operation (supportedBandCombinationList)	NR CA	SDR	Clause 7.5A.1	Up to 16 DL carriers Same numerology across carrier for data/control channel at a given time
PDSCH repetitions over multiple slots (pdsch- RepetitionMultiSlots)	FR2 TDD	PDSCH	Clause 7.2.2.2	
DRX Adaptation (drx-Adaptation- r16)	FR2 TDD	PDCCH	Clause 7.3.2.2.3	If the Test 3-1 in Clause 7.3.2.2.3 is passed, the test coverage can be considered fulfilled without executing Test 1-2 in clause 7.3.2.2.1.
256QAM for PDSCH (pdsch-256QAM-FR2)	FR2 TDD	PDSCH	Clause 7.2.2.2.1 (Test 1-4)	
256QAM for PDSCH (pdsch- 256QAM-FR2)	FR2 TDD	SDR	Clause 7.5A.1	For UE capable of pdsch- 256QAM-FR2 for certain band(s), mcs-Table is configured to '64QAM' for SDR test.

7.1.1.4 Applicability of requirements for mandatory UE features with capability signalling

The performance requirements in Table 7.1.1.4-1 shall apply for UEs which support mandatory UE features with capability signalling only.

Table 7.1.1.4-1: Requirements applicability for mandatory features with UE capability signalling

UE feature/capability [14]	Test t	уре	Test list	Applicability notes
Supported maximum number of PDSCH MIMO layers (maxNumberMIMO-LayersPDSCH)	FR2 TDD	PDSCH	Clause 7.2.2.2.1 (Tests from 2-1 to 2-6)	The requirements apply only in case the PDSCH MIMO rank in the test case does not exceed UE PDSCH MIMO layers capability
	FR2 TDD	PDSCH	Clause 7.2	
Support of PT-RS with one antenna port for DL reception (onePortsPTRS)		SDR	Clause 7.5.1 Clause 7.5A.1	
PCell operation on FR2 (<i>pCell-FR2</i>)	FR2 TDD	SDR	Clause 7.5A.1	
PDSCH mapping type B (pdsch-MappingTypeB)	FR2 TDD	PDSCH	Clause 7.2.2.2.3	

7.1.1.5 Applicability of CA requirements

7.1.1.5.1 Definition of CA capability

The definition with respect to CA capabilities is given as in Table 7.1.1.5.1-1.

Table 7.1.1.5.1-1: 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 Clause 5.5A.1 of TS 38.101-2 [7].					
CA_N corresponds to NR CA configurations and bandwidth combination sets defined in Clause 5.5A.2 of TS 38.101-2 [7]. CA_AX corresponds to NR CA configurations and bandwidth combination sets defined in Clause 5.5A.3 of TS 38.101-2 [7].					

7.1.1.5.2 Applicability and test rules for different CA configurations and bandwidth combination sets

The performance requirement for CA UE demodulation tests in Clause 7.2A are defined independent of CA configurations and bandwidth combination sets specified in Clause 5.5A of TS 38.101-2. For UEs supporting different CA configurations and bandwidth combination sets, the applicability and test rules are defined in Table 7.1.1.5.2-1 and Table 7.1.1.5.2-2. For simplicity, CA configuration below refers to combination of CA configuration and bandwidth combination set.

Table 7.1.1.5.2-1: 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 Clause 7.2A.2.1	CA_C, CA_N, CA_AX	Table 7.1.1.5.2-2	Largest aggregated CA bandwidth combination	Any of CCs

Table 7.1.1.5.2-2: Selection of CA configurations

CA capability	Step 1	Step 2	Step 3			
CA_C or CA_N or CA_AX	Select CA configuration(s), which contain all CA bandwidth combinations requiring SNR below test equipment maximum achievable SNR	Select the CA configurations with the maximum number of CCs, for which the supported maximum number of MIMO layers is not lower than 2, among all the selected CA configurations from Step 1.	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 2.			
NOTE 1: Maximum supported data rate for Step 3 is calculated based clause 4.1.2 of TS 38.306 [14]						
NOTE 2: Tested data rate for Step 3 is calculated based on the equation $DataRate = 10^{-3} \sum_{j=1}^{J} TBS_j 2^{\mu_j}$ and FRCs						
used in the test.						

7.2 PDSCH demodulation requirements

The parameters specified in Table 7.2-1 are valid for all PDSCH demodulation tests unless otherwise stated.

Table 7.2-1: Common Test Parameters

Parameter			Value
PDSCH transmission scheme			Transmission scheme 1
PTRS epre-Ratio			0
Actual carrier	Offset between Point A and the lowest usable subcarrier on this carrier (Note 2)	RBs	0
configuration	Subcarrier spacing	kHz	60 or 120
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 38.101-2 [7] for tested channel bandwidth and subcarrier spacing
Common conving	Physical Cell ID		0
Common serving cell parameters	SSB position in burst		1
	SSB periodicity	ms	20
	Slots for PDCCH monitoring		Each slot
	Symbols with PDCCH		0
	Number of PRBs in CORESET		Table 7.2-2 for tested channel bandwidth and subcarrier spacing
	Number of PDCCH candidates and aggregation levels		1/AL8
	CCE-to-REG mapping type		Non-interleaved
PDCCH	DCI format		1_1
configuration	TCI state		TCI state #1
	PDCCH & PDCCH DMRS Precoding configuration		Single Panel Type I, Random per slot with equal probability of each applicable i ₁ , i ₂ combination, and with REG bundling granularity for number of Tx larger than 1
Cross carrier schedul			Not configured
	First subcarrier index in the PRB used for CSI-RS (<i>k</i> ₀)		0 for CSI-RS resource 1,2,3,4
CSI-RS for tracking	First OFDM symbol in the PRB used for CSI-RS (<i>lo</i>)		6 for CSI-RS resource 1 and 3 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	60 kHz SCS: 80 for CSI- RS resource 1,2,3,4 120 kHz SCS: 160 for CSI-RS resource 1,2,3,4
	CSI-RS offset	Slots	60 kHz SCS: 40 for CSI-RS resource 1 and 2 41 for CSI-RS resource 3 and 4 120 kHz SCS: 80 for CSI-RS resource 1 and 2 81 for CSI-RS resource 3 and 4

			Start PRB 0		
	Frequency Occupation			Number of PRB = BWP	
	Frequency Occupation			size	
	QCL info			TCI state #0	
	First subcarrier index in the PRB used for CSI-				
	RS (k_0)	index in the FRB asea for GGI		0	
		nbol in the PRB used for CSI-RS			
	(<i>I</i> ₀)	ibor in the rinks about or bor no		12	
	Number of CSI-	RS ports (X)		2	
	CDM Type	rte pene (x)		FD-CDM2	
NZP CSI-RS for CSI acquisition	Density (ρ)			1	
			Slots	60 kHz SCS: 80	
	CSI-RS periodic	CSI-RS periodicity		120 kHz SCS: 160	
	CSI-RS offset			0	
				Start PRB 0	
	Frequency Occi	upation		Number of PRB = BWP	
				size	
	QCL info			TCI state #1	
	First subcarrier index in the PRB used for CSI-			4	
	RS (k ₀)			4	
		nbol in the PRB used for CSI-RS		12	
	(10)			12	
	Number of CSI-	RS ports (X)		4	
ZP CSI-RS for CSI	CDM Type			FD-CDM2	
acquisition	Density (ρ)			1	
acquisition	CSI-RS periodic	rity	Slots	60 kHz SCS: 80	
	-	orty	Oloto	120 kHz SCS: 160	
	CSI-RS offset			0	
				Start PRB 0	
	Frequency Occupation			Number of PRB = BWP	
				size	
		index in the PRB used for CSI-		k ₀ =0 for CSI-RS	
	RS			resource 1,2	
	First OFDM symbol in the PRB used for CSI-RS			$I_0 = 8$ for CSI-RS	
				resource 1	
				l ₀ = 9 for CSI-RS	
				resource 2 1 for CSI-RS resource	
	Number of CSI-RS ports (X)			1,2	
				'No CDM' for CSI-RS	
CSI-RS for beam	CDM Type			resource 1,2	
refinement				3 for CSI-RS resource	
remement	Density (ρ)			1,2	
				60 kHz SCS: 80 for CSI-	
	001 00		Cloto	RS resource 1,2	
	CSI-RS periodicity		Slots	120 kHz SCS: 160 for	
				CSI-RS resource 1,2	
	CSI-RS offset		Slots	0 for CSI-RS resource	
	CSI-RS dilset		31018	1,2	
	Repetition			ON	
	QCL info			TCI state #1	
	Antenna ports indexes			{1000} for Rank 1 tests	
				{1000, 1001} for Rank 2	
				tests	
				10010	
PDSCH DMRS	Position of the first DMRS for PDSCH mapping				
configuration				_	
	type A			2	
	31				
	N. J. (PROOFFEE)				
		CH DMRS CDM group(s) without		1	
TCI state #0	data	SSB index		CCD #0	
	Type 1 QCL information	SSB index		SSB #0	
	iiiioiiiialioii	QCL Type		Type C	
		SSB index		SSB #0	
	I	OOD IIIUGA		33D #U	

	Type 2 QCL information	QCL Type	Type D
	Type 1 QCL information	CSI-RS resource	CSI-RS resource 1 from 'CSI-RS for tracking' configuration
TOI -1-1- //4		QCL Type	Type A
TCI state #1	Type 2 QCL information	CSI-RS resource	CSI-RS resource 1 from 'CSI-RS for tracking' configuration
		QCL Type	Type D
	Frequency den	sity (K _{PT-RS})	2
PTRS configuration	Time density (I	PT-RS)	1
	Resource Elem		2
		s for ACK/NACK feedback	1
Maximum number of		ion	4
HARQ ACK/NACK bu	ındling		Multiplexed
Redundancy version	coding sequence		{0,2,3,1}
PDSCH & PDSCH DI	Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i ₁ , i ₂ combination, andwith Wideband granularity		
Symbols for all unuse	OP.1 FDD as defined in Annex A.5.1.1 OP.1 TDD as defined in Annex A.5.2.1		
Physical signals, char	As specified in Annex B.4.1		
Note 1: UE assum	es that the TCI st	ate for the PDSCH is identical to the	TCI state applied for the PDCCH

Table 7.2-2: Number of PRBs in CORESET

Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-2 [7] for

SCS (kHz)	50 MHz	100 MHz	200 MHz	400 MHz
60	66	132	264	N.A
120	30	66	132	264

7.2.1 1RX requirements

(Void)

Note 2:

7.2.2 2RX requirements

7.2.2.1 FDD

(Void)

7.2.2.2 TDD

7.2.2.2.1 Minimum requirements for PDSCH Mapping Type-A

tested channel bandwidth and subcarrier spacing.

For PDSCH Type-A scheduling, the requirements are specified in Table 7.2.2.2.1-3, 7.2.2.2.1-4 and 7.2.2.2.1-5, with the addition of the parameters in Table 7.2.2.2.1-2 and the downlink physical channel setup according to Annex C.5.1. The purpose is to verify the performance of PDSCH Type-A scheduling.

The test purposes are specified in Table 7.2.2.1.1-1.

Table 7.2.2.1.1-1: Tests purpose

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

Table 7.2.2.2.1-2: Test Parameters

	Parameter	Unit	Value
Duplex mode			TDD
Active DL BWP index			1
CSI-RS for tracking	First OFDM symbol in the PRB used for CSI-RS (I_0)		For Test 1-1 and 1-2: 3 for CSI-RS resource 1 and 3 7 for CSI-RS resource 2 and 4
	CSI-RS offset	Slots	For Test 1-2: 82 for CSI-RS resource 1 and 2 83 for CSI-RS resource 3 and 4
PDCCH configuration	Number of PDCCH candidates and aggregation levels		1/AL4 for Test 1-4 and 2-3 1/AL8 for other tests
	Mapping type k0		Type A 0
	Starting symbol (S) Length (L)		Specific to each Reference channel as defined in A.3.2.2
	PDSCH aggregation factor		1
PDSCH configuration	PRB bundling type PRB bundling size		Static WB for Test 1-1, 2 for other tests
-	Resource allocation type		Test 2-1: Type 1 with start RB = 30, L _{RBs} = 6 Other tests: Type 0
	RBG size		Test 2-1: N/A Other tests: Config2
	VRB-to-PRB mapping type VRB-to-PRB mapping interleaver bundle size		Non-interleaved N/A
PDSCH DMRS configuration	DMRS Type Number of additional DMRS Maximum number of OFDM symbols for		Type 1 1 1
Number of HARQ Process	DL front loaded DMRS		8 for Test 1-1, 1-3, 1-4, 2-2, 2-4 10 for Test 2-1, 2-3, 2-5, 2-6, 3-1 16 for Test 1-2
The number of slots between information	een PDSCH and corresponding HARQ-ACK		As defined in Annex A.1.3

Table 7.2.2.2.1-3: Minimum performance for Rank 1 (FRC)

						Correlation	Reference value	
Test num	Referenc e channel	Bandwidth (MHz) / Subcarrier spacing (kHz)	Modulatio n and code rate	TDD UL- DL pattern	Propagatio n condition	matrix and antenna configuratio n	Fraction of maximum throughpu t (%)	SNR _B _B (dB)
1-1	R.PDSCH .5-1.1 TDD	100 / 120	QPSK, 0.30	FR2.120- 1A	TDLC60- 300	2x2 ULA Low	70	-0.4
1-2	R.PDSCH .5-2.1 TDD	100 / 120	16QAM, 0.48	FR2.120- 1	TDLA30- 300	2x2 ULA Low	30	1.7
1-3	R.PDSCH .5-3.1 TDD	100 / 120	64QAM, 0.46	FR2.120- 1	TDLA30- 300	2x2 XPL Medium	70	12.4
1-4	R.PDSCH .5-9.1 TDD	50 / 120	256QAM 0.67	FR2.120- 1	TDLD30-75	2x2 ULA Low	70	[20.2]

Table 7.2.2.2.1-4: Minimum performance for Rank 2 (FRC)

	Bandwidth					Correlation	Reference value	
Test num	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulatio n and code rate	TDD UL-DL pattern	Propagatio n condition	matrix and antenna configuratio n	Fraction of maximum throughp ut (%)	SNR _{BB} (dB)
2-1	R.PDSCH. 5-4.1 TDD	100 / 120	QPSK, 0.30	FR2.12 0-2	TDLA30-75	2x2 ULA Low	70	4.1
2-2	R.PDSCH. 5-2.2 TDD	100 / 120	16QAM, 0.48	FR2.12 0-1	TDLA30- 300	2x2 ULA Low	70	14.4
2-3	R.PDSCH. 5-5.2 TDD	50 / 120	16QAM,0.4 8	FR2.12 0-2	TDLA30-75	2x2 ULA Low	70	14.0
2-4	R.PDSCH. 5-2.3 TDD	200 / 120	16QAM, 0.48	FR2.12 0-1	TDLA30- 300	2x2 ULA Low	70	14.2
2-5	R.PDSCH. 4-1.1 TDD	50 / 60	16QAM, 0.48	FR2.60- 1	TDLA30-75	2x2 ULA Low	70	14.3
2-6	R.PDSCH. 5-6.1 TDD	100 / 120	64QAM, 0.43	FR2.12 0-2	TDLA30-75	2x2 ULA Low	70	18.6

Table 7.2.2.2.1-5: Minimum performance for Rank 2 (FRC) for Enhanced Receiver Type 1

		Bandwidt				Correlation	Reference	value
Test num	Reference channel	h (MHz) / Subcarrier spacing (kHz)	Modulatio n and code rate	TDD UL- DL pattern	Propagatio n condition	matrix and antenna configuratio n	Fraction of maximum throughpu t (%)	SNR _B _B (dB)
3-1	R.PDSCH.5 -5.1 TDD	100 / 120	16QAM, 0.48	FR2.120 -2	TDLA30-75	2x2 ULA Medium	70	19.0

7.2.2.2.2 Minimum requirements for PDSCH repetitions over multiple slots

For PDSCH with slot aggregation, the requirements are specified in Table 7.2.2.2.2-3, additional parameters in Table 7.2.2.2.2-2 and the downlink physical channel setup according to Annex C.5.1.

The test purpose is specified in Table 7.2.2.2.1.

Table 7.2.2.2.1: Test purpose

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

Table 7.2.2.2.2-2: Test Parameters

	Parameter	Unit	Value
Duplex mode			TDD
Active DL BWP index			1
	Mapping type		Type A
	k0		0
	Starting symbol (S)		1
	Length (L)		13
	PDSCH aggregation factor		2
PDSCH configuration	PRB bundling type		Static
1 Door comigaration	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	Number of additional DMRS		1
configuration	Maximum number of OFDM symbols for DL front loaded DMRS		1
Number of HARQ Processes			2
The number of slots between final repetition of PDSCH and corresponding HARQ-ACK information			As defined in Annex A.1.3 (Note 1)
Note 1: ACK/NACK fee	edback is generated for PDSCH on slot i, whe	re mod(i,4) =	1, where i is the slot index per

frame; i = {0,...,79}

Table 7.2.2.2.3: Minimum performance for Rank 1 (FRC)

Test	Reference	Bandwidth (MHz) / Modulation TDD UL- Propagation		Correlation matrix and	Reference value			
num	Subcarrier and code	condition	antenna configuration	Target BLER	SNR (dB)			
1-1	R.PDSCH. 5-10.1 TDD	100 / 120	16QAM, 0.37	FR2.120-2	TDLA30-75	2x2 ULA Low	1% (Note 1)	[-1.1]

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.

7.2.2.2.3 Minimum requirements for PDSCH Mapping Type B

The performance requirements are specified in Table 7.2.2.2.2-3, with the addition of test parameters in Table 7.2.2.2.2-2 and the downlink physical channel setup according to Annex C.5.1. The purpose is to verify the performance of PDSCH Type B scheduling.

The test purposes are specified in Table 7.2.2.2.1.

Table 7.2.2.2.1: Test purpose

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

Table 7.2.2.2.2: Test parameters

Parameter			Value
Duplex mode			TDD
Active DL BWP inde	ex		1
PDCCH configuration	Number of PDCCH candidates and aggregation levels		1/AL8
	Mapping type		Туре В
	k0 Starting symbol (S)		0 1
	Length (L)		2
PDSCH	PDSCH aggregation factor PRB bundling type		1 Static
configuration	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	Number of additional DMRS		0
configuration	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.1.3

Table 7.2.2.2-3: Minimum performance for Rank 1

		Bandwidth	Madulatian	TDD !!!		Correlation	Reference va	alue
Test num.	Reference channel	(MHz) / Subcarrier spacing (kHz)	Modulation format and code rate	TDD UL- DL pattern	Propagation condition	matrix and antenna configuration	Fraction of maximum throughput (%)	SNR (dB)
1-1	R.PDSCH. 5-1.2 TDD	100 / 120	QPSK, 0.30	FR2.120- 1	[TDLA30-75]	2x2, ULA Low	70	[1.3]

7.2A PDSCH demodulation requirements for CA

The parameters specified in Table 7.2-1 for PDSCH single carrier tests are reused for PDSCH CA test unless otherwise stated.

7.2A.1 1RX requirements

(Void)

7.2A.2 2RX requirements

7.2A.2.1 Minimum requirements

For CA with different numbers of DL component carriers, the requirements are defined in Table 7.2A.2.1-3 based on the single carrier requirements for different bandwidth specified in Table 7.2A.2.1-2, with the parameters in Table 7.2A.2.1-1 and the downlink physical channel setup according to Annex C.5.1. The performance requirements specified in this sub-cluase do not apply for UE single carrier test.

Table 7.2A.2.1-1: Test parameters for CA

	Parameter	Unit	Value
Duplex mode			TDD
Active DL BWP index	X		1
	Mapping type		Type A
	k0		0
	Starting symbol (S)		1
	Length (L)		Specific to each Reference channel
	PDSCH aggregation factor		1
PDSCH	PRB bundling type		Static
configuration	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		N/A
	size		IN/A
	DMRS Type		Type 1
PDSCH DMRS	Number of additional DMRS		1
configuration	Maximum number of OFDM symbols for		1
	DL front loaded DMRS		I.
Number of HARQ Pr	ocesses		8
TDD UL-DL pattern			120kHz SCS: FR2.120-1
The number of slots ACK information	between PDSCH and corresponding HARQ-		As defined in Annex A.1.3

Table 7.2A.2.1-2: Single carrier performance for TDD 120 kHz SCS for CA configurations

-		Modulation		Correlation			
Bandwidth (MHz)	Reference channel	format and code rate	Propagation condition	matrix and antenna configuration	Fraction of maximum throughput (%)	SNR (dB)	
50	R.PDSCH.5- 9.1 TDD	16QAM, 0.33	TDLA30-75	2x2, ULA Low	70	[10.4]	
100	R.PDSCH.5- 9.2 TDD	16QAM, 0.33	TDLA30-75	2x2, ULA Low	70	[10.2]	
200	R.PDSCH.5- 9.3 TDD	16QAM, 0.33	TDLA30-75	2x2, ULA Low	70	[10.3]	
400	R.PDSCH.5- 9.4 TDD	16QAM, 0.33	TDLA30-75	2x2, ULA Low	70	[10.3]	

Table 7.2A.2.1-3: Minimum performance for multiple CA configurations

Test number		CA duplex mode	Minimum performance requirements
1		TDD 120 kHz + TDD 120 kHz	As defined in Table 7.2A.2.1-2
Note 1: The		pplicability of requirements for different	CA duplex modes, SCSs, CA configurations and bandwidth
	combi	ination sets is defined in 7.1.1.5.	

7.3 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 7.3-1 are valid for all PDCCH tests unless otherwise stated.

Table 7.3-1: Common test Parameters

	Parameter		Unit	Value
Carrier	Offset between	n Point A and the		0
configuration	lowest usable	subcarrier on this		
	carrier (Note	1)		
DL BWP	Cyclic prefix			Normal
configuration #1 Common	Physical Cell	ID		0
serving cell	SSB position			1
parameters	SSB periodici		ms	20
paramotoro		CH monitoring	1110	Each slot
		OCCH candidates		1
PDCCH	Cranica action			Start from RB = 0
configuration	allocation for	main resource		with contiguous RB
		OOKLOLI		allocation
	TCI state	and the state of the state of DDD		TCI state #1
		er index in the PRB		0
	used for CSI-	KS (KU)		CSI-RS resource 1:
				4
				CSI-RS resource 2:
	First OFDM s	ymbol in the PRB		8
	used for CSI-	RS (I0)		CSI-RS resource 3:
				4
				CSI-RS resource 4:
001 00 (Number of CC	CLDC porto (V)		8
CSI-RS for tracking	CDM Type	SI-RS ports (X)		No CDM
liacking	Density (ρ)			3
	CSI-RS perior	dicity	Slots	160
	COLITIC POLICE	aronty	0.0.0	80 for CSI-RS
	CSI-RS offset		Slots	resource 1 and 2
	CSI-RS Olisei		Sidis	81 for CSI-RS
				resource 3 and 4
	F			Start PRB 0
	Frequency Oc	ccupation		Number of PRB = BWP size
	QCL info			TCI state #0
		er index in the PRB		
	used for CSI-			0
				CSI-RS resource 1:
	First OFDM s	ymbol in the PRB		8
	used for CSI-	RS (I0)		CSI-RS resource 2:
	N 1 (00	N DO 1 ()()		9
NZP CSI-RS for		SI-RS ports (X)		No CDM
beam	CDM Type Density (ρ)			No CDM 3
management	Density (p)			120 kHz SCS: 160
	CSI-RS period	dicity	Slots	for CSI-RS resource
		- · · ,		1,2
	CSI-RS offset		Slots	0 for CSI-RS
		•	51015	resource 1,2
	Repetition			ON TOLetete #4
	QCL info			TCI state #1
				Single Panel Type I, Random per slot
				with equal
				probability of each
PDCCH & PDCCH	I DMPS Proces	ding configuration		applicable i ₁ , i ₂
I DOOM & FDOOF	I DIVING FIECOC	ang coningulation		combination, and
				with REG bundling
				granularity for
				number of Tx larger than 1
	Type 1 QCL	SSB index		SSB #0
TOL	information	QCL Type		Type C
TCI state #0	Type 2 QCL	SSB index		SSB #0
	information	QCL Type		Type D

	Type 1 QCL information	CSI-RS resource	CSI-RS resource 1 from 'CSI-RS for tracking' configuration	
TCI state #1		QCL Type	Type A	
TOI State #1	Type 2 QCL information	CSI-RS resource	CSI-RS resource 1 from 'CSI-RS for tracking' configuration	
		QCL Type	Type D	
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		
Note 1: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38 101-1 [6] for tested channel bandwidth and subcarrier spacing				

from TS 38.101-1 [6] for tested channel bandwidth and subcarrier spacing.

7.3.1 1RX requirements

(Void)

7.3.2 2RX requirements

7.3.2.1 **FDD**

(Void)

7.3.2.2 **TDD**

The parameters specified in Table 7.3.2.2-1 are valid for all TDD tests unless otherwise stated.

Table 7.3.2.2-1: Test Parameters

Parameter	Unit	1 Tx Antenna	2 Tx Antenna
TDD UL-DL pattern		FR2.12	20-1
CCE to REG mapping type		Interlea	aved
REG bundle size		2 for test 1-1	2
REG buildle size		6 for test 1-2	2
Interleaver size		3 for test 1-1	2
interieavei size		2 for test 1-2	3
Shift index	t index 0		

7.3.2.2.1 1 Tx Antenna performances

For the parameters specified in Table 7.3.2.2-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 7.3.2.2.1-1. The downlink physical setup is in accordance with Annex C.5.1.

Table 7.3.2.2.1-1: Minimum performance requirements with 120 kHz SCS

Test	Bandwidth	CORES	CORESET	Aggregation	Reference	Propagation Condition	Antenna configuration	_	erence alue
num ber	(MHz)	ET RB	duration	Aggregation level	Channel		and correlation Matrix	Pm- dsg (%)	SNR _{BB} (dB)
1-1	100	60	1	2	R.PDCCH. 5-1.1 TDD	TDLA30-75	1x2 Low	1	6.4
1-2	100	60	1	4	R.PDCCH. 5-1.2 TDD	TDLA30-300	1x2 Low	1	3.0

7.3.2.2.2 2 Tx Antenna performances

For the parameters specified in Table 7.3.2.2-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 7.3.2.2.2-1. The downlink physical setup is in accordance with Annex C.5.1.

Table 7.3.2.2.2-1: Minimum performance requirements with 120 kHz SCS

Test	Bandwidth	CORESE	CORESET	FOFT Ammonstion Defounds Dropoution		Antenna configuration	-	erence alue	
num ber	(MHz)	TRB	CORESET duration	Aggregation level	Reference Channel	Propagation Condition	and correlation Matrix	Pm- dsg (%)	SNR _{BB} (dB)
2-1	100	60	1	8	R.PDCCH. 5-1.3 TDD	TDLA30-75	2x2 Low	1	0.1
2-2	100	60	2	16	R.PDCCH. 5-2.1 TDD	TDLA30-75	2x2 Low	1	-3.0

7.3.2.2.3 Minimum requirements for power saving

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 7.3.2.2.3-1 are valid for normal PDCCH in DRX on period and PDCCH in DRX off period.

Table 7.3.2.2.3-1: Test Parameters

	Parameter	Unit	1 Tx Antenna			
TDE	UL-DL pattern		FR2.120-1			
CCE to	REG mapping type		Interleaved			
RE	G bundle size		6			
In	terleaver size		2			
	Shift index		0			
Numb	er of UE antennas		2Rx			
	DRX cycle	ms	10			
ps	-WakeUp-r16		absent			
Wake-up indic	ation bit in DCI format 2_6		1			
	PS-offset		$(T_{minimumTimeGap}+1)/2^{\mu}/0.125$			
PDCCH DCI format	Number of PDCCH candidates		1			
2_6 configuration	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: T _{minimumTimeGap}	is signaled as a part of drx-Adaptation	n-r16 UE cap	pability.			

For the parameters specified in Table 7.3.2.2.3-2, the average probability of a missed downlink scheduling grant (Pmdsg) observed on PDCCH during DRX on shall be below the specified value in Table 7.3.2.2.3-2. The downlink physical setup is in accordance with Annex C.5.1.

Table 7.3.2.2.3-2: Minimum performance requirements with 120 kHz SCS

Test	Bandwidth	CORESET	CORESET	Aggregation	n Reference Propagation	Propagation Condition	Antenna configuration		rence lue
numbe		RB	duration	Aggregation level	Channel		and correlation Matrix	Pm- dsg (%)	SNR _{BB} (dB)
3-1	100	60	1	4	R.PDCCH. 5-1.2 TDD	TDLA30-300	1x2 Low	1	3.0
3-1	100	00	ı	8	R.PDCCH. 5-1.4 TDD	1DLA30-300	TAZ LOW	'	3.0

7.4 PBCH demodulation requirements

The receiver characteristics of PBCH are determined by the probability of miss-detection of the PBCH (Pm-bch), which is defined as

$$Pm - bch = 1 - \frac{A}{B}$$

Where A is the number of correctly decoded MIB PDUs and B is the number of transmitted MIB PDUs. The Pm-bch is derived with the assumption UE combines the PBCH symbols of the same SS/PBCH block index within the MIB TTI (80ms).

7.4.1 1RX requirements

(Void)

7.4.2 2RX requirements

7.4.2.1 FDD

(Void)

7.4.2.2 TDD

Table 7.4.2.2-1: Test parameters for PBCH

Parameter	Unit	Single antenna port
Physical Cell ID		0
Cyclic prefix		Normal
Number of SS/PBCH blocks within an SS burst set periodicity		1
SS/PBCH block index Note1		0
SS/PBCH block periodicity	ms	20
TDD UL-DL pattern		FR2.120-1
Note 1: as specified in clause 4.1 of TS 38.213 [11]		
Note 2: as specified in clause 11.1 of TS 38.213 [11]		

For the parameters specified in Table 7.4.2.2-1 the average probability of a miss-detected PBCH (Pm-bch) shall be below the specified values in Table 7.4.2.2-2 in case SS/PBCH block index is not known and below the specified values in Table.7.4.2.2-3 in case SS/PBCH block index is known. The downlink physical setup is in accordance with Annex C.5.1.

Table 7.4.2.2-2: Minimum performance PBCH in case SS/PBCH block index is not known

Γ	Test	Bandwidth (MHz) /	Reference	Propagation	Antenna configuration	Referer	nce value
	number	Subcarrier spacing (kHz)	channel	condition	and correlation matrix	Pm- bch (%)	SNR _{BB} (dB)
F	1	100 / 120	R.PBCH.5	TDLA30-300	1 x 2 Low	1	-6.3
	2	100 / 240	R.PBCH.6	TDLA30-75	1 x 2 Low	1	-6.1

Table 7.4.2.2-3 Minimum performance PBCH in case SS/PBCH block index is known

Test	Bandwidth (MHz) /	Reference	Propagation	Antenna configuration	Refere	nce value
number	Subcarrier spacing	channel	condition	and correlation matrix	Pm-	PBCH
	(kHz)				bch	SNR
					(%)	(dB)
1	100 / 120	R.PBCH.5	TDLA30-300	1 x 2 Low	1	-7.9
2	100 / 240	R.PBCH.6	TDLA30-75	1 x 2 Low	1	-7.6

7.5 Sustained downlink data rate provided by lower layers

7.5.1 FR2 single carrier requirements

The requirements in this clause are applicable to the FR2 single carrier case.

The requirements and procedure defined in Clause 7.5A.1 apply using operating band instead of CA configuration, and bandwidth instead of bandwidth combination.

7.5A Sustained downlink data rate provided by lower layers

7.5A.1 FR2 CA requirements

The Sustained Data Rate (SDR) requirements in this clause are applicable to the FR2 CA.

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.

The test parameters are determined by the following procedure:

- Step 1: Calculate the date rate for all supported CA configurations and set of per component carrier (CC) UE capabilities among all supported UE capabilities:
 - Use Table 7.5A.1-3 to determine the MCS (=MCS1) achieving the largest data rate [clause 4.1.2 of TS 38.306 [14]] based on UE capabilities.
 - Use Table 7.5A.1-4 to determine the largest MCS (=MCS2) requiring SNR below test equipment maximum achievable SNR for that CA configuration.
 - Compute the data rate for CA configuration using the MCS = min(MCS1,MCS2) and the following equation for each CC in CA bandwidth combination.

$$DataRate = 10^{-3} \sum_{j=1}^{J} TBS_{j} 2^{\mu_{j}}$$

where

J is the number of aggregated component carriers in CA bandwidth combination

TBS_j is the total number of DL-SCH transport block bits calculated based on methodology in Clause 5.1.3.2 of TS 38.214 [12] and using parameters from Table 7.5A.1-1

μ_i is provided in Clause 4.2 of TS 38.211 for different subcarrier spacing values

- Step 2: Choose the CA bandwidth combination among all supported CA configurations that achieves maximum data rate in step 1 among all UE capabilities.
 - 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 data rate, select one among sets with the smallest aggregated channel bandwidth.
- Step 3: For each CC in chosen CA bandwidth combination, use determined MCS for each CC in step 1 for that CA configuration based on test parameters and indicated UE capabilities.

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.3.1.

The TB success rate is defined as $100\%*N_{DL_correct_rx}/(N_{DL_newtx} + N_{DL_retx})$, where N_{DL_newtx} is the number of newly transmitted DL transport blocks, N_{DL_retx} is the number of retransmitted DL transport blocks, and $N_{DL_correct_rx}$ is the number of correctly received DL transport blocks.

The test parameters are specified in Table 7.5A.1-1.

Unless otherwise stated, no user data is scheduled on slot #0, 40 and 41 within 20 ms for SCS 60 kHz.

Unless otherwise stated, no user data is scheduled on slot #0, 80 and 81 within 20 ms for SCS 120 kHz.

Table 7.5A.1-1: Test parameters for FR2 TDD

	Parameter	Unit	Value
PDSCH transmission			Transmission scheme 1
PTRS epre-Ratio		-	0
Channel bandwidth		MHz	Channel bandwidth from selected CA bandwidth combination
	Physical Cell ID		0
Common serving	SSB position in burst		First SSB in Slot #0
cell parameters	SSB periodicity First DMRS position for Type A PDSCH	ms	20
	mapping		2
Cross carrier schedu			Not configured
Active DL BWP inde			1
Actual carrier configuration	Offset between Point A and the lowest usable subcarrier on this carrier (Note 3)	RBs	0
comiguration	Subcarrier spacing	kHz	60 or 120
	RB Offset		0
DL BWP configuration #1	Number of contiguous PRB		Maximum transmission bandwidth configuration as specified in clause 5.3.2 of TS 38.101-2 [7] for tested channel bandwidth and subcarrier spacing
	Subcarrier spacing	kHz	60 or 120
	Cyclic prefix		Normal
	Slots for PDCCH monitoring		Each slot
	Symbols with PDCCH Number of PRBs in CORESET		Symbols #0 Table 7.5A.1-2
	Number of PRBs in CORESET Number of PDCCH candidates and		
	aggregation levels		1/8
PDCCH	CCE-to-REG mapping type		Non-interleaved
configuration	DCI format		1-1
Comiguration	TCI State		TCI state #1
	PDCCH &PDCCH DMRS Precoding configuration		Single Panel Type I, Random per slot with equal probability of precoder index 0 and 2, and with REG bundling granularity for number of Tx larger than 1
	Mapping type		Type A
	k0		0
	PDSCH aggregation factor		1
	PRB bundling type		Static
PDSCH	PRB bundling size Resource allocation type		WB Type 0
configuration	RBG size		Config2
2093144011	VRB-to-PRB mapping type		Non-interleaved
	VRB-to-PRB mapping interleaver bundle size		N/A
	Starting symbol (S)		1
	Length (L)		13
	DMRS Type		Type 1
	Number of additional DMRS		1
PDSCH DMRS	Length		1 (4000) for 4 l 00-
configuration	Antenna ports indexes		{1000} for 1 Layer CCs {1000, 1001} for 2 Layers CCs
	Number of PDSCH DMRS CDM group(s) without data		1
PTRS configuration	Frequency density (<i>K</i> _{PT-RS}) Time density (<i>L</i> _{PT-RS})		2
- Comgaration	Subcarrier indexes in the PRB used for		$k_0 = 3$ for CSI-RS resource 1,2,3,4
	CSI-RS OFDM symbols in the PRB used for CSI-		l ₀ = 6 for CSI-RS resource 1 and 3
CSI-RS for tracking	RS		l ₀ = 10 for CSI-RS resource 2 and 4
	Number of CSI-RS ports (X)		1 for CSI-RS resource 1,2,3,4 'No CDM' for CSI-RS resource
	CDM Type Density (ρ)		1,2,3,4 3 for CSI-RS resource 1,2,3,4
	Penoity (h)		3 101 C31-R3 1650ulte 1,2,3,4

	•			
				60 kHz SCS: 80 for CSI-RS resource
	CSI-RS periodicity		Slots	1,2,3,4
				120 kHz SCS: 160 for CSI-RS
				resource 1,2,3,4 60 kHz SCS:
				40 for CSI-RS resource 1 and 2
				41 for CSI-RS resource 3 and 4
	CSI-RS offset		Slots	41 for COLING resource 5 and 4
			0.010	120 kHz SCS:
				80 for CSI-RS resource 1 and 2
				81 for CSI-RS resource 3 and 4
	Frequency Occupa	tion		Start PRB 0
	гтечиенсу Оссира	liOH		Number of PRB = BWP size
	QCL info			TCI state #0
		in the PRB used for		$k_0 = 4$
	CSI-RS	h - DDD d f- :: 001		
	RS	he PRB used for CSI-		$I_0 = 13$
	Number of CSI-RS	norte (V)		Same as number of transmit antenna
	CDM Type	ports (A)		'FD-CDM2'
NZP CSI-RS for	Density (p)			1 D-CDIVIZ
CSI acquisition	- 11			60 kHz SCS: 80
	CSI-RS periodicity		Slots	120 kHz SCS: 160
	CSI-RS offset			0
				Start PRB 0
	Frequency Occupa	tion		Number of PRB = BWP size
	QCL info			TCI state #1
	Subcarrier indexes	in the PRB used for		$k_0 = 0$
	CSI-RS			K ₀ = U
		he PRB used for CSI-		lo = 12
	RS			10 - 12
	Number of CSI-RS	ports (X)		4
ZP CSI-RS for CSI	CDM Type			'FD-CDM2'
acquisition	Density (ρ)			1
	CSI-RS periodicity		Slots	60 kHz SCS: 80
	CSI-RS offset			120 kHz SCS: 160 0
	CSI-RS Oliset			Start PRB 0
	Frequency Occupation			Number of PRB = BWP size
	First subcarrier inde	ex in the PRB used for		
	CSI-RS			k ₀ =0 for CSI-RS resource 1,2
	First OFDM symbol	in the PRB used for		l ₀ = 8 for CSI-RS resource 1
	CSI-RS			l ₀ = 9 for CSI-RS resource 2
	Number of CSI-RS	ports (X)		1 for CSI-RS resource 1,2
	CDM Type			'No CDM' for CSI-RS resource 1,2
CSI-RS for beam	Density (ρ)			3 for CSI-RS resource 1,2
refinement				60 kHz SCS: 80 for CSI-RS resource
	CSI-RS periodicity		Slots	1,2
	Co. Ho policulony		0.010	120 kHz SCS: 160 for CSI-RS
	CCL DC offeet		Cloto	resource 1,2 0 for CSI-RS resource 1,2
	CSI-RS offset		Slots	O for CSI-RS resource 1,2 ON
	Repetition QCL info			TCI state #1
	Type 1 QCL	SSB index		SSB #0
	information	QCL Type		Type C
TCI state #0	Type 2 QCL	SSB index		SSB #0
	information	QCL Type		Type D
				CSI-RS resource 1 from 'CSI-RS for
	Type 1 QCL	CSI-RS resource		tracking' configuration
TCL state #1	information	QCL Type		Type A
TCI state #1	Type 2 OCI	CSI-RS resource		CSI-RS resource 1 from 'CSI-RS for
	Type 2 QCL information			tracking' configuration
		QCL Type		Type D
Maximum number of feedback	f code block groups for	or ACK/NACK		1
Number of HARQ Pr	ocesses			10 for FR2.60-1 and 8 for FR2.120-1
K1 value				Specific to each UL-DL pattern

Maximum number o	f HARQ transmission	4			
HARQ ACK/NACK b	oundling	Multiplexed			
Redundancy version	n coding sequence	{0,2,3,1}			
TDD UL-DL pattern		60 kHz SCS: FR2.60-1 120 kHz SCS: FR2.120-1			
PDSCH & PDSCH [DMRS Precoding configuration	Single Panel Type I, Precoder index 0 per slot with Wideband granularity for Rank 2			
Symbols for all unus	sed 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	on	Static propagation condition No external noise sources are applied			
Antenna	1 layer CCs	1x2 or 1x4			
configuration	2 layers CCs	2x2 or 2x4			
Physical signals, ch	annels mapping and precoding	As specified in Annex B.4.1			
Note 1: PDSCH is scheduled only on full DL slots not containing SSB or TRS. Note 2: UE assumes that the TCI state for the PDSCH is identical to the TCI state applied for the PDCCH transmission. Note 3: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-2 [7] for tested channel bandwidth and subcarrier spacing.					

Table 7.5A.1-2: Number of PRBs in CORESET

SCS (kHz)	50 MHz	100 MHz	200 MHz	400 MHz
60	66	132	264	N.A
120	30	66	132	264

Table 7.5A.1-3: MCS indexes for indicated UE capabilities

Maximum number of PDSCH MIMO layers	Maximum modulation format (Note 1)	Scaling factor	MCS (Note 2)
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	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

Note 1: For the band(s) on which UE supporting "Maximum modulation format" of 8, the MCS index is derived from the rows with "Maximum modulation format" of 6.

Note 2: MCS Index is based on MCS index Table 1 defined in clause 5.1.3.1 of TS 38.214 [12].

Table 7.5A.1-4: SNR required to achieve 85% of peak throughput under AWGN conditions

MCS Index (Note 1)	SNR _{BB} (dB) for maximum number of PDSCH MIMO Layers = 1	SNR _{BB} (dB) for maximum number of PDSCH MIMO Layers = 2
13	6.2	9.0
14	7.2	9.9
15	8.2	10.9
16	8.7	11.6
17	10.1	13.2
18	10.7	13.7
19	11.7	14.7
20	12.7	15.6
21	13.6	16.5
22	14.8	17.6
23	15.6	18.6
24	16.9	19.7
25	18.3	21.2
26	19.3	22.3
27	20.5	23.3

Note 1: MCS Index is based on MCS index Table 1 defined in clause 5.1.3.1 of TS 38.214 [12].

8 CSI reporting requirements (Radiated requirements)

8.1 General

This clause includes radiated requirements for the reporting of channel state information (CSI).

8.1.1 Applicability of requirements

8.1.1.1 General

The minimum performance requirements are applicable to the FR2 operating bands defined in TS 38.101-2 [7] with F_{DL_high} not exceeding 40000 MHz.

The minimum performance requirements in Clause 8 are mandatory for UE supporting NR operation, except test cases listed in Clause 8.1.1.3, 8.1.1.4.

8.1.1.2 Applicability of requirements for different number of RX antenna ports

UE shall support 2 RX ports for different RF operating bands. The UE requirements applicability is defined in Table 8.1.1.2-1.

Table 8.1.1.2-1: Requirements applicability

Supported RX antenna ports	Test type	Test list
UE supports 2RX	CQI	All tests in Clause 8.2.2
antenna	PMI	All tests in Clause 8.3.2
	RI	All tests in Clause 8.4.2

8.1.1.3 Applicability of requirements for optional UE features

The performance requirements in Table 8.1.1.3-1 shall apply for UEs which support optional UE features only.

Table 8.1.1.3-1: Requirements applicability for optional UE features

UE feature/capability [14]	Test	type	Test list	Applicability notes
256QAM modulation scheme for PDSCH for FR2 (<i>pdsch-</i> 256QAM-FR2)	FR2 TDD	CQI	Clause 8.2.2.2.1.1 (Tests 3 and 4)	The test coverage can be considered fulfilled without executing of Test 1 and 2 from Clause 8.2.2.2.1.1 if UE passes Test 3 and 4 from Clause 8.2.2.2.1.1

8.1.1.4 Applicability of requirements for mandatory UE features with capability signalling

The performance requirements in Table 8.1.1.4-1 shall apply for UEs which support mandatory UE features with capability signalling only.

.

Table 8.1.1.4-1: Requirements applicability for mandatory features with UE capability signalling

UE feature/capability [14]	Test	type	Test list	Applicability notes
Supported maximum number of PDSCH MIMO layers (maxNumberMIMO-	FR2 TDD	CQI	Clause 8.2.2.2.1.1	The requirements apply only in case the PDSCH MIMO rank in the test case does not exceed UE
LayersPDSCH)		RI	Clause 8.4.2.2	PDSCH MIMO layers capability
Cupport of 1 port DTDC	FR2 TDD	CQI	Clause 8.2	
Support of 1 port PTRS (onePortsPTRS)		PMI	Clause 8.3	
(Olier Olisr TNS)		RI	Clause 8.4	

8.1.1.5 Applicability of Channel Quality Indicator (CQI) reporting requirements for CA

8.1.1.5.1 Applicability and test rules for different CA configurations and bandwidth combination sets

The performance requirement for CA CQI tests in clause 8.2A are defined independent of CA configurations and bandwidth combination sets specified in clasue 5.5A in TS 38.101-2 [7].

For UEs supporting multiple CA capabilities, test any one of the supported CA capabilities with largest aggregated CA bandwidth combination. The categorization of CA capability is specified in clasue 7.1.1.5.1.

For UEs supporting multiple CA configurations from the selected CA capability, test any one of the supported CA configurations with largest aggregated CA bandwidth combination. For simplicity, the CA configuration refers to combination of CA configuration and bandwidth combination set.

A single uplink CC is configured for all tests.

8.1.1.5.2 Test coverage for different number of componenet carriers

For CA CQI tests specified in clause 8.2A, among all supported CA capabilities, if corresponding CA tests with the largest number of CCs supported by the UE are tested, the test coverage can be considered fulfilled without executing the CA tests with less than the largest number of CCs supported by the UE.

8.1.2 Common test parameters

Parameters specified in Table 8.1.2-1 are applied for all test cases in this clause unless otherwise stated.

Table 8.1.2-1: Test parameters for CSI test cases

	Parameter	Unit	Value
PDSCH transmis	ssion scheme		Transmission
	SSION SCHEME		scheme 1
Duplex Mode		-	TDD
PTRS epre-Ration		-	0
Actual carrier configuration	Offset between Point A and the lowest usable subcarrier on this carrier (Note 3)	RBs	0
	Subcarrier spacing	kHz	120
	Cyclic prefix		Normal
	RB offset	RBs	0
DL BWP configuration #1	Number of contiguous PRB	PRBs	Maximum transmission bandwidth configuration as specified in clause 5.3.2 of TS 38.101-2 [7] for tested channel bandwidth and subcarrier spacing
Active DL BWP			1
Common	Physical Cell ID		0
serving cell	SSB position in burst		First SSB in Slot #0
parameters	SSB periodicity	ms	20
	Slots for PDCCH monitoring		Each slot
	Symbols with PDCCH Number of PDCCH candidates and aggregation levels		0,1 1/AL8
	DCI format	1	1_1
PDCCH configuration	PDCCH & PDCCH DMRS Precoding configuration		TCI state #1 Multi-path fading propagation conditions: Single Panel Type I, Random per slot with equal probability of each applicable i1, i2 combination, and with REG bundling granularity for number of Tx larger than 1 Static propagation
Additional PDCCH Configuration	Slots for PDCCH monitoring Symbols with PDCCH Number of PDCCH candidates		conditions: Single Panel Type I, Random precoder chosen from precoder index 0 and 2, selection updated per slot Each slot 0,1
for Aperiodic	and aggregation levels		1/AL8
Reporting	DCI format		0_1
(Note 4)	TCI state		TCI state #1

	T		I
	PDCCH & PDCCH DMRS Precoding configuration		Multi-path fading propagation conditions: Single Panel Type I, Random per slot with equal probability of each applicable i1, i2 combination, and with REG bundling granularity for number of Tx larger
			than 1
Cross carrier sch			Not configured
	Mapping type		Type A
	kO		0
	Starting symbol (S)		2
	Length (L)		12
	PDSCH aggregation factor		1
PDSCH	PRB bundling type		Static
configuration	PRB bundling size		2
	Resource allocation type		Type 0
	RBG size		Config2
	VRB-to-PRB mapping type		Non-interleaved
	VRB-to-PRB mapping interleaver		NI/A
	bundle size		N/A
	DMRS Type		Type 1
	Number of additional DMRS		1
	Transcr or additional Bivine		{1000} for Rank1
	DMPS ports indexes		{1000,1001} for
PDSCH DMRS	DMRS ports indexes		Rank2
	14		Rankz
configuration	Maximum number of OFDM symbols for DL front loaded DMRS		1
	Number of PDSCH DMRS CDM group(s) without data		2
	Frequency density (KPT-RS)		2
PTRS	Time density (<i>L_{PT-RS}</i>)		1
configuration	Resource Element Offset		2
	First subcarrier index in the PRB		0 for CSI-RS
	used for CSI-RS (k ₀)		resource 1,2,3,4
	E: . OEDM		4 for CSI-RS
	First OFDM symbol in the PRB		resource 1 and 3
	used for CSI-RS (Io)		8 for CSI-RS
			resource 2 and 4
	Number of CSL BS ports (V)		1 for CSI-RS
	Number of CSI-RS ports (X)		resource 1,2,3,4
	00117		No CDM for CSI-RS
	CDM Type		resource 1,2,3,4
			3 for CSI-RS
CSI-RS for	Density (ρ)		resource 1,2,3,4
			120kHz SCS: 160 for
tracking	CCL DC mariadiaity	-1-4	
	CSI-RS periodicity	slot	CSI-RS resource
			1,2,3,4
			120 kHz SCS:
			80 for CSI-RS
	CSI-RS offset	slot	resource 1 and 2
			81 for CSI-RS
			resource 3 and 4
			Start PRB 0
	Frequency Occupation		Number of PRB =
			BWP size
	QCL info		TCI state #0
	QOL IIIIO		
NZP CSI-RS	Francisco Occur ettera		Start PRB 0
for CSI	Frequency Occupation		Number of PRB =
acquisition			BWP size
aoquionion	QCL info		TCI state #1
			-

	1			Otrait DDD 0	
ZP CSI-RS for CSI acquisition	Frequency C	Occupation		Start PRB 0 Number of PRB = BWP size	
	First subcarr	ier index in the PRB		k ₀ =0 for CSI-RS	
	used for CSI	-110		resource 1,2 I ₀ = 8 for CSI-RS	
	First OFDM s	symbol in the PRB		resource 1	
	used for CSI			$I_0 = 9$ for CSI-RS	
				resource 2	
	Number of C	SI-RS ports (X)		1 for CSI-RS resource 1,2	
CSI-RS for	CDM Type			'No CDM' for CSI-RS	
beam refinement	ODIVI Type			resource 1,2 3 for CSI-RS	
reimement	Density (ρ)			resource 1,2	
				120 kHz SCS: 160	
	CSI-RS perio	odicity	Slots	for CSI-RS resource	
				1,2 0 for CSI-RS	
	CSI-RS offse	et	Slots	resource 1,2	
	Repetition			ON	
	QCL info	Loop: I		TCI state #1	
	Type 1 QCL	SSB index		SSB #0	
TOI	information	QCL Type		Type C	
TCI state #0	Type 2	SSB index		SSB #0	
	QCL information	QCL Type		Type D	
	Inionnation			CSI-RS resource 1	
	Type 1	CSI-RS resource		from 'CSI-RS for	
	QCL	CSI-RS lesouice		tracking'	
	information	001 7		configuration	
TCI state #1		QCL Type		Type A	
	Type 2			CSI-RS resource 1 from 'CSI-RS for	
	QCL QCL	CSI-RS resource		tracking'	
	information			configuration	
		QCL Type		Type D	
Number of HARO				8	
HARQ ACK/NAC Redundancy ver		auonco		Multiplexed {0,2,3,1}	
Reduitdancy ver	sion coding set	quence		For FR2.120-1:	
				3 if mod $(i.5) = 0$,	
				6 if $mod(i,5) = 2$	
144				For FR2.120-2:	
K1 value (PDSCH-to-HAR	O timina india	ator)		11 if $mod(i,8) = 0$, 7]if $mod(i,8) = 4$,	
(FD3CH-t0-HAN	Q-IIIIIIIg-IIIulca	3101)		6]if $mod(i,8) = 4$,	
				where i is slot index	
				per radio fame with	
				values 0-79.	
				OP.1 FDD as defined in Annex	
				A.5.1.1	
Symbols for unus	sed REs			OP.1 TDD as	
				defined in Annex	
				A.5.2.1	
Physical signals,	As specified in Annex B.4.1				
	r slots which are not				
full DL. Note 2: UE assumes that the TCI state for the PDSCH is identical to the TCI state					
	applied for the PDCCH transmission.				
from TS 38.101-2 [7] for tested channel bandwidth and subcarrier spacing.					
		onfiguration for aperio porting configured.	dic reporting	is only for test cases	
······································					

8.2 Reporting of Channel Quality Indicator (CQI)

8.2.1 1RX requirements

(Void)

8.2.2 2RX requirements

8.2.2.1 FDD

(Void)

8.2.2.2 TDD

8.2.2.2.1 CQI reporting under AWGN conditions

The reporting accuracy of the channel quality indicator (CQI) under frequency non-selective conditions is determined by the reporting variance and the BLER performance using the transport format indicated by the reported CQI median. The purpose is to verify that the reported CQI values are in accordance with the CQI definition given in TS 38.214 [12]. To account for sensitivity of the input SNR the reporting definition is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

8.2.2.2.1.1 Minimum requirement for periodic CQI reporting

For the parameters specified in Table 8.2.2.2.1.1-1, and using the downlink physical channels specified in Annex C.5.1, the minimum requirements are specified by the following:

- a) the reported CQI value shall be in the range of ± 1 of the reported median more than 90% of the time;
- b) if the PDSCH BLER using the transport format indicated by median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (median CQI + 1) shall be greater than 0.1. If the PDSCH BLER using the transport format indicated by the median CQI is greater than 0.1, the BLER using transport format indicated by (median CQI 1) shall be less than or equal to 0.1.

Table 8.2.2.2.1.1-1 Test parameters

	Parameter	Unit	Test 1	Test 2
Bandwidth		MHz		00
Subcarrier sp		kHz		20
Duplex Mode				DD
TDD Slot Cor	nfiguration			Annex A.1.3
SNR _{BB}		dB	8 9	14 15
Propagation of	channel			VGN
Antenna conf	iguration			tatic channel n Annex B.1
Beamforming	Model			ed in Annex .4.1
	CSI-RS resource Type		Pei	riodic
	Number of CSI-RS ports (X)			4
	CDM Type		FD-	CDM2
ZP CSI-RS	Density (ρ)			1
configuratio n	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)			8
	First OFDM symbol in the PRB used for CSI-RS (I ₀ , I ₁)			13
	CSI-RS periodicity and offset	slot	8	3/1
	CSI-RS resource Type		Pei	riodic
	Number of CSI-RS ports (X)			2
	CDM Type		fd-C	CDM2
NZP CSI-	Density (ρ)			1
RS for CSI	First subcarrier index in the			
acquisition	PRB used for CSI-RS (k ₀ , k ₁)			6
acquiomen.	First OFDM symbol in the PRB used for CSI-RS (I ₀ , I ₁)			13
	NZP CSI-RS-timeConfig	slot	,	3/1
	periodicity and offset	3101		
	CSI-IM resource Type		Pei	riodic
CSI-IM	CSI-IM RE pattern			1
configuratio	CSI-IM Resource Mapping		(8.	, 13)
n	(KCSI-IM, ICSI-IM)		(0,	,
	CSI-IM timeConfig	slot	8	3/1
	periodicity and offset			
ReportConfig	Туре			riodic
CQI-table				ble 1
reportQuantity				PMI-CQI
	onForChannelMeasurements			nfigured
	nForInterferenceMeasurements			nfigured
cqi-FormatInd				eband
pmi-FormatIn			Wid	eband
Sub-band Siz		RB		8
csi-Reporting				11111
	eriodicity and offset	slot		3/3
aperiodicTrigg				nfigured
	Codebook Type		typel-Si	nglePanel
	Codebook Mode			1
Codebook	(CodebookConfig-	1	Not co	nfigured
configuration	N1,CodebookConfig-N2)	1		•
	CodebookSubsetRestriction			0000
<u></u>	RI Restriction			J/A
Physical char	nnel for CSI report	1		CCH
ļ., .	CQI/RI/PMI delay	ms	8.	375
Maximum nur	mber of HARQ transmission			1
Measurement	t channel			ed in Table TBS.1-2

8.2.2.2.2 CQI reporting under fading conditions

8.2.2.2.2.1 Minimum requirement for wideband CQI reporting

The purpose of the requirements is to verify that the UE is tracking the channel variations and selecting the largest transport format possible according to the prevailing channel state for the frequency non-selective scheduling.

The reporting accuracy of CQI under frequency non-selective fading conditions is determined by the reporting variance, the relative increase of the throughput obtained when the transport format is indicated by the reported CQI compared to the throughput obtained when a fixed transport format is configured according to the reported median CQI, and a minimum BLER using the transport formats indicated by the reported CQI. To account for sensitivity of the input SNR the CQI reporting under frequency non-selective fading conditions is considered to be verified if the reporting accuracy is met for at least one of two SNR levels separated by an offset of 1 dB.

For the parameters specified in Table 8.2.2.2.2.1-1 and using the downlink physical channels specified in Annex C.5.1, the minimum requirements are specified by the following:

- a) a CQI index not in the set {median CQI -1, median CQI, median CQI +1} shall be reported at least α % of the time, where α % is specified in Table 8.2.2.2.2.1-2;
- b) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index and that obtained when transmitting a fixed transport format configured according to the wideband CQI median shall be ≥ γ, where γ is specified in Table 8.2.2.2.2.1-2;
- c) when transmitting the transport format indicated by each reported wideband CQI index, the average BLER for the indicated transport formats shall be greater or equal to 0.01.

Table 8.2.2.2.1-1 Test parameters

	Parameter	Unit	Tes	st 1	Tes	st 2	Tes	st 3	Te	st 4
Bandwidth		MHz		10	00				50	
Subcarrier spa	acing	kHz					20			
Duplex Mode							DD			
TDD Slot Con	figuration			1	FR2.	120-2	Annex	A.1.3	1 _	1
SNR _{BB}		dB						[21]		
Propagation of	channel						30-35			
Antenna confi						ULA	≺ 2 High			
Beamforming				ı	As spe			x B.4	.1	
	CSI-RS resource Type						iodic			
	Number of CSI-RS ports (X)						4			
7D 001 D0	CDM Type						DM2			
ZP CSI-RS	Density (ρ) First subcarrier index in the						1			
configuratio n	PRB used for CSI-RS (k ₀ , k ₁)					8	3			
	First OFDM symbol in the PRB									
	used for CSI-RS (I ₀ , I ₁)					1	3			
	CSI-RS	alat					/4			
	interval and offset	slot				8/				
	CSI-RS resource Type					Apei	riodic			
	Number of CSI-RS ports (X)						2			
	CDM Type						DM2			
NZP CSI-	Density (ρ)						1			
RS for CSI	First subcarrier index in the					(3			
acquisition	PRB used for CSI-RS (k ₀ , k ₁) First OFDM symbol in the PRB									
	used for CSI-RS (I ₀ , I ₁)		13							
	NZP CSI-RS-timeConfig	-1-4				1-4	<i>c</i>	_1		
	interval and offset	slot			r	Not cor	ntigure	a		
	aperiodicTriggeringOffset			0						
	CSI-IM resource Type		Aperiodic							
CSI-IM	CSI-IM RE pattern					•	1			
configuratio	CSI-IM Resource Mapping					(8,	13)			
n	(kcsi-im,lcsi-im) CSI-IM timeConfig		(5, 15)							
	interval and offset	slot			١	Not cor	nfigure	d		
ReportConfig						Apei	riodic			
CQI-table	71		Table 1 Table 2							
reportQuantity	/				C	ri-RI-F	МІ-СС)/		
timeRestrictio	nForChannelMeasurements				- 1	Vot cor	nfigure	d		
timeRestrictio	nForInterferenceMeasurements		Not configured							
cqi-FormatInd			Wideband							
pmi-FormatIn			Wideband							
Sub-band Siz		RB					3			
csi-Reporting						11111				
	eriodicity and offset	slot			<u> </u>	Not cor		d		
CSI request	port Slot Offset		1 in	slots	i, wher	e mod		1, oth	erwise	it is
reportTriggerS	Si70					equa	l to 0			
reportringger	JIEU		One	State	with on	e Asso	r ciated	Reno	rt	
CSI-Aperiodic	:TriggerStateList		Confi Asso	guration ciated	on Repor	t Confi	guratio	n con		
	O debeste		point	ers to	NZP C					
	Codebook Type				ty	pel-Sin	igiePai 1	nei		
Codobask	Codebook Mode						ı			
Codebook configuration	(CodebookConfig- N1,CodebookConfig-N2)				1	Vot cor	nfigure	d		
Comiguration	CodebookSubsetRestriction					000	001			
	RI Restriction						/A			
Physical chan	inel for CSI report		PUSCH							
, 2.22 0	CQI/RI/PMI delay	ms					375			
Maximum nur	nber of HARQ transmission						1			
-										

Macaurament abannal	As specified in Table	As specified in Table
Measurement channel	A.4-1, TBS.1-1	A.4-2, TBS.2-7

Table 8.2.2.2.1-2 Minimum requirements

	Test 1	Test 2	Test 3	Test 4
α[%]	2	2	[2]	[2]
γ	1.05	1.05	[1.05]	[1.05]

8.2A Reporting of Channel Quality Indicator (CQI) for CA

8.2A.1 General

This clause includes the requirements for the reporting of channel quality indicator (CQI) with the UE configured for CA. The purpose is to verify that the CQI is correctly reported in accordance with the CQI definition given in TS 38.214 [12] for each CC with multiple cells configured for periodic reporting.

8.2A.2 1RX requirements

(Void)

8.2A.3 2RX requirements

8.2A.3.1 CQI reporting definition under AWGN conditions

8.2A.3.1.1 Minimum requirement for periodic CQI reporting

For the CA CQI reporting test defined in Table 8.2A.3.1.1-4, the test requirements and the test parameters are defined as below.

For each CC, the test parameters are specified in Table 8.2A.3.1.1-1.

For CA with 2 DL CC, for the SNR configuration specified in Table 8.2A.3.1.1-2, and using the downlink physical channels specified in Annex C.5.1 on each CC, the difference between the wideband CQI indices of PCell and SCell reported shall be such that

wideband CQI_{PCell} – wideband $CQI_{SCell} \ge 2$

for more than 90% of the time.

For CA with 3 or more DL CC, for the SNR configuration specified in Table 8.2A.3.1.1-3, and using the downlink physical channels specified in Annex C.5.1 on each cell, the difference between the wideband CQI indices of PCell and SCell1 reported, and the difference between the wideband CQI indices of SCell1 and SCell2, 3... reported shall be such that

wideband CQI_{PCell} – wideband $CQI_{SCell1} \ge 2$

wideband CQI_{SCell1} – wideband $CQI_{SCell2, 3...} \ge 2$

for more than 90% of the time.

Table 8.2A.3.1.1-1: CA CQI reporting test parameters for each CC

	Parameter	Unit	Value
Subcarrier sp	acing	kHz	120
Duplex Mode			TDD
TDD Slot Cor	nfiguration		FR2.120-2 Annex A.1.3
Propagation of			AWGN
Antonno conf	iguration		1x2 with static channel
Antenna conf	iguration		specified in Annex B.1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		4
ZP CSI-RS	CDM Type		FD-CDM2
configuratio	Density (ρ)		1
n	First subcarrier index in the		8
''	PRB used for CSI-RS (k ₀ , k ₁)		0
	First OFDM symbol in the PRB		13
	used for CSI-RS (I ₀ , I ₁)		13
	CSI-RS periodicity and offset	slot	8/1
	CSI-RS resource Type		Periodic
	Number of CSI-RS ports (X)		1
	CDM Type		No CDM
NZP CSI-	Density (ρ)		1
RS for CSI	First subcarrier index in the		6
acquisition	PRB used for CSI-RS (k ₀ , k ₁)		Ŭ
	First OFDM symbol in the PRB		13
	used for CSI-RS (I ₀ , I ₁)		
	NZP CSI-RS-timeConfig	slot	8/1
	periodicity and offset		
	CSI-IM resource Type		Periodic
CSI-IM	CSI-IM RE pattern		1
configuratio	CSI-IM Resource Mapping		(8, 13)
n	(KCSI-IM, ICSI-IM)		· · · ·
	CSI-IM timeConfig	slot	8/1
PoportConfig	periodicity and offset		Doriodio
ReportConfig CQI-table	туре		Periodic Table 1
reportQuantit	,		cri-RI-PMI-CQI
timoPostrictio	y nForChannelMeasurements		Not configured
	nForInterferenceMeasurements		Not configured
cqi-FormatInd			Wideband
pmi-Formatin			Wideband
pini-i Unnatin	uicatoi		8 for 50MHz, 100MHz,
Sub-band Siz	r _e	RB	16 for 200MHz,
Oub band Oiz		I ND	32 for 400MHz
csi-Reporting	Band		111111111
CSI-Report periodicity and offset		slot	8/3
aperiodicTrig		5.50	Not configured
	nnel for CSI report		PUCCH
CQI/RI/PMI d		ms	8.375
	mber of HARQ transmission		1
			Derived as per section
Measuremen	t channel		5.1.3.2 of TS 38.214 [12]
L			

Table 8.2A.3.1.1-2: SNR configurations for 2 DL CA

Parameter	PCell	SCell
SNR (dB)	10.0	4.0

Table 8.2A.3.1.1-3: SNR configurations for 3 or more DL CA

Parameter	PCell	SCell1	SCell2, 3
SNR (dB)	12.0	6.0	0.0

Table 8.2A.3.1.1-4: List of CA CQI reporting test

Test number		CA duplex mode and SCS combination
1		TDD 120 kHz + TDD 120 kHz
Note 1: The applicability of requirements for different CA configuration		pplicability of requirements for different CA configurations and
bandwidth combination sets is defined in 8.1.1.5.1.		

8.3 Reporting of Precoding Matrix Indicator (PMI)

The minimum performance requirements of PMI reporting are defined based on the precoding gain, expressed as the relative increase in throughput when the transmitter is configured according to the UE reports compared to the case when the transmitter is using random precoding, respectively. When the transmitter uses random precoding, for each PDSCH allocation a precoder is randomly generated and applied to the PDSCH. A fixed transport format (FRC) is configured for all requirements.

The requirements for transmission mode 1 with 2TX and higher layer parameter *codebookType* set to 'typeI-SinglePanel' are specified in terms of the ratio

$$\gamma = \frac{t_{ue}}{t_{rnd}}$$

In the definition of γ , for 2TX PMI requirements, t_{ue} is 90 % of the maximum throughput obtained at SNR_{ue} using the precoders configured according to the UE reports, and t_{rnd} is the throughput measured at SNR_{ue} with random precoding.

8.3.1 1RX requirements

(Void)

8.3.2 2RX requirements

8.3.2.1 FDD

(Void)

8.3.2.2 TDD

8.3.2.2.1 Single PMI with 2TX Typel-SinglePanel Codebook

For the parameters specified in Table 8.3.2.2.1-1, and using the downlink physical channels specified in Annex C.5.1, the minimum requirements are specified in Table 8.3.2.2.1-2.

Table 8.3.2.2.1-1: Test parameters (single layer)

Pa	rameter	Unit	Test 1	Test 2
Bandwidth		MHz	100	100
Subcarrier spacing	ng	kHz	120	120
			FR2.120-2 as	FR2.120-1 as
TDD DL-UL conf	iguration		specified in	specified in
Propagation char	nnel		Annex A.1.3 TDLA30-35	Annex A.1.3 TDLA30-35
Antenna configur			2 x 2 ULA Low	2 x 2 ULA Low
Ţ.			As specified in	As specified in
Beamforming Mo			Annex B.4.1	Annex B.4.1
	CSI-RS resource Type		Periodic	Periodic
	Number of CSI-RS ports (X)		4	4
	CDM Type		FD-CDM2	FD-CDM2
	Density (ρ)		1	1
ZP CSI-RS configuration	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 4, (8,-)	Row 4, (8,-)
	First OFDM symbol in the PRB used for CSI-RS (I ₀ , I ₁)		(13,-)	(13,-)
	CSI-RS interval and offset	slot	8/1	5/1
	CSI-RS resource Type		Aperiodic	Aperiodic
	Number of CSI-RS ports (X)		2	2
	CDM Type		FD-CDM2	FD-CDM2
	Density (ρ)		1	1
NZP CSI-RS for CSI acquisition	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 3, (6,-)	Row 3, (6,-)
	First OFDM symbol in the PRB used for CSI-RS (I ₀ , I ₁)		(13,-)	(13,-)
	CSI-RS interval and offset	slot	Not configured	Not configured
	aperiodicTriggering Offset		0	0
	CSI-IM resource Type		Aperiodic	Aperiodic
	CSI-IM RE pattern		Pattern 1	Pattern 1
CSI-IM configuration	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(8,13)	(8,13)
	CSI-IM timeConfig interval and offset	slot	Not configured	Not configured
ReportConfigTyp	e		Aperiodic	Aperiodic
CQI-table			Table 1	Table 1
reportQuantity timeRestrictionForChannelMeasureme			cri-RI-PMI-CQI	cri-RI-PMI-CQI
nts			Not configured	Not configured
ements	orInterferenceMeasur		Not configured	Not configured
cqi-FormatIndica			Wideband	Wideband
pmi-FormatIndica	ator		Wideband	Wideband

Sub-band Size		RB	8	8
csi-ReportingBar	nd		111111111	111111111
CSI-Report inter	val and offset	slot	Not configured	Not configured
Aperiodic Report	t Slot Offset		6	8
CSI request			1 in slots i, where mod(i, 8) = 1, otherwise it is equal to 0	1 in slots i, where mod(i, 5) = 1, otherwise it is equal to 0
reportTriggerSize	е		1	1
	CSI-AperiodicTriggerStateList		One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM	One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
	Codebook Type		typel- SinglePanel	typel- SinglePanel
	Codebook Mode		1	1
Codebook configuration	(CodebookConfig- N1,CodebookConfi g-N2)		N/A	N/A
	CodebookSubsetR estriction		001111	001111
	RI Restriction		N/A	N/A
Physical channel for CSI report			PUSCH	PUSCH
CQI/RI/PMI delay		ms	1.375	1.75
Maximum number transmission	er of HARQ		4	4
Measurement ch	annel		R.PDSCH.5-8.1 TDD	R.PDSCH.5- 7.1 TDD

Note 1: For random precoder selection, the precoder shall be updated in each slot (0.125 ms granularity).

Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-4)], this reported PMI cannot be applied at the gNB downlink before slot#(n+4)].

Note 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3.

Table 8.3.2.2.1-2: Minimum requirement

Parameter	Test 1	Test 2
γ	1.05	1.05

8.4 Reporting of Rank Indicator (RI)

The purpose of this test is to verify that the reported rank indicator accurately represents the channel rank. The accuracy of RI reporting is determined by the relative increase of the throughput obtained when transmitting based on the reported rank compared to the case for which a fixed rank is used for transmission.

8.4.1 1RX requirements

(Void)

8.4.2 2RX requirements

8.4.2.1 FDD

(Void)

8.4.2.2 TDD

The minimum performance requirement in Table 8.4.2.2-2 is defined as

- a) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be $\geq \gamma_1$;
- b) The ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 2 shall be $\geq \gamma_2$;

For the parameters specified in Table 8.4.2.2-1, and using the downlink physical channels specified in Annex C.5.1, the minimum requirements are specified in Table 8.4.2.2-2.

Table 8.4.2.2-1: RI Test (TDD)

Parameter		Unit	Test 1	Test 2	Test 3
Bandwidth	Bandwidth		100	100	100
	Subcarrier spacing		120	120	120
Duplex Mode			TDD	TDD	TDD
TDD Slot Cor	nfiguration		FR1.120-2	FR1.120-2	FR1.120-2
SNR		dB	0	16	16
Propagation (TDLA30-35	TDLA30-35	TDLA30-35
Antenna conf	iguration		ULA Low 2x2	ULA Low 2x2	XP High 2x2
Beamforming	Model		As defined in Annex B.4.1	As defined in Annex B.4.1	As defined in Annex B.4.1
	CSI-RS resource Type		Periodic	Periodic	Periodic
	Number of CSI-RS ports (X)		4	4	4
	CDM Type		FD-CDM2	FD-CDM2	FD-CDM2
ZP CSI-RS	Density (ρ)		1	1	1
configuratio n	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 4, (8,-)	Row 4, (8,-)	Row 4, (8,-)
	First OFDM symbol in the PRB used for CSI-RS (I ₀ , I ₁)		(13,-)	(13,-)	(13,-)
	CSI-RS	1.	8/1	8/1	8/1
	interval and offset	slot	5	<u>.</u>	5 , 1
	CSI-RS resource Type		Aperiodic	Aperiodic	Aperiodic
	Number of CSI-RS ports (X)		2	2	2
	CDM Type		FD-CDM2	FD-CDM2	FD-CDM2
NZP CSI-	Density (ρ)		1	1	1
RS for CSI acquisition	First subcarrier index in the PRB used for CSI-RS (k ₀ , k ₁)		Row 3 (6,-)	Row 3 (6,-)	Row 3 (6,-)
aoquioition	First OFDM symbol in the PRB used for CSI-RS (I ₀ , I ₁)		(13,-)	(13,-)	(13,-)
	NZP CSI-RS-timeConfig	slot	Not configured	Not	Not
	interval and offset	3101		configured	configured
	aperiodicTriggeringOffset		0	0	0
	CSI-IM resource Type		Periodic	Periodic	Periodic
CSI-IM	CSI-IM RE pattern		Pattern 1	Pattern 1	Pattern 1
configuratio n	CSI-IM Resource Mapping (kcsi-im,lcsi-im)		(8,13)	(8,13)	(8,13)
	CSI-IM timeConfig interval and offset	slot	Not configured	Not configured	Not configured
ReportConfig			Aperiodic	Aperiodic	Aperiodic
CQI-table	туре		Table 1	Table 1	Table 1
reportQuantit	у		cri-RI-PMI-CQI	cri-RI-PMI- CQI	cri-RI-PMI- CQI
timeRestriction	onForChannelMeasurements		not configured	not configured	not configured
timeRestriction	onForInterferenceMeasurements		not configured	not configured	not configured
cqi-FormatInd	cqi-FormatIndicator		Wideband	Wideband	Wideband
	pmi-FormatIndicator		Wideband	Wideband	Wideband
Sub-band Size		RB	8	8	8
csi-ReportingBand			111111111	111111111	111111111
CSI-Report interval and offset		slot	Not configured	Not configured	Not configured
Aperiodic Re	port Slot Offset		7	7	7
CSI request			1 in slots i, where mod(i, 8) = 1,	1 in slots i, where mod(i, 8) = 1,	1 in slots i, where mod(i, 8) = 1,
			otherwise it is equal to 0	otherwise it is equal to 0	otherwise it is equal to 0
reportTrigger	Size		1	1	1

CSI-Aperiodic	TriggerStateList		One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM	One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM	One State with one Associated Report Configuration Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM
	Codebook Type		typel- SinglePanel	typel- SinglePanel	typel- SinglePanel
	Codebook Mode (CodebookConfig- N1,CodebookConfig-N2)		1	1	1
Codebook			N/A	N/A	N/A
configuration CodebookSubsetRestriction			010000 for fixed rank 2, 010011 for following rank	000011 for fixed rank 1, 010011 for following rank	000011 for fixed rank 1, 010011 for following rank
RI Restriction			N/A	N/A	N/A
Physical channel for CSI report			PUSCH	PUSCH	PUSCH
CQI/RI/PMI delay		ms	1.375	1.375	1.375
Maximum number of HARQ transmission			1	1	1
RI Configuration			Fixed RI = 2 and follow RI	Fixed RI = 1 and follow RI	Fixed RI = 1 and follow RI
NOTE 1: Measurements channels are specified in Table A 4.1 TPS 1.1 is used for Pank 1 case. TPS 1.2					

NOTE 1: Measurements channels are specified in Table A.4-1. TBS.1-1 is used for Rank 1 case. TBS.1-2 is used for Rank 2 case.

Table 8.4.2.2-2: Minimum requirement (TDD)

	Test 1	Test 2	Test 3
24	N/A	1.05	1.05
72	1.0	N/A	N/A

9 Demodulation performance requirements for interworking

9.1 General

This clause covers the UE demodulation performance requirements for EN-DC, NE-DC, inter-band NR-DC between FR1 and FR2, and inter-band NR CA between FR1 and FR2.

9.1.1 Applicability of requirements

The following applicability rules are specified for demodulation performance requirements for interworking:

- For UEs supporting both SA and NSA,
 - The performance requirements specified in Clause 5 will be verified only for SA except for the sustained downlink data rate test specified in Clause 5.5 and 5.5A.
 - The performance requirements specified in Clause 7 will be verified only for SA except for the sustained downlink data rate test specified in Clause 7.5 and 7.5A.
 - The sustained downlink data rate tests specified in Clauses 5.5, 5.5A and 7.5, 7.5A for SA and in Clause 9.4B for NSA are verified separately.

- The FR1 EN-DC test cases with the NR TDD DL-UL configurations which are not aligned with LTE's can be tested on the corresponding EN-DC band combinations where UE supports simultaneous transmission and reception.
- For UEs supporting NR FR1 CA and/or NR CA including FR1 and FR2, the requirements applicability is specified in Table 9.1.1-1.

Table 9.1.1-1: Requirements applicability for UEs supporting NR FR2 CA and NR CA including FR1 and FR2

Supported scenarios	Requirements
NR FR2 CA	Clause 7.5A
NR CA including FR1 and FR2	Clause 9.4A.1
Both NR FR2 CA and NR CA including FR1 and FR2	Clause 7.5A

- For UEs supporting EN-DC including FR2 and/or EN-DC including FR1 and FR2, the requirements applicability is specified in Table 9.1.1-2.

Table 9.1.1-2: Requirements applicability for UEs supporting EN-DC including FR2 and EN-DC including FR1 and FR2

Supported scenarios	SDR requirements	PDSCH requirements	PDCCH requirements
EN-DC including FR2	Clause 9.4B.1.2	Clause 9.2B.1.2	Clause 9.3B.1.2
EN-DC including FR1 and FR2	Clause 9.4B.1.3	Clause 9.2B.1.3	Clause 9.3B.1.3
Both EN-DC including FR2 and EN-DC including FR1 and FR2	Clause 9.4B.1.2	Clause 9.2B.1.2	Clause 9.3B.1.2

- For UEs supporting NR-DC including FR1 and FR2, if the FR2 requirements in Clause 7.2 and Clause 7.3 are tested, the test coverage can be considered fulfilled without executing requirements in Clause 9.2B.2 and Clause 9.3B.2.
- For UEs supporting NR-DC between FR1 and FR2, if requirements in Clause 9.4A.1 are tested under same or higher data rate as in Clause 9.4B.2, the test coverage can be considered fulfilled without executing the requirements in Clause 9.4B.2.
- For UEs supporting NE-DC and EN-DC, the test coverage of demodulation performance requirements can be considered fulfilled, if the demodulation requirements in Clause 5 and Clause 9.4B.1 are executed for UE under test in the standalone mode.
- For UEs supporting NE-DC and not supporting EN-DC, the test coverage of demodulation performance requirements can be considered fulfilled, if the demodulation requirements in Clause 5 and Clause 9.4B.3 are executed for UE under test.
- For UEs supporting NGEN-DC, the test coverage of demodulation performance requirements can be considered fulfilled, if the demodulation requirements in Clause 5 and Clause 9.4B.1 are executed for UE under test.
- For UEs supporting FR1 intra-band contiguous and non-contiguous EN-DC, the requirements applicability is specified in Table 9.1.1-3.

Table 9.1.1-3: Requirements applicability for UE supporting FR1 intra-band and inter-band EN-DC

	Inter-band	UE indicates	UE does not indicate
	scenarios are not	"interBandContiguousMRDC"	"interBandContiguousMRDC"
	supported	(Note 1, Note 2)	(Note 1, Note 3)
Intra-band	N/A	Clause 9.5B.1.1 is executed for	Clause 9.5B.1.2 is executed for
scenarios are not		inter-band EN-DC scenarios	inter-band EN-DC scenarios
supported			
UE does not	Clause 9.5B.1.1 is	Clause 9.5B.1.1 is executed for	Clause 9.5B.1.1 is only executed
indicate	only executed for	both intra-band and inter-band	for intra-band EN-DC scenarios
"intraBandENDC-	intra-band EN-DC	EN-DC scenarios	
Support" or UE	scenarios		
indicates "both" in			
"intraBandENDC-			
Support" (Note 4)			
UE indicates "non-	Clause 9.5B.1.2 is	Clause 9.5B.1.1 is executed for	Clause 9.5B.1.2 is executed for
contiguous" in	only executed for	inter-band EN-DC scenarios	both intra-band and inter-band
"intraBandENDC-	intra-band EN-DC		EN-DC scenarios
Support" (Note 5)	scenarios		

Note 1: Requirements are applicable to intra-band scenarios and only inter-band scenarios from Table 5.5B.4.1-1 of TS 38.101-3 [8] for which Note 4 is applied.

Note 2: TBD.

Note 3: UE supports intra-band non-contiguous EN-DC requirements for supported inter-band EN-DC combinations.

Note 4: UE supports intra-band contiguous EN-DC, or both intra-band contiguous and non-contiguous EN-DC for supported intra-band EN-DC combinations.

Note 5: UE supports only intra-band non-contiguous EN-DC for supported intra-band EN-DC combinations.

9.1.1.1 Applicability of requirements for optional UE features

Table 9.1.1.1-1: Void

The applicability rule defined in Clause 5.1.1.3 shall be applied for performance requirements in Clauses 9.2B.1.1 and 9.4B.1.1.

The applicability rule defined in Clause 7.1.1.3 shall be applied for performance requirements in Clauses 9.2B.1.2, 9.4A.1, 9.4B.1.2 and 9.4B.1.3.

9.1.1.2 Applicability of requirements for mandatory UE features with capability signalling

The applicability rule defined in Clause 5.1.1.4 shall be applied for performance requirements in Clauses 9.2B.1.1 and 9.4B.1.1.

The applicability rule defined in Clause 7.1.1.4 shall be applied for performance requirements in Clauses 9.2B.1.2, 9.4A.1, 9.4B.1.2 and 9.4B.1.3.

9.1.2 E-UTRA Cell setup

This sub-clause provides the parameters for E-UTRA cell during the demodulation performance test for EN-DC unless otherwise stated. For EN-DC with multiple E-UTRA carriers or bands, randomly selected one carrier or band can be used as E-UTRA Pcell for the connection setup unless otherwise stated.

9.1.2.1 FDD

The parameters specified in Table 9.1.2.1-1 and Table 9.1.2.1-2 are used to setup E-UTRA cell. One of test setup in Table 9.1.2.1-2 will be selected for the E-UTRA Cell depending on the maximum bandwidth of an E-UTRA carrier for all the EN-DC band combinations supported by the UE.

The measurement channels in Table 9.1.2.1-2 and OCNG pattern OP.1 FDD are specified in TS 36.101 [4]. The physical channel setup with downlink power allocation is according to Annex C.3.2 of TS 36.101 [4].

Table 9.1.2.1-1: Common Test Parameters (FDD)

Parameter	Unit	Value
Cyclic prefix		Normal
Physical Cell ID		0
Number of PDCCH symbols	symbols	1
PHICH Ng (Note 1)		1
PHICH duration		Normal
Number of HARQ processes per component carrier	Processes	8
Maximum number of HARQ transmission		4
Redundancy version coding sequence		{0,0,1,2} for 64QAM
Propagation condition		Static propagation condition No external noise sources are applied
Transmission mode		1
Transmission time difference between E- UTRA cell and NR cell(s)	μs	0
Antenna configuration		All NR cells are in FR1: 1x2 Any NR cell is in FR2: 1 Tx ^{Note 1}
Codebook subset restriction		10
Symbols for all unused REs		OCNG in Annex A.5

Note 1: As the link can be provided over the air, the UE Rx antenna configuration is not relevant for the test configuration and has no impact on the test implementation.

Table 9.1.2.1-2: Specific Test Parameters (FDD [64QAM])

Test setup	Bandwidth (MHz)		ownlir power cation	•
-	,	$ ho_{\scriptscriptstyle A}$	$ ho_{\scriptscriptstyle B}$	σ
1	5	0	0	0
2	10	0	0	0
3	15	0	0	0
4	20	0	0	0

9.1.2.2 TDD

The parameters specified in Table 9.1.2.2-1 and Table 9.1.2.2-2 are used to setup an E-UTRA cell. One of test setup in Table 9.1.2.2-2 will be selected for the E-UTRA Cell depending on the maximum bandwidth of an E-UTRA carrier for all the EN-DC band combinations supported by the UE.

The measurement channels in Table 9.1.2.2-2 and OCNG pattern OP.1 TDD are specified in TS 36.101 [4]. The physical channel setup with downlink power allocation is according to Annex C.3.2 of TS 36.101 [4].

Table 9.1.2.2-1: Common Test Parameters (TDD)

Parameter	Unit	Value
UL DL configuration		2 (Note1)
Special subframe configuration		7
Number of PDCCH symbols	symbols	1
PHICH Ng (Note 3)		1
PHICH duration		Normal
Cyclic prefix		Normal
Cell ID		0
Maximum number of HARQ transmission		4
Redundancy version coding sequence		{0,0,1,2} for 64QAM
Propagation condition		Static propagation condition No external noise sources are applied
Transmission mode		1
Transmission time difference between E- UTRA cell and NR cell(s)	μs	0
Antenna configuration		All NR cells are in FR1: 1x2 Any NR cell is in FR2: 1 Tx ^{Note 2}
Codebook subset restriction		10
Symbols for all unused REs		OCNG in Annex A.5

NOTE 1: The start of transmission of LTE frame is delayed by 2 LTE subframes with respect to the start of transmission of NR frame when TDD-TDD EN-DC configuration is configured during the test.

NOTE 2: As the link can be provided over the air, the UE Rx antenna configuration is not relevant for the test configuration and has no impact on the test implementation.

Table 9.1.2.2-2: Specific Test Parameters (FDD 64QAM)

Test	Bandwidth		nlink p cation	
setup	(MHz)	$ ho_{\scriptscriptstyle A}$	$ ho_{\scriptscriptstyle B}$	٥
1	10	0	0	0
2	15	0	0	0
3	20	0	0	0

9.2 PDSCH Demodulation

9.2A PDSCH demodulation for CA

9.2A.1 NR CA between FR1 and FR2

(Void)

9.2B PDSCH demodulation for DC

9.2B.1 EN-DC

9.2B.1.1 EN-DC within FR1

9.2B.1.1.1 PDSCH

The test setup for E-UTRA PCell is specified in Clause 9.1.2. The NR PDSCH demodulation performance requirements for NR are specified in Clause 5.2. During the test, only the PDSCH performance on the NR cell(s) shall be verified.

9.2B.1.2 EN-DC including FR2 NR carrier only

9.2B.1.2.1 PDSCH

The test setup for E-UTRA PCell is specified in Clause 9.1.2. The NR PDSCH demodulation performance requirements for NR are specified in Clause 7.2. During the test, only the PDSCH performance on the NR cell(s) on FR2 carriers shall be verified.

9.2B.1.3 EN-DC including FR1 and FR2 NR carriers

The test setup for E-UTRA PCell is specified in Clause 9.1.2. The NR PDSCH demodulation performance requirements for NR are specified in Clause 9.2B.1.1 and Clause 9.2B.1.2. During the test, only the PDSCH performance on the NR cell(s) on FR2 carriers shall be verified.

9.2B.2 NR DC between FR1 and FR2

The test setup for FR1 PCell is specified in Table 5.5A-1 with antenna configuration 1x2. The PDSCH demodulation performance requirements for NR FR2 cell(s) are specified in Clause 7.2. During the test, only the PDSCH performance on FR2 NR cell(s) shall be verified.

9.3 PDCCH demodulation

9.3A PDCCH demodulation for CA

9.3A.1 NR CA between FR1 and FR2

(Void)

9.3B PDCCH demodulation for DC

9.3B.1 EN-DC

9.3B.1.1 EN-DC within FR1

9.3B.1.1.1 PDCCH

The test setup for E-UTRA PCell is specified in Clause 9.1.2. The NR PDCCH demodulation performance requirements for NR are specified in Clause 5.3. During the test, only the PDCCH performance on the single NR cell shall be verified.

9.3B.1.2 EN-DC including FR2 NR carrier only

9.3B.1.2.1 PDCCH

The test setup for E-UTRA PCell is specified in Clause 9.1.2. The NR PDCCH demodulation performance requirements are specified in Clause 7.3. During the test, only the PDCCH performance on the single NR cell shall be verified.

9.3B.1.3 EN-DC including FR1 and FR2 NR carriers

The test setup for E-UTRA PCell is specified in Clause 9.1.2. The NR PDCCH demodulation performance requirements are specified in Clause 9.3B.1.1 and Clause 9.3B.1.2. During the test, only the PDCCH performance on the NR cell(s) on FR2 carriers shall be verified.

9.3B.2 NR DC between FR1 and FR2

The test setup for FR1 PCell is specified in Table 5.5A-1 with antenna configuration 1x2. The PDCCH demodulation performance requirements for NR FR2 cell are specified in Clause 7.3. During the test, only the PDCCH performance on FR2 NR cell shall be verified.

9.4 Void

9.4A SDR test for CA

9.4A.1 NR CA between FR1 and FR2

The Sustained Data Rate (SDR) requirements in this clause are applicable to the NR CA between FR1 and FR2 NR carriers.

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 conditions and the required success rate of delivered TB by Layer 1 to meet the sustained data rate requirement.

The test parameters are determined by the following procedure:

- Step 1: Calculate the NR FR1 data rate for CA bandwidth combinations, using a procedure from clause 4.1.2 of TS 38.306 [14], for all supported CA configurations and set of per NR component carrier (CC) UE capabilities among all supported UE capabilities:
 - Set of per NR CC UE capabilities includes a channel bandwidth, subcarrier spacing, number of PDSCH MIMO layers, modulation format and scaling factor as defined in clause 4.1.2 of TS 38.306 [14].
- Step 2: Calculate the NR FR2 data rate for CA bandwidth combinations, using a procedure from Clause 7.5A, for all supported CA configurations and set of per NR component carrier (CC) UE capabilities among all supported UE capabilities:
 - Set of per NR CC UE capabilities includes a channel bandwidth, subcarrier spacing, number of PDSCH MIMO layers, modulation format and scaling factor as defined in clause 4.1.2 of TS 38.306 [14].
- Step 3: Select the CA bandwidth combination among all supported CA configurations that achieves maximum total data rate in steps 1 and 2 among all UE capabilities:
 - When there are multiple sets of CA bandwidth combinations and UE capabilities with the same largest data rate, select a single set with the smallest aggregated channel bandwidth.
- Step 4: For each NR FR2 CC in the selected CA bandwidth combination, use MCS determined in step 2 for that CA bandwidth combination based on test parameters and indicated UE capabilities.

The test setup for NR FR1 PCell is specified in Clause 5.5A. The NR FR2 SDR tests setup is specified in Clause 7.5A. During the test, only the PDSCH performance on the NR cell(s) on FR2 carriers is verified and only NR FR1 PCell is activated from all FR1 CCs for the tested CA bandwidth combination.

The TB success rate shall be higher than 85% when NR FR2 PDSCH is scheduled with MCS defined for the selected CA bandwidth combination and with the downlink physical channel setup according to Annex C.3.1.

9.4B SDR test for DC

9.4B.1 EN-DC

< Editor note: which NR SDR test case(s) will be selected for EN-DC test need FFS.>

9.4B.1.1 EN-DC within FR1

9.4B.1.1.1 SDR test

The Sustained Data Rate (SDR) requirements in this clause are applicable to the EN-DC within FR1.

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.

The test parameters are determined by the following procedure:

- Select one EN-DC bandwidth combination among all supported EN-DC 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 NR 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].
 - Set of per E-UTRA CC UE capabilities includes channel bandwidth, number of PDSCH MIMO layers and modulation format in accordance with clause 4.1.2 of TS 38.306 [14].
 - When there are multiple sets of EN-DC bandwidth combinations and UE capabilities with same largest data rate, select one among sets with the smallest aggregated channel bandwidth.
- For each NR FR1 CC in EN-DC bandwidth combination, use Table 5.5A-5 in Clause 5.5A to determine MCS based on test parameters and indicated UE capabilities.
- For each E-UTRA CC in EN-DC bandwidth combination, use Table 9.4B.1.1.1-2 and Table 9.4B.1.1.1-3 to determine FRC based on test parameters and indicated UE capabilities.

The test setup for E-UTRA Pcell is specified in Clause 9.1.2 and Table 9.4B.1.1.1-1. The NR SDR tests setup is specified in Clause 5.5A. During the test, the PDSCH performance on both the NR cell(s) and LTE cell(s) shall be verified.

The TB success rate shall be higher than 85% when NR PDSCH is scheduled with MCS defined for the selected EN-DC bandwidth combination and with the downlink physical channel setup according to Annex C.3.1 and when E-UTRA PDSCH is scheduled with FRC defined for the selected EN-DC bandwidth combination and with the downlink physical channel setup according to Annex C.3.2 from TS 36.101 [4]. The TB success rate of delivered PDCP SDU(s) by Layer2 is defined according to the different DRB type: Split bearer, MCG or SCG bearer.

For the configuration of DRB type of Split bearer, the TB success rate across CGs is defined as TB success rate = 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. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blocks across all the CGs used for DC transmission or reception.

- For the configuration of DRB type of MCG or SCG bearer, the TB success rate across CGs is defined as TB success rate = 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 DL_correct_rx is the number of correctly received DL transport blocks. All the above numbers of transmitted, retransmitted or correctly received DL transport blocks are calculated as the sum of the numbers of DL transport blocks per CG used for DC.

Table 9.4B.1.1.1-1: Additional test setup for E-UTRA CC

Table 9.4B.1.1	.1-2: E-UTRA	FRC for SDR	test (FDD)

Parameter	Unit	Value
Inter-TTI Distance		1
Number of OFDM		
symbols for PDCCH per	OFDM symbols	1
component carrier		
Cross carrier scheduling		Not configured
Propagation condition		Static propagation condition
1 Topagation condition		No external noise sources are applied
$\hat{E}_{\scriptscriptstyle s}$ at antenna port	dBm/15kHz	-85
Antonno configuration	2 layer CC	2x2 or 2x4
Antenna configuration	4 layer CC	4x4
Codebook subset	2 layer CC	10
restriction	4 layer CC	1000
Downlink power	2 layer CC	$\rho_A = -3$ dB, $\rho_B = -3$ dB, $\sigma = 0$ dB
allocation	4 layer CC	$\rho_A = -6$ dB, $\rho_B = -6$ dB, $\sigma = 3$ dB

MIMO lover	Bandwidth	Reference channel					
MIMO layer	Danuwium	64QAM	256QAM	1024QAM			
	5	R.PDSCH.4-1.1 FDD	R.PDSCH.4-3.1 FDD	R.PDSCH.4-5.1 FDD			
2 lover	10	R.PDSCH.4-1.2 FDD	R.PDSCH.4-3.2 FDD	R.PDSCH.4-5.2 FDD			
2 layer	15	R.PDSCH.4-1.3 FDD	R.PDSCH.4-3.3 FDD	R.PDSCH.4-5.3 FDD			
	20	R.PDSCH.4-1.4 FDD	R.PDSCH.4-3.4 FDD	R.PDSCH.4-5.4 FDD			
	5	R.PDSCH.4-2.1 FDD	R.PDSCH.4-4.1 FDD	R.PDSCH.4-6.1 FDD			
4 lover	10	R.PDSCH.4-2.2 FDD	R.PDSCH.4-4.2 FDD	R.PDSCH.4-6.2 FDD			
4 layer	15	R.PDSCH.4-2.3 FDD	R.PDSCH.4-4.3 FDD	R.PDSCH.4-6.3 FDD			
	20	R.PDSCH.4-2.4 FDD	R.PDSCH.4-4.4 FDD	R.PDSCH.4-6.4 FDD			

Table 9.4B.1.1.1-3: E-UTRA FRC for SDR test (TDD)

MIMO layer	Bandwidth	Reference channel				
WITIVIO Tayer	Danuwium	64QAM	256QAM	1024QAM		
	10	R.PDSCH.6-1.1 TDD	R.PDSCH.6-3.1 TDD	R.PDSCH.6-5.1 TDD		
2 layer	15	R.PDSCH.6-1.2 TDD	R.PDSCH.6-3.2 TDD	R.PDSCH.6-5.2 TDD		
	20	R.PDSCH.6-1.3 TDD	R.PDSCH.6-3.3 TDD	R.PDSCH.6-5.3 TDD		
	10	R.PDSCH.6-2.1 TDD	R.PDSCH.6-4.1 TDD	R.PDSCH.6-6.1 TDD		
4 layer	15	R.PDSCH.6-2.2 TDD	R.PDSCH.6-4.2 TDD	R.PDSCH.6-6.2 TDD		
	20	R.PDSCH.6-2.3 TDD	R.PDSCH.6-4.3 TDD	R.PDSCH.6-6.3 TDD		

9.4B.1.2 EN-DC including FR2 NR carrier

9.4B.1.2.1 SDR test

The Sustained Data Rate (SDR) requirements in this clause are applicable to the EN-DC including FR2 NR carrier.

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 conditions and the required success rate of delivered TB by Layer 1 to meet the sustained data rate requirement.

The test parameters are determined by the following procedure:

- Step 1: Calculate the NR FR2 data rate for EN-DC bandwidth combinations, using a procedure from Clause 7.5A, for all supported EN-DC configurations and set of per NR component carrier (CC) UE capabilities among all supported UE capabilities:
 - Set of per NR CC UE capabilities includes a channel bandwidth, subcarrier spacing, number of PDSCH MIMO layers, modulation format and scaling factor as defined in clause 4.1.2 of TS 38.306 [14].
- Step 2: Calculate the E-UTRA data rate for EN-DC bandwidth combinations, using a procedure from clause 4.1.2 of TS 38.306 [14], for all supported EN-DC configurations and set of per E-UTRA component carrier (CC) UE capabilities among all supported UE capabilities:
 - Set of per E-UTRA CC UE capabilities includes a channel bandwidth, number of PDSCH MIMO layers and modulation format as defined in clause 4.1.2 of TS 38.306 [14].
- Step 3: Select the EN-DC bandwidth combination among all supported EN-DC configurations that achieves maximum total data rate in steps 1 and 2 among all UE capabilities:
 - When there are multiple sets of EN-DC bandwidth combinations and UE capabilities with the same largest data rate, select a single set with the smallest aggregated channel bandwidth.
- Step 4: For each NR FR2 CC in the selected EN-DC bandwidth combination, use MCS determined in step 1 for that EN-DC bandwidth combination based on test parameters and indicated UE capabilities.

The test setup for E-UTRA Pcell is specified in Clause 9.1.2 and Table 9.4B.1.1.1-1. The NR PDSCH SDR tests setup is specified in Clause 7.5A. During the test, only the PDSCH performance on the NR cell(s) on FR2 carriers is verified.

The TB success rate shall be higher than 85% when NR PDSCH is scheduled with MCS defined for the selected EN-DC bandwidth combination and with the downlink physical channel setup according to Annex C.3.1.

9.4B.1.3 EN-DC including FR1 and FR2 NR carriers

The Sustained Data Rate (SDR) requirements in this clause are applicable to the EN-DC including both FR1 and FR2 NR carriers.

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 conditions and the required success rate of delivered TB by Layer 1 to meet the sustained data rate requirement.

The test parameters are determined by the following procedure:

- Step 1: Calculate the NR FR1 data rate for EN-DC bandwidth combinations, using a procedure from clause 4.1.2 of TS 38.306 [14], for all supported EN-DC configurations and set of per NR component carrier (CC) UE capabilities among all supported UE capabilities:
 - Set of per NR CC UE capabilities includes a channel bandwidth, subcarrier spacing, number of PDSCH MIMO layers, modulation format and scaling factor as defined in clause 4.1.2 of TS 38.306 [14].
- Step 2: Calculate the NR FR2 data rate for EN-DC bandwidth combinations, using a procedure from Clause 7.5A, for all supported EN-DC configurations and set of per NR component carrier (CC) UE capabilities among all supported UE capabilities:
 - Set of per NR CC UE capabilities includes a channel bandwidth, subcarrier spacing, number of PDSCH MIMO layers, modulation format and scaling factor as defined in clause 4.1.2 of TS 38.306 [14].
- Step 3: Calculate the E-UTRA data rate for EN-DC bandwidth combinations, using a procedure from clause 4.1.2 of TS 38.306 [14], for all supported EN-DC configurations and set of per E-UTRA component carrier (CC) UE capabilities among all supported UE capabilities:
 - Set of per E-UTRA CC UE capabilities includes a channel bandwidth, number of PDSCH MIMO layers and modulation format as defined in clause 4.1.2 of TS 38.306 [14].

- Step 4: Select the EN-DC bandwidth combination among all supported EN-DC configurations that achieves the maximum total data rate in steps 1, 2 and 3 among all UE capabilities:
 - When there are multiple sets of EN-DC bandwidth combinations and UE capabilities with the same largest data rate, select a single set among sets with the smallest aggregated channel bandwidth.
- Step 5: For each NR FR2 CC in the selected EN-DC bandwidth combination, use MCS determined in step 2 for that EN-DC bandwidth combination based on test parameters and indicated UE capabilities.

The test setup for E-UTRA Pcell is specified in Clause 9.1.2 and Table 9.4B.1.1.1-1. The NR FR2 PDSCH SDR tests setup is specified in Clause 7.5A. During the test, only the PDSCH performance on the NR cell(s) on FR2 carriers is verified.

The TB success rate shall be higher than 85% when NR FR2 PDSCH is scheduled with MCS defined for the selected EN-DC bandwidth combination and with the downlink physical channel setup according to Annex C.3.1.

9.4B.2 NR DC between FR1 and FR2

The methodology for selection of tested NR DC bandwidth combination and the requirements are specified in Clause 9.4A.1.

9.4B.3 NE-DC

9.4B.3.1 NE-DC within FR1

The methodology for selection of tested NE-DC bandwidth combination and the requirements are specified in Clause 9.4B.1.1.

9.5B PDSCH demodulation for DC with power imbalance

9.5B.1 EN-DC

9.5B.1.1 Intra-band contiguous EN-DC within FR1

9.5B.1.1.1 PDSCH

The requirements in this section verify the ability of intra-band contiguous EN-DC UE to demodulate the signal transmitted by the NR SCG in the presence of a stronger E-UTRA MCG. The parameters specified in Table 5.2A.2.2-2 and Table 5.2A.3.2-2 are valid for all intra-band contiguous EN-DC power imbalance tests unless otherwise stated. The test setup for each E-UTRA MCG CC is specified in Clause 9.1.2. During the test, only the PDSCH performance on the NR SCG CC shall be verified.

The test parameters of channel bandwidth and allocated resource blocks are determined by the following procedure:

- Step 1: First select the CBW combinations with the same BWs between E-UTRA MCG carrier(s) and NR SCG carrier. If there is no such CBW combination, go to Step 1a. Otherwise go to step 2.
 - Step 1a: Select the CBW combinations that the BW of NR SCG carrier is smaller than the BW of E-UTRA MCG carrier(s). If there is no such CBW combination, go to Step 1c.
 - Step 1b: Among the CBW combinations selected from Step 1a, select the CBW combinations with the smallest CBW difference between NR SCG carrier and E-UTRA MCG carrier(s). Go to step 2.
 - Step 1c: Select the EN-DC combinations with smallest CBW difference between the NR SCG carrier and E-UTRA MCG carrier(s). Go to step 2.
- Step 2: Among the CBW combinations selected from Step 1, select the EN-DC combination with the largest aggregated CBW.

- When the BW of NR SCG carrier is smaller than or equal to the BW of E-UTRA MCG carrier(s), test full allocated PRBs
- When the BW of NR SCG carrier is larger than the BW of E-UTRA MCG carrier(s), test partial allocated PRBs, and the PRB number for testing equals to the PRB number in the full bandwidth of E-UTRA MCG carrier(s).
 - If frequency of NR SCG carrier is higher than E-UTRA MCG carrier, then the test RBs will be allocated on the highest part of NR SCG carrier.
 - If frequency of NR SCG carrier is lower than E-UTRA MCG carrier, then the test RBs will be allocated on the lowest part of NR SCG carrier.

The performance requirements are specified in Table 9.5B.1.1.1-1 and Table 9.5B.1.1.1-2. The downlink physical channel setup according to Annex C.3.1.

Table 9.5B.1.1.1-1: Minimum performance for FDD EN-DC with 15kHz SCS

Test Number	Bandwidth (MHz)	Reference channel		Power at antenna port (dBm/Hz)		Reference value Fraction of Maximum Throughput (%)	
	NR SCG CC	E-UTRA MCG CC (Note 1)	NR SCG CC	E-UTRA MCG CC	NR SCG CC	E-UTRA MCG CC (Note 1)	NR SCG CC
1	Selected EN-DC combination as per the test procedure	NA	Derived as per section 5.1.3.2 of TS 38.214 [12]	-106	-112	NA	85
Note 1:	The number of E-U7 EN-DC configuration				and and inte	r-band conti	guous

Table 9.5B.1.1.1-2: Minimum performance for TDD EN-DC with 30kHz SCS

Test Number	Bandwidth (MHz)	Reference channel		Power at antenna port (dBm/Hz)		Reference value Fraction of Maximum Throughput (%)	
	NR SCG CC	E-UTRA MCG CC (Note 1)	NR SCG CC	E-UTRA MCG CC	NR SCG CC	E-UTRA MCG CC (Note 1)	NR SCG CC
1	Selected EN-DC combination as per the test procedure	NA	Derived as per section 5.1.3.2 of TS 38.214 [12]	-106	-112	NA	85
Note 1:		The number of E-UTRA MCG carriers depend on the intra-band and inter-band contiguous EN-DC configuration and bandwidth combination set					

9.5B.1.2 Intra-band non-contiguous EN-DC within FR1

9.5B.1.2.1 PDSCH

The requirements in this section verify the ability of intra-band non-contiguous EN-DC UE to demodulate the signal transmitted by the NR SCG in the presence of a stronger E-UTRA MCG. The parameters specified in Table 5.2A.2.2-2 and Table 5.2A.3.2-2 are valid for all intra-band non-contiguous EN-DC power imbalance tests unless otherwise stated. The test setup for each E-UTRA MCG CC is specified in Clause 9.1.2. During the test, only the PDSCH performance on the NR SCG CC shall be verified.

The test parameters of channel bandwidth and allocated resource blocks are determined by the following procedure:

- Step 1: First select the CBW combinations with the same BWs between E-UTRA MCG carrier(s) and NR SCG carrier. If there is no such CBW combination, go to Step 1a. Otherwise go to step 2.
 - Step 1a: Select the CBW combinations that the BW of NR SCG carrier is smaller than the BW of E-UTRA MCG carrier(s). If there is no such CBW combination, go to Step 1c.
 - Step 1b: Among the CBW combinations selected from Step 1a, select the CBW combinations with the smallest CBW difference between NR SCG carrier and E-UTRA MCG carrier(s). Go to step 2.
 - Step 1c: Select the EN-DC combinations with smallest CBW difference between the NR SCG carrier and E-UTRA MCG carrier(s). Go to step 2.
- Step 2: Among the CBW combinations selected from Step 1, select the EN-DC combination with the largest aggregated CBW.
 - When the BW of NR SCG carrier is smaller than or equal to the BW of E-UTRA MCG carrier(s), test full allocated PRBs
 - When the BW of NR SCG carrier is larger than the BW of E-UTRA MCG carrier(s), test partial allocated PRBs, and the PRB number for testing equals to the PRB number in the full bandwidth of E-UTRA MCG carrier(s).
 - If frequency of NR SCG carrier is higher than E-UTRA MCG carrier, then the test RBs will be allocated on the highest part of NR SCG carrier.
 - If frequency of NR SCG carrier is lower than E-UTRA MCG carrier, then the test RBs will be allocated on the lowest part of NR SCG carrier.

The performance requirements are specified in Table 9.5B.1.2.1-1 and Table 9.5B.1.2.1-2. The downlink physical channel setup according to Annex C.3.1.

Table 9.5B.1.2.1-1: Minimum performance for FDD EN-DC with 15kHz SCS

Test Number	Bandwidth (MHz)	Reference channel		Power at antenna port (dBm/Hz)		Reference value Fraction of Maximum Throughput (%)	
	NR SCG CC	E-UTRA MCG CC (Note 1)	NR SCG CC	E-UTRA MCG CC	NR SCG CC	E-UTRA MCG CC (Note 1)	NR SCG CC
1	Selected EN-DC combination as per the test procedure	NA	Derived as per section 5.1.3.2 of TS 38.214 [12]	-106	-112	NA	85
Note 1:	The number of E-U	TRA MCG car	riers depend	on the intra-ba	and and inte	r-band non-o	contiguous

Note 1: The number of E-UTRA MCG carriers depend on the intra-band and inter-band non-contiguous EN-DC configuration and bandwidth combination set

Test **Bandwidth** Reference channel Power at antenna Reference value Number (MHz) port (dBm/Hz) Fraction of Maximum Throughput (%) NR SCG NR SCG CC E-UTRA NR SCG E-UTRA NR SCG E-UTRA MCG CC MCG CC CC MCG CC CC CC (Note 1) (Note 1) Selected EN-DC -106 -112 85 1 NA Derived as NA combination as per per section the test procedure 5.1.3.2 of TS 38.214 [12] Note 1: The number of E-UTRA MCG carriers depend on the intra-band and inter-band non-contiguous EN-DC configuration and bandwidth combination set

Table 9.5B.1.2.1-2: Minimum performance for TDD EN-DC with 30kHz SCS

10 CSI reporting requirements for interworking

10.1 General

This clause specifies CSI performance requirements for EN-DC, NE-DC, inter-band NR-DC between FR1 and FR2, and inter-band NR CA between FR1 and FR2.

The definition of frequency ranges (FR1 and FR2) are specified in table 5.1-1 of TS 38.101-3 [8].

10.1.1 Applicability of requirements

The following applicability rules are specified for demodulation performance requirements for interworking:

- For UEs supporting both SA and NSA,
 - The performance requirements specified in Clause 6 will be verified only for SA.
 - The performance requirements specified in Clause 8 will be verified only for SA.
- The FR1 EN-DC test cases with the NR TDD DL-UL configurations which are not aligned with LTE's can be tested on the corresponding EN-DC band combinations where UE supports simultaneous transmission and reception.
- For UEs supporting NR-DC including FR1 and FR2, if the FR2 requirements in Clause 8.2, Clause 8.3 and Clause 8.4 are tested, the test coverage can be considered fulfilled without executing requirements in Clause 10.2B.2, Clause 10.3B.2 and Clause 10.4B.2.
- For UEs supporting NE-DC, the test coverage of CSI reporting requirements can be considered fulfilled, if the CSI reporting requirements in Clause 6 are executed for UE under test in the standalone mode.
- For UEs supporting NGEN-DC, the test coverage of CSI reporting requirements can be considered fulfilled, if the CSI reporting requirements in Clause 6 are executed for UE under test.
- For UEs supporting EN-DC including FR2 and/or EN-DC including FR1 and FR2, the requirements applicability is specified in Table 10.1.1-1.

Table 10.1.1-1: Requirements applicability for UEs supporting EN-DC including FR2 and/or EN-DC including FR1 and FR2

Supported scenarios	CQI requirements	PMI requirements	RI requirements
EN-DC including FR2	Clause 10.2B.1.2	Clause 10.3B.1.2	Clause 10.4B.1.2
EN-DC including FR1 and FR2	Clause 10.2B.1.3	Clause 10.3B.1.3	Clause 10.4B.1.3
Both EN-DC including FR2 and EN-DC including FR1 and FR2	Clause 10.2B.1.2	Clause 10.3B.1.2	Clause 10.4B.1.2

10.1.1.1 Applicability of requirements for optional UE features

Table 10.1.1.1-1: Void

10.1.1.2 Applicability of requirements for mandatory UE features with capability signalling

The applicability rule defined in Clause 6.1.1.4 shall be applied for performance requirements in Clauses 10.2B.1.1, 10.3B.1.1 and 10.4B.1.1.

The applicability rule defined in Clause 8.1.1.4 shall be applied for performance requirements in Clauses 10.2B.1.2, 10.3B.1.2 and 10.4B.1.2.

10.2 Reporting of Channel Quality Indicator (CQI)

10.2A Reporting of Channel Quality Indicator (CQI) for CA

(Void)

10.2B Reporting of Channel Quality Indicator (CQI) for DC

10.2B.1 EN-DC

10.2B.1.1 EN-DC within FR1

The test setup for E-UTRA PCell is specified in Clause 9.1.2. The NR CQI reporting requirements are specified in Clause 6.2. During the test, only the performance based on NR requirements on the NR cell(s) shall be verified.

10.2B.1.2 EN-DC including FR2 NR carrier

The test setup for E-UTRA PCell is specified in Clause 9.1.2. The NR CQI reporting requirements are specified in Clause 8.2. During the test, only the performance based on NR requirements on the NR cell(s) on FR2 carriers shall be verified.

10.2B.1.3 EN-DC including FR1 and FR2 NR carriers

The test setup for E-UTRA PCell is specified in Clause 9.1.2. The NR CQI reporting requirements are specified in Clause 10.2B.1.1 and Clause 10.2B.1.2. During the test, only the performance based on NR requirements on the NR cell(s) on FR2 carriers shall be verified.

10.2B.2 NR DC between FR1 and FR2

The test setup for FR1 PCell is specified in Table 5.5A-1 with antenna configuration 1x2. The test setup for FR2 cell is specified in Clause 8.1.2 and Clause 8.2. The NR CQI reporting requirements are specified in Clause 8.2. During the test, only the CQI performance based on NR requirements on the NR cell(s) on FR2 carriers shall be verified.

10.3 Reporting of Precoding Matrix Indicator (PMI)

10.3A Reporting of Precoding Matrix Indicator (PMI) for CA (Void)

10.3B Reporting of Precoding Matrix Indicator (PMI) for DC

10.3B.1 EN-DC

10.3B.1.1 EN-DC within FR1

The test setup for E-UTRA PCell is specified in Clause 9.1.2. The NR PMI reporting requirements are specified in Clause 6.3. During the test, only the performance based on NR requirements on the NR cell(s) shall be verified.

10.3B.1.2 EN-DC including NR FR2 carrier

The test setup for E-UTRA PCell is specified in Clause 9.1.2. The NR PMI reporting requirements are specified in Clause 8.3. During the test, only the performance based on NR requirements on the NR cell(s) on FR2 carriers shall be verified.

10.3B.1.3 EN-DC including FR1 and FR2 NR carriers

The test setup for E-UTRA PCell is specified in Clause 9.1.2. The NR PMI reporting requirements are specified in Clause 10.3B.1.1 and Clause 10.3B.1.2. During the test, only the performance based on NR requirements on the NR cell(s) on FR2 carriers shall be verified.

10.3B.2 NR DC between FR1 and FR2

The test setup for FR1 PCell is specified in Table 5.5A-1 with antenna configuration 1x2. The test setup for FR2 cell is specified in Clause 8.1.2 and Clause 8.3. The PMI reporting requirements are specified in Clause 8.3. During the test, only the PMI performance based on NR requirements on the NR cell(s) on FR2 carriers shall be verified.

10.4 Reporting of Rank Indicator (RI)

10.4A Reporting of Rank Indicator (RI) for CA

10.4B Reporting of Rank Indicator (RI) for DC

10.4B.1 EN-DC

10.4B.1.1 EN-DC within FR1

The test setup for E-UTRA PCell is specified in Clause 9.1.2. The NR RI reporting requirements are specified in Clause 6.4. During the test, only the performance based on NR requirements on the NR cell(s) shall be verified.

10.4B.1.2 EN-DC including NR FR2 carrier

The test setup for E-UTRA PCell is specified in Clause 9.1.2. The NR RI reporting requirements are specified in Clause 8.4. During the test, only the performance based on NR requirements on the NR cell(s) on FR2 carriers shall be verified.

10.4B.1.3 EN-DC including FR1 and FR2 NR carriers

The test setup for E-UTRA PCell is specified in Clause 9.1.2. The NR PMI reporting requirements are specified in Clause 10.4B.1.1 and Clause 10.4B.1.2. During the test, only the performance based on the NR requirements on the NR cell(s) on FR2 carriers shall be verified.

10.4B.2 NR DC between FR1 and FR2

The test setup for FR1 PCell is specified in Table 5.5A-1 with antenna configuration 1x2. The test setup for FR2 cell is specified in Clause 8.1.2 and Clause 8.4. The NR RI reporting requirements for NR FR2 cell are specified in Clause 8.4. During the test, only the RI performance based on NR requirements on the NR cell(s) on FR2 carriers shall be verified.

Annex A (normative): Measurement channels

A.1 General

A.1.1 Throughput definition

The throughput values defined in the measurement channels specified in Annex A, are calculated and are valid per codeword. For multi-codeword transmissions, the throughput referenced in the minimum requirements is the sum of throughputs of all codewords.

A.1.2 TDD UL-DL configurations for FR1

TDD UL-DL configurations for performance requirements are provided in Tables A.1.2-1, A.1.2-2, and A.1.2-3.

Table A.1.2-1: TDD UL-DL configuration for SCS 15 kHz

	Parameter	Unit	UL-DL pattern
	Parameter	Unit	FR1.15-1
TDD Slot Configurat	ion pattern (Note 1)		DDDSU
Special Slot Configu	ration (Note 2)		10D+2G+2U
referenceSubcarrier	Spacing	kHz	15
pattern1	dl-UL-TransmissionPeriodicity	ms	5
	nrofDownlinkSlots		3
	nrofDownlinkSymbols		10
	nrofUplinkSlot		1
	nrofUplinkSymbols		2
The number of slots	between PDSCH and corresponding		4 if $mod(i,5) = 0$
HARQ-ACK information	tion (Note 3)		3 if $mod(i,5) = 1$
			2 if $mod(i,5) = 2$
			6 if $mod(i,5) = 3$

guard symbols; U denotes a slot with all DL symbols; S denotes a slot with a mix of DL, UL and guard symbols; U denotes a slot with all UL symbols. The field is for information.

Note 2: D, G, U denote DL, guard and UL symbols, respectively. The field is for information.

Note 3: i is the slot index per frame; $i = \{0,...,9\}$.

Table A.1.2-2: TDD UL-DL configuration for SCS 30 kHz

Parameter		1	UL-DL pattern					
		Unit	FR1.30-1	FR1.30-2	FR1.30-3	FR1.30-4	FR1.30-5	FR1.30-6
TDD Slot Configuration pattern	(Note 1)		7DS2U	DDDSU	DDDSUDDSUU	DDDSUUDDDD	DSUU	DS₁S₂U
Special Slot Configuration (Note	e 2)		6D+4G+4U	10D+2G+2U	10D+2G+2U	6D+4G+4U	12D+2G	S1: 10D+2G+2U S2: 12D+2G+0U
referenceSubcarrierSpacing		kHz	30	30	30	30	30	30
pattern1								
	dl-UL- TransmissionPeriodicity	ms	5	2.5	2.5	3	2	1
	nrofDownlinkSlots		7	3	3	3	1	1
	nrofDownlinkSymbols		6	10	10	6	12	10
	nrofUplinkSlot		2	1	1	2	2	0
_	nrofUplinkSymbols		4	2	2	4	0	2
pattern2	dl-UL- TransmissionPeriodicity	ms	N/A	N/A	2.5	2	N/A	1
	nrofDownlinkSlots		N/A	N/A	2	4	N/A	0
	nrofDownlinkSymbols		N/A	N/A	10	0	N/A	12
	nrofUplinkSlot		N/A	N/A	2	0	N/A	1
	nrofÚplinkSymbols		N/A	N/A	2	0	N/A	0
The number of slots between P HARQ-ACK information (Note 3			8 if mod(i,10) = 0 7 if mod(i,10) = 1 6 if mod(i,10) = 2 5 if mod(i,10) = 3 5 if mod(i,10) = 4 4 if mod(i,10) = 5 3 if mod(i,10) = 6 2 if mod(i,10) = 7	4 if mod(i,5) = 0 3 if mod(i,5) = 1 2 if mod(i,5) = 2 6 if mod(i,5) = 3	4 if mod(i,10) = 0 $3 if mod(i,10) = 1$ $2 if mod(i,10) = 2$ $5 if mod(i,10) = 3$ $3 if mod(i,10) = 5$ $3 if mod(i,10) = 6$ $2 if mod(i,10) = 7$	5 if mod(i,10) = 0 4 if mod(i,10) = 1 3 if mod(i,10) = 2 2 if mod(i,10) = 6 7 if mod(i,10) = 7 6 if mod(i,10) = 8 5 if mod(i,10) = 9	3 if mod(i,4) = 0 2 if mod(i,4) = 1	3 if mod(i,4) = 0 2 if mod(i,4) = 1 3 if mod(i,4) = 2

- Note 1: D denotes a slot with all DL symbols; S denotes a slot with a mix of DL, UL and guard symbols; U denotes a slot with all UL symbols. The field is for information.
- Note 2: D, G, U denote DL, guard and UL symbols, respectively. The field is for information. Note 3: i is the slot index per frame; $i = \{0,...,19\}$

Table A.1.2-2a: TDD UL-DL configuration for SCS 30 kHz for DCI-based dynamic UL/DL detection

Parameter		Unit	UL-DL pattern	
			FR1.30-1A	
TDD Slot Configuration pattern (Note 1)			7DS2U	
Special Slot Configuration (Note 2)			6D+4G+4U	
referenceSubcarrierSpacing		kHz	N/A	
pattern1 (Note 4)				
	dl-UL- TransmissionPeriodicity	ms	N/A	
	nrofDownlinkSlots		N/A	
	nrofDownlinkSymbols		N/A	
	nrofUplinkSlot		N/A	
	nrofUplinkSymbols		N/A	
PDCCH DCI Configuration	DCI Format		1-1 for slot	
			indices with	
			mod(i,10) =	
			0,1,2,3,4,5,6,7	
	Scheduled Grant		Symbol 2-13 for	
			slot indices with	
			mod(i,10) =	
			0,1,2,3,4,5,6 and	
			Symbol 2-5 for	
			slot indices with	
			mod(i,10) = 7	
The number of slots between PD	SCH and corresponding		8 if $mod(i,10) = 0$	
HARQ-ACK information (Note 3)			7 if $mod(i,10) = 1$	
(PDSCH-to-HARQ-timing-indicate	or)		6 if $mod(i,10) = 2$	
			5 if $mod(i,10) = 3$	
			5 if $mod(i,10) = 4$	
			4 if $mod(i,10) = 5$	
			3 if $mod(i,10) = 6$	
			2 if mod(i,10) = 7	
Note 1: D denotes a slot with all DL symbols; S denotes a slot with a mix of DL, UL				
guard symbols; U denotes a slot with all UL symbols. The field is for information.				
Note 2: D, G and U denote DL, guard and UL symbols, respectively. The field is for information.				
Note 3: i is the slot index per fr	rame; $i = \{0,, 19\}$			
Note 4: Do not configure tdd-U	<i>IL-DL-ConfigurationCommon</i> ւ	ising RF	RC configuration	

A.1.3 TDD UL-DL configurations for FR2

TDD UL-DL patterns configurations for performance requirements are provided in Tables A.1.3-1, A.1.3-2.

Table A.1.3-1: TDD UL-DL pattern for SCS 60 kHz

Parameter		Unit	UL-DL pattern
		Offic	FR2.60-1
TDD Slot Configuration pattern	(Note 1)		DDSU
Special Slot Configuration (Not	e 2)		11D+3G+0U
referenceSubcarrierSpacing		kHz	60
pattern1	dI-UL-	ms	1
	TransmissionPeriodicity		I
	nrofDownlinkSlots		2
	nrofDownlinkSymbols		11
	nrofUplinkSlot		1
	nrofUplinkSymbols		0
The number of slots between PDSCH and corresponding			3 if $mod(i,4) = 0$
HARQ-ACK information (Note 3	HARQ-ACK information (Note 3)		2 if $mod(i,4) = 1$
			5 if $mod(i,4) = 2$

Note 1: D denotes a slot with all DL symbols; S denotes a slot with a mix of DL, UL and guard symbols; U

denotes a slot with all UL symbols. The field is for information.

Note 2: D, G, U denote DL, guard and UL symbols, respectively. The field is for information.

Note 3: i is the slot index per frame; $i = \{0,...,39\}$

Table A.1.3-2: TDD UL-DL configuration for SCS 120 kHz

Parameter		Unit	UL-DL pattern		
	Parameter		FR2.120-1	FR2.120-2	
TDD Slot Configuration	onfiguration pattern (Note 1)		DDDSU	DDSU	
Special Slot Configuration	on (Note 2)		10D+2G+2U	11D+3G+0U	
referenceSubcarrierSpa	acing	kHz	120	120	
pattern1	dl-UL-	ms	0.625	0.5	
	TransmissionPeriodicity		0.625	0.5	
	nrofDownlinkSlots		3	2	
	nrofDownlinkSymbols		10	11	
	nrofUplinkSlot		1	1	
	nrofUplinkSymbols		2	0	
The number of slots bet	ween PDSCH and corresponding		4 if $mod(i,5) = 0$	3 if mod(i,4) = 0	
HARQ-ACK information(Note 3)			3 if $mod(i,5) = 1$	2 if mod(i,4) = 1	
			2 if $mod(i,5) = 2$	5 if $mod(i,4) = 2$	
			6 if $mod(i.5) = 3$		

Note 1: D denotes a slot with all DL symbols; S denotes a slot with a mix of DL, UL and guard symbols; U denotes a slot with all UL symbols. The field is for information.

Note 2: D, G, U denote DL, guard and UL symbols, respectively. The field is for information.

Note 3: i is the slot index per frame; $i = \{0, ..., 79\}$

Table A.1.3-2a: TDD UL-DL configuration for SCS 120 kHz for DCI-based dynamic UL/DL detection

Parameter		Unit	UL-DL pattern		
			FR2.120-1A		
TDD Slot Configuration pattern (Note 1)			DDDSU		
Special Slot Configuration (Note 2)		10D+2G+2U		
referenceSubcarrierSpacing	g	kHz	N/A		
pattern1 (Note 4)	dl-UL- TransmissionPeriodicity	ms	N/A		
	nrofDownlinkSlots		N/A		
	nrofDownlinkSymbols		N/A		
	nrofUplinkSlot		N/A		
	nrofUplinkSymbols		N/A		
PDCCH DCI Configuration	DCI Format		1-1 for slot indices with mod(i,5) = 0,1,2,3		
	Scheduled Grant		Symbol 1-13 for slot indices with mod(i,5) = 0,1,2 and Symbol 1-9 for slot indices with mod(i,5) = 3		
The number of slots betwee HARQ-ACK information(No	en PDSCH and corresponding te 3)		4 if mod(i,5) = 0 3 if mod(i,5) = 1 2 if mod(i,5) = 2 6 if mod(i,5) = 3		
Note 1: D denotes a slot with all DL symbols; S denotes a slot with a mix of DL, UL and guard symbols; U denotes a slot with all UL symbols. The field is for information.					
Note 2: D, G and U denote DL, guard and UL symbols, respectively. The field is for information.					
	Note 3: i is the slot index per frame; i = {0,,79} Note 4: Do not configure <i>tdd-UL-DL-ConfigurationCommon</i> using RRC configuration.				

A.2 Void

< Editor's note: Clause A.2 is a placeholder for UL Measurement channels>

A.3 DL reference measurement channels

A.3.1 General

The transport block size (TBS) determination procedure is described in clause 5.1.3.2 of TS 38.214 [12].

Unless otherwise stated, no user data is scheduled on slot #0 within 20 ms in order to avoid SSB and PDSCH transmissions in one slot and simplify test configuration.

A.3.2 Reference measurement channels for PDSCH performance requirements

For PDSCH reference channels if more than one Code Block is present, an additional CRC sequence of L=24 Bits is attached to each Code Block (otherwise L=0 Bit).

A.3.2.1 FDD

A.3.2.1.1 Reference measurement channels for SCS 15 kHz FR1

Table A.3.2.1.1-1: PDSCH Reference Channel for FDD (QPSK)

Parameter	Unit			Value				
Reference channel		R.PDSCH.1-	R.PDSCH.1-	R.PDSCH.1-	R.PDSCH.1-	R.DSCH.1-		
Reference channel		1.1 FDD	1.2 FDD	1.3 FDD	1.4 FDD	2.5 FDD		
Channel bandwidth	MHz	10	10	10	10	10		
Subcarrier spacing	kHz	15	15	15	15	15		
Number of allocated	PRBs	52	6	52	52	52		
resource blocks	I IVD3	32	0	32	32			
Number of consecutive		12	12	7	12	12		
PDSCH symbols		12	12	,	12			
Allocated slots per 2	Slots	19	19	19	19	19		
frames	Cioto	• •						
MCS table		64QAM	64QAM	64QAM	64QAMLowSE	64QAMLowSE		
MCS index		4	4	4	14	19		
Modulation		QPSK	QPSK	QPSK	QPSK	16QAM		
Target Coding Rate		0.30	0.30	0.30	0.59	0.54		
Number of MIMO layers		1	1	1	1	2		
Number of DMRS REs		18	12	12	12	12		
Overhead for TBS		0	0	0	0	0		
determination				ŭ	Ŭ			
Information Bit Payload								
per Slot						21/2		
For Slot i = 0	Bits	N/A	N/A	N/A	N/A	N/A		
For Slots i = 1,, 19	Bits	3904	480	2280	8064	29704		
Transport block CRC								
per Slot	D.,	N 1/A	N 1/A	21/2	21/2	N1/A		
For Slot i = 0	Bits	N/A	N/A	N/A	N/A	N/A		
For Slots i = 1,, 19	Bits	24	16	16	24	24		
Number of Code Blocks								
per Slot	CD-	N/A	NI/A	NI/A	NI/A	NI/A		
For Slot i = 0 For Slots i = 1,, 19	CBs CBs	1 N/A	N/A 1	N/A 1	N/A 1	N/A 4		
	CBS	1	1	1	1	4		
Binary Channel Bits Per Slot								
For Slot i = 0	Bits	N/A	N/A	N/A	N/A	N/A		
	Bits	12480	1512	6864	13104	49920		
For Slots i = 10, 11 For Slots i =1,, 9, 12,	DIIS	12400	1312	0004	13104	54912		
, 19	Bits	13104	1584	7488	13728	34912		
Max. Throughput						28.219		
averaged over 2 frames	Mbps	3.709	0.456	2.166	7.661	20.219		
	c ic trans	mitted in slot #0	with periodicity	/ 20 ms	l			
Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms								

Note 2: Slot i is slot index per 2 frames

Table A.3.2.1.1-2: PDSCH Reference Channel for FDD (16QAM)

Parameter	Unit			Value		
Deference channel		R.PDSCH.1-	R.PDSCH.1-	R.PDSCH.1-	R.PDSCH.1-	R.PDSCH.1-
Reference channel		2.1 FDD	2.2 FDD	2.3 FDD	2.4 FDD	2.5 FDD
Channel bandwidth	MHz	10	10	10	10	10
Subcarrier spacing	kHz	15	15	15	15	15
Number of allocated resource blocks	PRBs	52	52	52	52	52
Number of consecutive PDSCH symbols		12	12	12	12	12
Allocated slots per 2 frames	Slots	19	19	19	19	19
MCS table		64QAM	64QAM	64QAM	64QAM	64QAM
MCS index		13	13	13	13	16
Modulation		16QAM	16QAM	16QAM	16QAM	16QAM
Target Coding Rate		0.48	0.48	0.48	0.48	0.64
Number of MIMO layers		1	2	3	4	1
Number of DMRS REs		12	12	24	24	12
Overhead for TBS		0	0	0	0	0
determination		U	U	U	U	
Information Bit Payload per Slot						
For Slot i = 0	Bits	N/A	N/A	N/A	N/A	N/A
For Slots i = 1,, 19	Bits	13064	26120	35856	48168	17424
Transport block CRC per Slot						
For Slot i = 0	Bits	N/A	N/A	N/A	N/A	N/A
For Slots i = 1,, 19	Bits	24	24	24	24	24
Number of Code Blocks per Slot						
For Slot i = 0	CBs	N/A	N/A	N/A	N/A	N/A
For Slots i = 1,, 19	CBs	2	4	5	6	3
Binary Channel Bits Per Slot						
For Slot i = 0	Bits	N/A	N/A	N/A	N/A	N/A
For Slots i = 10, 11	Bits	26208	52416	71136	94848	26208
For Slots i = 1,, 9, 12,, 19	Bits	27456	54912	74880	99840	27456
Max. Throughput averaged over 2 frames	Mbps	12.411	24.814	34.063	45.760	16.553

SS/PBCH block is transmitted in slot #0 with periodicity 20 ms Slot i is slot index per 2 frames

Note 2:

Table A.3.2.1.1-3: PDSCH Reference Channel for FDD (64QAM)

Parameter	Unit			Value		
Deference showned		R.PDSCH.1-	R.PDSCH.1-	R.PDSCH.1-	R.PDSCH.1-	
Reference channel		3.1 FDD	3.2 FDD	3.3 FDD	3.4 FDD	
Channel bandwidth	MHz	10	10	10	10	
Subcarrier spacing	kHz	15	15	15	15	
Number of allocated resource	PRBs	52	52	26 (Note 3)	26 (Note 4)	
blocks	PRDS	52			•	
Number of consecutive PDSCH		12	12	12	12	
symbols		12				
Allocated slots per 2 frames	Slots	19	19	19	19	
MCS table		64QAM	64QAM	64QAM	64QAM	
MCS index		19	19	19	19	
Modulation		64QAM	64QAM	64QAM	64QAM	
Target Coding Rate		0.51	0.51	0.51	0.51	
Number of MIMO layers		2	2	2	2	
Number of DMRS REs		12	24	24	24	
Overhead for TBS determination		0	0	0	0	
Information Bit Payload per Slot						
For Slot i = 0	Bits	N/A	N/A	N/A	N/A	
For Slots i = 1,, 19	Bits	42016	37896	18960	18960	
Transport block CRC per Slot						
For Slot i = 0	Bits	N/A	N/A	N/A	N/A	
For Slots i = 1,, 19	Bits	24	24	24	24	
Number of Code Blocks per Slot						
For Slot i = 0	CBs	N/A	N/A	N/A	N/A	
For Slots i = 1,, 19	CBs	5	5	3	3	
Binary Channel Bits Per Slot						
For Slot i = 0	Bits	N/A	N/A	N/A	N/A	
For Slots i = 10, 11	Bits	78624	67392	33696	33696	
For Slots i = 1,, 9, 12,, 19	Bits	82368	74880	37440	37440	
Max. Throughput averaged over 2 frames	Mbps	39.915	36.001	18.012	18.012	

Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms

Note 2:

Slot i is slot index per 2 frames PDSCH is scheduled in PRB numbers from 0 to 25. Note 3: Note 4: PDSCH is scheduled in PRB numbers from 26 to 51.

Table A.3.2.1.1-4: PDSCH Reference Channel for FDD (256QAM)

Parameter	Unit		Value
Reference channel		R.PDSCH.1-	
Reference channel		4.1 FDD	
Channel bandwidth	MHz	10	
Subcarrier spacing	kHz	15	
Number of allocated resource blocks	PRBs	52	
Number of consecutive PDSCH		12	
symbols		12	
Allocated slots per 2 frames	Slots	19	
MCS table		256QAM	
MCS index		24	
Modulation		256QAM	
Target Coding Rate		0.82	
Number of MIMO layers		1	
Number of DMRS REs		12	
Overhead for TBS determination		0	
Information Bit Payload per Slot			
For Slot $i = 0$	Bits	N/A	
For Slots i = 1,, 19	Bits	45096	
Transport block CRC per Slot			
For Slot $i = 0$	Bits	N/A	
For Slots i = 1,, 19	Bits	24	
Number of Code Blocks per Slot			
For Slot $i = 0$	CBs	N/A	
For Slots i = 1,, 19	CBs	6	
Binary Channel Bits Per Slot			
For Slot $i = 0$	Bits	N/A	
For Slots i = 10, 11	Bits	52416	
For Slots i = 1,, 9, 12,, 19	Bits	54912	
Max. Throughput averaged over 2	Mbps	42.841	
frames	IVIDPS	42.041	

Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms Note 2: Slot i is slot index per 2 frames

Table A.3.2.1.1-5: PDSCH Reference Channel for FDD and CSI-RS overlapped with PDSCH

Parameter	Unit		Value
Deference showned		R.PDSCH.1-	
Reference channel		5.1 FDD	
Channel bandwidth	MHz	10	
Subcarrier spacing	kHz	15	
Number of allocated resource blocks	PRBs	52	
Number of consecutive PDSCH		12	
symbols		12	
Allocated slots per 2 frames	Slots	19	
MCS table		64QAM	
MCS index		13	
Modulation		16QAM	
Target Coding Rate		0.48	
Number of MIMO layers		2	
Number of DMRS REs		12	
Overhead for TBS determination		0	
Information Bit Payload per Slot			
For Slot i = 0	Bits	N/A	
For Slots i = 1,, 19	Bits	26120	
Transport block CRC per Slot			
For Slot i = 0	Bits	N/A	
For Slots i = 1,, 19	Bits	24	
Number of Code Blocks per Slot			
For Slot i = 0	CBs	N/A	
For Slots i = 1,, 19	CBs	4	
Binary Channel Bits Per Slot			
For Slot i = 0	Bits	N/A	
For Slots i = 5, 15	Bits	50752	
For Slots i = 10	Bits	48256	
For Slots i = 11	Bits	52416	
For Slots $i = 1,,4,6,,$	Bits	54912	
9,12,14,16,,19	טונס	J4312	
Max. Throughput averaged over 2	Mbps	24.814	
frames			

SS/PBCH block is transmitted in slot #0 with periodicity 20 ms Slot i is slot index per 2 frames

Table A.3.2.1.1-6: PDSCH Reference Channel for FDD PMI reporting requirements

Unit			Value	
	R.PDSCH.1-	R.PDSCH.1-	R.PDSCH.1-	
	6.1 FDD	6.2 FDD	6.3 FDD	
MHz	10	10	10	
kHz		15		
PRBS	52	52	52	
	40	4.0	40	
	12	12	12	
Slots	15	15	15	
	64QAM	64QAM	64QAM	
1				
	1	2	2	
	0	0	0	
Bits	N/A	N/A	N/A	
	N/A	N/A	N/A	
Bits	12040	24072	40976	
Bits	N/A	N/A	N/A	
	N/A	N/A	N/A	
D.:	0.4	0.4	0.4	
Bits	24	24	24	
CBs	N/A	N/A	N/A	
	NI/A	N1/A	N1/A	
	N/A	N/A	N/A	
CD.	0	2	_	
CBS	2	3	5	
Bits	N/A	N/A	N/A	
	NI/A	NI/A	NI/A	
	IN/A	IN/A	IN/A	
Bits	23712	47424	71136	
Dito	24060	40000	74000	
Bits	24960	49920	74880	
Mhna	0.020	19.054	20.722	
Nipps	9.030	16.054	30.732	
	Bits Bits CBs CBs Bits Bits Mbps	R.PDSCH.1- 6.1 FDD MHz 10 kHz 15 PRBs 52 12 Slots 15 64QAM 13 16QAM 0.48 1 1 24 0 Bits N/A N/A Bits 12040 Bits N/A N/A CBs 2 Bits N/A N/A CBs 2 Bits N/A N/A Bits 24 CBs N/A N/A CBs 2 Bits N/A N/A Rits 24 CBs N/A N/A CBs 2 Bits N/A N/A Rits 24 CBs N/A N/A CBs 2 Bits N/A N/A Rits N/A N/A OBits	R.PDSCH.1-6.1 FDD 6.2 FDD MHz	R.PDSCH.1-6.1 FDD R.PDSCH.1-6.2 FDD R.PDSCH.1-6.3 FDD MHz 10 10 10 kHz 15 15 15 PRBs 52 52 52 12 12 12 12 Slots 15 15 15 64QAM 64QAM 64QAM 64QAM 13 13 20 64QAM 16QAM 16QAM 64QAM 64QAM 0.48 0.48 0.55 1 2 2 1 2 2 2 2 2 24 <t< td=""></t<>

SS/PBCH block is transmitted in slot #0 with periodicity 20 ms Note 1:

Note 2: Note 3: Slot i is slot index per 2 frames Number of DMRS REs includes the overhead of the DM-RS CDM groups without data

Table A.3.2.1.1-7: PDSCH Reference Channel for FDD LTE-NR coexistence scenario

Parameter	Unit	it Value				
Reference channel		R.PDSCH.1- 7.1 FDD	R.PDSCH.1- 7.2 FDD			
Channel bandwidth	MHz	10	10			
Subcarrier spacing	kHz	15	15			
Number of allocated resource blocks	PRBs	52	52			
Number of consecutive PDSCH symbols	TREG	9	11			
Allocated slots per 2 frames	Slots	16	16			
MCS table		64QAM	64QAM			
MCS index		4	4			
Modulation		QPSK	QPSK			
Target Coding Rate		0.30	0.30			
Number of MIMO layers		1	1			
Number of DMRS REs		12	12			
Overhead for TBS determination		18	18			
Information Bit Payload per Slot						
For Slots i = 0,5,10,15	Bits	N/A	N/A			
For Slots i, if $mod(i, 5) = \{1,2,3,4\}$ for i from $\{0,,19\}$	Bits	2472	3240			
Transport block CRC per Slot						
For Slots i = 0,5,10,15	Bits	N/A	N/A			
For Slots i, if $mod(i, 5) = \{1,2,3,4\}$ for i from $\{0,,19\}$	Bits	16	16			
Number of Code Blocks per Slot						
For Slots i = 0,5,10,15	CBs	N/A	N/A			
For Slots i, if $mod(i, 5) = \{1,2,3,4\}$ for i from $\{0,,19\}$	CBs	1	1			
Binary Channel Bits Per Slot						
For Slots i = 0,5,10,15	Bits	N/A	N/A			
For Slots i = 11	Bits	7760	10256			
For Slots i, if $mod(i, 5) = \{1,2,3,4\}$ for i from $\{1,, 9, 12,, 19\}$	Bits	8384	10880			
Max. Throughput averaged over 2 frames	Mbps	1.978	2.592			

SS/PBCH block is transmitted in slot #0 with periodicity 20 ms Note 1:

Note 2:

Slot i is slot index per 2 frames
No user data is scheduled on slots with LTE PBCH/PSS/SSS Note 3:

Table A.3.2.1.1-8: PDSCH Reference Channel for FDD HST scenario

Parameter	Unit			Value		
Deference sharmal		R.PDSCH.1-	R.PDSCH.1-	R.PDSCH.1-	R.PDSCH.1-	
Reference channel		8.1 FDD	8.2 FDD	8.3 FDD	8.4 FDD	
Channel bandwidth	MHz	10	10	10	10	
Subcarrier spacing	kHz	15	15	15	15	
Number of allocated resource blocks	PRBs	52	52	52	52	
Number of consecutive PDSCH symbols		12	12	12	12	
Allocated slots per 2 frames	Slots	19	19	19	19	
MCS table		64QAM	64QAM	64QAM	64QAM	
MCS index		13	17	13	17	
Modulation		16QAM	64QAM	16QAM	64QAM	
Target Coding Rate		0.48	0.43	0.48	0.43	
Number of MIMO layers		1	1	2	2	
Number of DMRS REs		18	18	18	18	
Overhead for TBS determination		0	0	0	0	
Information Bit Payload per Slot						
For Slot i = 0	Bits	N/A	N/A	N/A	N/A	
For Slots i = 1,, 19	Bits	12552	16896	25104	28680	
Transport block CRC per Slot						
For Slot i = 0	Bits	N/A	N/A	N/A	N/A	
For Slots i = 1,, 19	Bits	24	24	24	24	
Number of Code Blocks per Slot						
For Slot i = 0	CBs	N/A	N/A	N/A	N/A	
For Slots i = 1,, 19	CBs	2	3	3	4	
Binary Channel Bits Per Slot						
For Slot i = 0	Bits	N/A	N/A	N/A	N/A	
For Slots i = 1,2,11,12	Bits	24960	37440	51168	76752	
For Slots i = 3,, 10, 13,, 19	Bits	26208	39312	52416	78624	
Max. Throughput averaged over 2 frames	Mbps	11.924	16.0512	23.8488	27.246	

Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms

Note 2: Slot i is slot index per 2 frames

Table A.3.2.1.1-9: PDSCH Reference Channel for FDD CC and CA scenario

Parameter	Unit			Value		
Deference channel		R.PDSCH.1-	R.PDSCH.1-	R.PDSCH.1-	R.PDSCH.1-	R.PDSCH.1-
Reference channel		9.1 FDD	9.2 FDD	9.3 FDD	9.4 FDD	9.5 FDD
Channel bandwidth	MHz	5	15	20	25	30
Subcarrier spacing	kHz	15	15	15	15	15
Number of allocated resource	PRBs	25	79	106	133	160
blocks	LVD2	25	19	100	133	100
Number of consecutive PDSCH		12	12	12	12	12
symbols						
Allocated slots per 2 frames	Slots	19	19	19	19	19
MCS table		64QAM	64QAM	64QAM	64QAM	64QAM
MCS index		13	13	13	13	13
Modulation		16QAM	16QAM	16QAM	16QAM	16QAM
Target Coding Rate		0.48	0.48	0.48	0.48	0.48
Number of MIMO layers		2	2	2	2	2
Number of DMRS REs		12	12	12	12	12
Overhead for TBS		0	0	0	0	0
determination		U	U	U	O	U
Information Bit Payload per Slot						
For Slot $i = 0$	Bits	N/A	N/A	N/A	N/A	N/A
For Slots i = 1,, 19	Bits	12552	39936	53288	67584	79896
Transport block CRC per Slot						
For Slot i = 0	Bits	N/A	N/A	N/A	N/A	N/A
For Slots i = 1,, 19	Bits	24	24	24	24	24
Number of Code Blocks per						
Slot						
For Slot i = 0	CBs	N/A	N/A	N/A	N/A	N/A
For Slots i = 1,, 19	CBs	2	5	7	9	10
Binary Channel Bits Per Slot						
For Slot i = 0	Bits	N/A	N/A	N/A	N/A	N/A
For Slots i = 10, 11	Bits	25200	79632	106848	134064	161280
For Slots i =1,, 9, 12,, 19	Bits	26400	83424	111936	140448	168960
Max. Throughput averaged	Mbps	11.924	37.939	50.624	64.205	75.901
over 2 frames	INIDDS		37.939	50.024	04.200	75.801

SS/PBCH block is transmitted in slot #0 with periodicity 20 ms Slot i is slot index per 2 frames

Note 2:

Table A.3.2.1.1-10: PDSCH Reference Channel for FDD CC and CA scenario

Parameter	Unit			Value
Reference channel		R.PDSCH.1-	R.PDSCH.1-	
Reference channel		10.1 FDD	10.2 FDD	
Channel bandwidth	MHz	40	50	
Subcarrier spacing	kHz	15	15	
Number of allocated resource blocks	PRBs	216	270	
Number of consecutive PDSCH symbols		12	12	
Allocated slots per 2 frames	Slots	19	19	
MCS table		64QAM	64QAM	
MCS index		13	13	
Modulation		16QAM	16QAM	
Target Coding Rate		0.48	0.48	
Number of MIMO layers		2	2	
Number of DMRS REs		12	12	
Overhead for TBS		0	0	
determination		U	U	
Information Bit Payload per Slot				
For Slot i = 0	Bits	N/A	N/A	
For Slots i = 1,, 19	Bits	108552	135296	
Transport block CRC per Slot				
For Slot i = 0	Bits	N/A	N/A	
For Slots i = 1,, 19	Bits	24	24	
Number of Code Blocks per Slot				
For Slot i = 0	CBs	N/A	N/A	
For Slots i = 1,, 19	CBs	13	17	
Binary Channel Bits Per Slot				
For Slot i = 0	Bits	N/A	N/A	
For Slots i = 10, 11	Bits	217728	272160	
For Slots i =1,, 9, 12,, 19	Bits	228096	285120	
Max. Throughput averaged over 2 frames	Mbps	103.124	128.531	

SS/PBCH block is transmitted in slot #0 with periodicity 20 ms Slot i is slot index per 2 frames

Note 2:

Table A.3.2.1.1-11: PDSCH Reference Channel for FDD

Parameter	Unit	Value				
Reference channel		R.PDSCH.1-	R.PDSCH.1-			
Reference charmer		11.1 FDD	11.2 FDD			
Channel bandwidth	MHz	10	10			
Subcarrier spacing	kHz	15	15			
Number of allocated resource	PRBs	52	52			
blocks	I IVD3	32				
Number of consecutive PDSCH		12	12			
symbols		12				
Allocated slots per 2 frames	Slots	18	18			
MCS table		64QAMLowSE	64QAMLowSE			
MCS index		19	19			
Modulation		16QAM	16QAM			
Target Coding Rate		0.54	0.54			
Number of MIMO layers		1	1			
Number of DMRS REs		12	12			
Overhead for TBS determination		0	0			
Information Bit Payload per Slot						
For Slot i = 0,1	Bits	N/A	N/A			
For Slots i = 2,, 19	Bits	14856	14856			
Transport block CRC per Slot						
For Slot $i = 0,1$	Bits	N/A	N/A			
For Slots i = 2,, 19	Bits	24	24			
Number of Code Blocks per Slot						
For Slot i = 0,1	CBs	N/A	N/A			
For Slots i = 2,, 19	CBs	2	2			
Binary Channel Bits Per Slot						
For Slot i = 0,1	Bits	N/A	N/A			
For Slots i = 10, 11	Bits	26208	24960			
For Slots i =2,, 9, 12,, 19	Bits	27456	27456			
Max. Throughput averaged over 2 frames	Mbps	6.685 (NOTE 3)	6.685 (NOTE 4)			
names		(110123)	(14016 4)			

Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms

Note 2:

Slot i is slot index per 2 frames
Throughput is calculated under assumption of aggregation factor 2.
Throughput is calculated under assumption of repetition number 2 Note 3:

Note 4:

Table A.3.2.1.1-12: PDSCH Reference Channel for FDD

Parameter	Unit		Value	
Reference channel		R.PDSCH.1-		
Reference charmer		12.1 FDD		
Channel bandwidth	MHz	10		
Subcarrier spacing	kHz	15		
Number of allocated resource	PRBs	52		
blocks	TINDS	32		
Number of consecutive PDSCH		2		
symbols				
Allocated slots per 2 frames	Slots	19		
MCS table		64QAM		
MCS index		4		
Modulation		QPSK		
Target Coding Rate		0.3		
Number of MIMO layers		1		
Number of DMRS REs		6		
Overhead for TBS determination		0		
Information Bit Payload per Slot				
For Slot i = 0	Bits	N/A		
For Slots i = 1,, 19	Bits	576		
Transport block CRC per Slot				
For Slot i = 0	Bits	N/A		
For Slots i = 1,, 19	Bits	16		
Number of Code Blocks per Slot				
For Slot i = 0	CBs	N/A		
For Slots i = 1,, 19	CBs	1		
Binary Channel Bits Per Slot				
For Slot i = 0	Bits	N/A		
For Slots i = 10, 11	Bits	1872		
For Slots i =1,, 9, 12,, 19	Bits	1872		
Max. Throughput averaged over 2 frames	Mbps	0.547		

Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms Note 2: Slot i is slot index per 2 frames

A.3.2.1.2 Reference measurement channels for SCS 30 kHz FR1

Table A.3.2.1.2-1: PDSCH Reference Channel for FDD (64QAM)

Parameter	Unit	Value					
Reference channel		R.PDSCH.2-					
Reference channel		1.1 FDD					
Channel bandwidth	MHz	20					
Subcarrier spacing	kHz	30					
Number of allocated resource blocks	PRBs	51					
Number of consecutive PDSCH symbols		12					
Allocated slots per 2 frames	Slots	39					
MCS table		64QAM					
MCS index		19					
Modulation		64QAM					
Target Coding Rate		0.51					
Number of MIMO layers		2					
Number of DMRS REs		12					
Overhead for TBS determination		0					
Information Bit Payload per Slot							
For Slot i = 0	Bits	N/A					
For Slots i = 1,, 39	Bits	40976					
Transport block CRC per Slot							
For Slot i = 0	Bits	N/A					
For Slots i = 1,, 39	Bits	24					
Number of Code Blocks per Slot							
For Slot i = 0	CBs	N/A					
For Slots i = 1,, 39	CBs	5					
Binary Channel Bits Per Slot							
For Slot i = 0	Bits	N/A					
For Slots i = 20, 21	Bits	77112					
For Slots i = 1,, 19, 22,, 39	Bits	80784					
Max. Throughput averaged over 2 frames	Mbps	79.903					
Note 1: SS/PBCH block is transmitte	ed in slot	#0 with periodici	ity 20 ms				

Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms

A.3.2.1.3 Reference measurement channels for SCS 60 kHz FR1

A.3.2.1.4 Reference measurement channels for E-UTRA

Table A.3.2.1.4-1: PDSCH Reference Channel for sustained data-rate test (64QAM, 2 MIMO layers)

Parameter	Unit	Value				
Reference channel		R.PDSCH.4-	R.PDSCH.4-	R.PDSCH.4-	R.PDSCH.4-	
		1.1 FDD	1.2 FDD	1.3 FDD	1.4 FDD	
Channel bandwidth	MHz	5	10	15	20	
Allocated resource blocks		Note 6	Note 7	Note 8	Note 9	
Allocated subframes per Radio Frame		9	10	10	10	
Modulation		64QAM	64QAM	64QAM	64QAM	
Coding Rate						
For Sub-Frames 1,2,3,4,6,7,8,9,		0.85	0.85	0.85	0.88	
For Sub-Frame 5		N/A	0.89	0.91	0.87	
For Sub-Frame 0		0.83	0.90	0.88	0.90	
Information Bit Payload (Note 3)						
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	18336	36696	55056	75376	
For Sub-Frame 5	Bits	N/A	35160	52752	71112	
For Sub-Frame 0	Bits	15840	36696	55056	75376	
Number of Code Blocks						
(Notes 3 and 4)						
For Sub-Frames 1,2,3,4,6,7,8,9	CBs	3	6	9	13	
For Sub-Frame 5	CBs	N/A	6	9	12	
For Sub-Frame 0	CBs	3	6	9	13	
Binary Channel Bits (Note 3)						
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	21600	43200	64800	86400	
For Sub-Frame 5	Bits	N/A	39744	60480	82080	
For Sub-Frame 0	Bits	19152	40752	62352	83952	
Number of layers		2	2	2	2	
Max. Throughput averaged over 1 frame (Note 3)	Mbps	16.253	36.542	54.826	74.950	

Note 1: 1 symbol allocated to PDCCH for all tests.

Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [15].

Note 3: Given per component carrier per codeword.

Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).

Note 5: Resource blocks n_{PRB} = 0..2 are allocated for SIB transmissions in sub-frame 5 for all bandwidths.

Note 6: Resource blocks $n_{PRB} = 0..24$ in sub-frames 0,1,2,3,4,6,7,8,9.

Note 7: Resource blocks n_{PRB} = 3..49 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..49 in sub-frames 0,1,2,3,4,6,7,8,9.

Note 8: Resource blocks nPRB = 4..74 are allocated for the user data in sub-frame 5, and resource blocks nPRB = 0..74 in sub-frames 0,1,2,3,4,6,7,8,9.

Note 9: Resource blocks $n_{PRB} = 4..99$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..99$ in sub-frames 0,1,2,3,4,6,7,8,9.

Table A.3.2.1.4-2: PDSCH Reference Channel for sustained data-rate test (64QAM, 4 MIMO layers)

Parameter	Unit	Value				
Reference channel		R.PDSCH.4-	R.PDSCH.4-	R.PDSCH.4-	R.PDSCH.4-	
		2.1 FDD	2.2 FDD	2.3 FDD	2.4 FDD	
Channel bandwidth	MHz	5	10	15	20	
Allocated resource blocks		Note 6	Note 7	Note 8	Note 9	
Allocated subframes per Radio Frame		9	10	10	10	
Modulation		64QAM	64QAM	64QAM	64QAM	
Coding Rate						
For Sub-Frames 1,2,3,4,6,7,8,9,		0.78	0.78	0.77	0.79	
For Sub-Frame 5		N/A	0.80	0.79	0.81	
For Sub-Frame 0		0.85	0.83	0.8	0.81	
Information Bit Payload (Note 3)						
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	31704	63776	93800	128496	
For Sub-Frame 5	Bits	N/A	59256	90816	124464	
For Sub-Frame 0	Bits	30576	63776	93800	128496	
Number of Code Blocks						
(Notes 3 and 4)						
For Sub-Frames 1,2,3,4,6,7,8,9	CBs	6	11	16	21	
For Sub-Frame 5	CBs	N/A	10	15	21	
For Sub-Frame 0	CBs	5	11	16	21	
Binary Channel Bits (Note 3)						
For Sub-Frames 1,2,3,4,6,7,8,9	Bits	40800	81600	122400	163200	
For Sub-Frame 5	Bits	N/A	74976	114144	154944	
For Sub-Frame 0	Bits	36192	76992	117792	158592	
Number of layers		4	4	4	4	
Max. Throughput averaged over 1 frame (Note 3)	Mbps	28.421	63.324	93.502	128.093	

- Note 1: 1 symbol allocated to PDCCH for all tests.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [15].
- Note 3: Given per component carrier per codeword.
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: Resource blocks n_{PRB} = 0..2 are allocated for SIB transmissions in sub-frame 5 for all bandwidths.
- Note 6: Resource blocks $n_{PRB} = 0..24$ in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 7: Resource blocks $n_{PRB} = 3..49$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..49$ in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 8: Resource blocks nPRB = 4..74 are allocated for the user data in sub-frame 5, and resource blocks nPRB = 0..74 in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 9: Resource blocks n_{PRB} = 4..99 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..99 in sub-frames 0,1,2,3,4,6,7,8,9.

Table A.3.2.1.4-3: PDSCH Reference Channel for sustained data-rate test (256QAM, 2 MIMO layers)

Parameter	Unit		Va	lue	
Reference channel		R.PDSCH.4-	R.PDSCH.4-	R.PDSCH.4-	R.PDSCH.4-
		3.1 FDD	3.2 FDD	3.3 FDD	3.4 FDD
Channel bandwidth	MHz	5	10	15	20
Allocated resource blocks		Note 6	Note 7	Note 8	Note 9
Allocated subframes per Radio Frame		10	10	10	10
Modulation		256QAM	256QAM	256QAM	256QAM
Coding Rate					
For Sub-Frames 3,4,8,9		0.85	0.85	0.88	0.85
For Sub-Frames 1,2,6,7		0.77	0.74	0.74	0.74
For Sub-Frame 5		0.79	0.77	0.77	0.75
For Sub-Frame 0		0.84	0.78	0.77	0.76
Information Bit Payload (Note 3)					
For Sub-Frames 3,4,8,9	Bits	24496	48936	75376	97896
For Sub-Frames 1,2,6,7	Bits	21384	42368	63776	84760
For Sub-Frame 5	Bits	19848	40576	61664	81176
For Sub-Frame 0	Bits	21384	42368	63776	84760
Number of Code Blocks					
(Notes 3 and 4)					
For Sub-Frames 3,4,8,9	CBs	4	8	13	16
For Sub-Frames 1,2,6,7	CBs	4	7	11	14
For Sub-Frame 5	CBs	4	7	11	14
For Sub-Frame 0	CBs	4	7	11	14
Binary Channel Bits (Note 3)					
For Sub-Frames 3,4,8,9	Bits	28800	57600	86400	115200
For Sub-Frames 1,2,6,7	Bits	28800	57600	86400	115200
For Sub-Frame 5	Bits	25344	52992	80640	109440
For Sub-Frame 0	Bits	25536	54336	83136	111936
Number of layers		2	2	2	2
Max. Throughput averaged over 1 frame (Note 3)	Mbps	22.475	44.816	68.205	89.656

- Note 1: 1 symbol allocated to PDCCH for all tests.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [15].
- Note 3: Given per component carrier per codeword.
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: Resource blocks n_{PRB} = 0..2 are allocated for SIB transmissions in sub-frame 5 for all bandwidths.
- Note 6: Resource blocks $n_{PRB} = 2..24$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..24$ in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 7: Resource blocks n_{PRB} = 3..49 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..49 in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 8: Resource blocks nPRB = 4..74 are allocated for the user data in sub-frame 5, and resource blocks nPRB = 0..74 in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 9: Resource blocks n_{PRB} = 4..99 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..99 in sub-frames 0,1,2,3,4,6,7,8,9.

Table A.3.2.1.4-4: PDSCH Reference Channel for sustained data-rate test (256QAM, 4 MIMO layers)

Parameter	Unit		Va	lue	
Reference channel		R.PDSCH.4-	R.PDSCH.4-	R.PDSCH.4-	R.PDSCH.4-
		4.1 FDD	4.2 FDD	4.3 FDD	4.4 FDD
Channel bandwidth	MHz	5	10	15	20
Allocated resource blocks		Note 6	Note 7	Note 8	Note 9
Allocated subframes per Radio Frame		10	10	10	10
Modulation		256QAM	256QAM	256QAM	256QAM
Coding Rate					
For Sub-Frames 3,4,8,9		0.85	0.78	0.79	0.78
For Sub-Frames 1,2,6,7		0.77	0.78	0.79	0.78
For Sub-Frame 5		0.79	0.82	0.82	0.786
For Sub-Frame 0		0.84	0.83	0.82	0.80
Information Bit Payload (Note 3)					
For Sub-Frames 3,4,8,9	Bits	42368	84760	128496	169544
For Sub-Frames 1,2,6,7	Bits	42368	84760	128496	169544
For Sub-Frame 5	Bits	39232	81176	124464	161760
For Sub-Frame 0	Bits	39232	84760	128496	169544
Number of Code Blocks					
(Notes 3 and 4)					
For Sub-Frames 3,4,8,9	CBs	7	14	21	28
For Sub-Frames 1,2,6,7	CBs	7	14	21	28
For Sub-Frame 5	CBs	7	14	21	27
For Sub-Frame 0	CBs	7	14	21	28
Binary Channel Bits (Note 3)					
For Sub-Frames 3,4,8,9	Bits	54400	108800	163200	217600
For Sub-Frames 1,2,6,7	Bits	54400	108800	163200	217600
For Sub-Frame 5	Bits	47744	99968	152192	206592
For Sub-Frame 0	Bits	48256	102656	157056	211456
Number of layers		4	4	4	4
Max. Throughput averaged over 1 frame (Note 3)	Mbps	41.741	84.4016	128.093	168.766

- Note 1: 1 symbol allocated to PDCCH for all tests.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [15].
- Note 3: Given per component carrier per codeword.
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: Resource blocks n_{PRB} = 0..2 are allocated for SIB transmissions in sub-frame 5 for all bandwidths.
- Note 6: Resource blocks $n_{PRB} = 2..24$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..24$ in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 7: Resource blocks n_{PRB} = 3..49 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..49 in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 8: Resource blocks nPRB = 4..74 are allocated for the user data in sub-frame 5, and resource blocks nPRB = 0..74 in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 9: Resource blocks n_{PRB} = 4..99 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..99 in sub-frames 0,1,2,3,4,6,7,8,9.

Table A.3.2.1.4-5: PDSCH Reference Channel for sustained data-rate test (1024QAM, 2 MIMO layers)

Parameter	Unit	Value				
Reference channel		R.PDSCH.4-	R.PDSCH.4-	R.PDSCH.4-	R.PDSCH.4-	
		5.1 FDD	5.2 FDD	5.3 FDD	5.4 FDD	
Channel bandwidth	MHz	5	10	15	20	
Allocated resource blocks		Note 6	Note 7	Note 8	Note 9	
Allocated subframes per Radio Frame		10	10	10	10	
Modulation		1024QAM	1024QAM	1024QAM	1024QAM	
Coding Rate						
For Sub-Frames 3,4,8,9		0.76	0.73	0.75	0.76	
For Sub-Frames 1,2,6,7		0.76	0.73	0.75	0.76	
For Sub-Frame 5		0.80	0.77	0.78	0.77	
For Sub-Frame 0		0.86	0.78	0.78	0.79	
Information Bit Payload (Note 3)						
For Sub-Frames 3,4,8,9	Bits	27376	52752	81176	110136	
For Sub-Frames 1,2,6,7	Bits	27376	52752	81176	110136	
For Sub-Frame 5	Bits	25456	51024	78704	105528	
For Sub-Frame 0	Bits	27376	52752	81176	110136	
Number of Code Blocks						
(Notes 3 and 4)						
For Sub-Frames 3,4,8,9	CBs	5	9	14	18	
For Sub-Frames 1,2,6,7	CBs	5	9	14	18	
For Sub-Frame 5	CBs	5	9	13	18	
For Sub-Frame 0	CBs	5	9	14	18	
Binary Channel Bits (Note 3)						
For Sub-Frames 3,4,8,9	Bits	36000	72000	108000	144000	
For Sub-Frames 1,2,6,7	Bits	36000	72000	108000	144000	
For Sub-Frame 5	Bits	31680	66240	100800	136800	
For Sub-Frame 0	Bits	31920	67920	103920	139920	
Number of layers		2	2	2	2	
Max. Throughput averaged over 1 frame (Note 3)	Mbps	27.18	52.58	80.93	109.68	

- Note 1: 1 symbol allocated to PDCCH for all tests.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [15].
- Note 3: Given per component carrier per codeword.
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: Resource blocks n_{PRB} = 0..2 are allocated for SIB transmissions in sub-frame 5 for all bandwidths.
- Note 6: Resource blocks $n_{PRB} = 2..24$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..24$ in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 7: Resource blocks n_{PRB} = 3..49 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..49 in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 8: Resource blocks nPRB = 4..74 are allocated for the user data in sub-frame 5, and resource blocks nPRB = 0..74 in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 9: Resource blocks n_{PRB} = 4..99 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..99 in sub-frames 0,1,2,3,4,6,7,8,9.

Table A.3.2.1.4-6: PDSCH Reference Channel for sustained data-rate test (1024QAM, 4 MIMO layers)

Parameter	Unit	Value				
Reference channel		R.PDSCH.4-	R.PDSCH.4-	R.PDSCH.4-	R.PDSCH.4-	
		6.1 FDD	6.2 FDD	6.3 FDD	6.4 FDD	
Channel bandwidth	MHz	5	10	15	20	
Allocated resource blocks		Note 6	Note 7	Note 8	Note 9	
Allocated subframes per Radio Frame		10	10	10	10	
Modulation		1024QAM	1024QAM	1024QAM	1024QAM	
Coding Rate						
For Sub-Frames 3,4,8,9		0.78	0.81	0.79	0.81	
For Sub-Frames 1,2,6,7		0.78	0.81	0.79	0.81	
For Sub-Frame 5		0.82	0.81	0.83	0.82	
For Sub-Frame 0		0.87	0.86	0.82	0.83	
Information Bit Payload (Note 3)						
For Sub-Frames 3,4,8,9	Bits	52752	110136	161760	220296	
For Sub-Frames 1,2,6,7	Bits	52752	110136	161760	220296	
For Sub-Frame 5	Bits	48936	101840	157432	211936	
For Sub-Frame 0	Bits	52752	110136	161760	220296	
Number of Code Blocks						
(Notes 3 and 4)						
For Sub-Frames 3,4,8,9	CBs	9	18	27	36	
For Sub-Frames 1,2,6,7	CBs	9	18	27	36	
For Sub-Frame 5	CBs	8	17	26	35	
For Sub-Frame 0	CBs	9	18	27	36	
Binary Channel Bits (Note 3)						
For Sub-Frames 3,4,8,9	Bits	68000	136000	204000	272000	
For Sub-Frames 1,2,6,7	Bits	68000	136000	204000	272000	
For Sub-Frame 5	Bits	59680	124960	190240	258240	
For Sub-Frame 0	Bits	60320	128320	196320	264320	
Number of layers		4	4	4	4	
Max. Throughput averaged over 1 frame (Note 3)	Mbps	52.37	109.31	161.33	219.46	

- Note 1: 1 symbol allocated to PDCCH for all tests.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [15].
- Note 3: Given per component carrier per codeword.
- Note 4: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 5: Resource blocks n_{PRB} = 0..2 are allocated for SIB transmissions in sub-frame 5 for all bandwidths.
- Note 6: Resource blocks n_{PRB} = 2..24 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..24 in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 7: Resource blocks n_{PRB} = 3..49 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..49 in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 8: Resource blocks nPRB = 4..74 are allocated for the user data in sub-frame 5, and resource blocks nPRB = 0..74 in sub-frames 0,1,2,3,4,6,7,8,9.
- Note 9: Resource blocks n_{PRB} = 4..99 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..99 in sub-frames 0,1,2,3,4,6,7,8,9.

A.3.2.2 TDD

A.3.2.2.1 Reference measurement channels for SCS 15 kHz FR1

Table A.3.2.2.1-1: PDSCH Reference Channel for TDD UL-DL pattern FR1.15-1 and LTE-NR coexistence scenario

Parameter	Unit			Value	
Reference channel		R.PDSCH.1-	R.PDSCH.1-		
	N 41 1-	1.1 TDD	1.2 TDD		
Channel bandwidth	MHz	10	10		
Subcarrier spacing	kHz	15	15		
Allocated resource blocks Number of consecutive PDSCH	PRBs	52	52		
symbols					
For Slot i, if mod(i, 5) = 3 for i from					
{0,,19}		N/A	N/A		
For Slot i, if $mod(i, 5) = \{0, 1, 2\}$ for i		_	4.4		
from {1,,19}		9	11		
Allocated slots per 2 frames		7	7		
MCS table		64QAM	64QAM		
MCS index		4	4		
Modulation		QPSK	QPSK		
Target Coding Rate		0.30	0.30		
Number of MIMO layers		1	1		
Number of DMRS REs					
For Slot i, if $mod(i, 5) = 3$ for i from		N/A	N/A		
{0,,19}		IN/A	IN/A		
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i		12	12		
from {1,,19}					
Overhead for TBS determination		18	18		
Information Bit Payload per Slot					
For Slot 0 and Slot i, if mod(i, 5) =	Bits	N/A	N/A		
{2,3,4} for i from {0,,19}			,		
For Slot i, if $mod(i, 5) = \{0, 1\}$ for i from	Bits	2472	3240		
{1,,19}					
Transport block CRC per Slot					
For Slot 0 and Slot i, if mod(i, 5) =	Bits	N/A	N/A		
$\{2,3,4\}$ for i from $\{0,,19\}$ For Slot i, if mod(i, 5) = $\{0,1\}$ for i from					
$\{1,,19\}$	Bits	16	16		
Number of Code Blocks per Slot					
For Slot 0 and Slot i, if mod(i, 5) =					
{2,3,4} for i from {0,,19}	CBs	N/A	N/A		
For Slot i, if $mod(i, 5) = \{0,1\}$ for i from			,		
{1,,19}	CBs	1	1		
Binary Channel Bits Per Slot					
For Slot 0 and Slot i, if mod(i, 5) =	Bits	N/A	N/A		
{2,3,4} for i from {0,,19}	DIIS				
For Slots i = 10, 11	Bits	7760	10256		
For Slot i, if $mod(i, 5) = \{0,1\}$ for i from	Bits	8384	10880		
{1,,9,12,,19}	טונס	0304	10000		
Max. Throughput averaged over 2	Mbps	0.865	1.134		
frames					

Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms

Note 2: Slot i is slot index per 2 frames

Note 3: No user data is scheduled on slots with LTE PBCH/PSS/SSS

Table A.3.2.2.1-2: PDSCH Reference Channel for TDD CC with UL-DL pattern FR1.15-1 and CA scenario

Parameter	Unit			Value				
		R.PDSCH.1-	R.PDSCH.1-	R.PDSCH.1-	R.PDSCH.1-	R.PDSCH.1-		
Reference channel		2.1 TDD	2.2 TDD	2.3 TDD	2.4 TDD	2.5 TDD		
Channel bandwidth	MHz	5	10	15	20	25		
Subcarrier spacing	kHz	15	15	15	15	15		
Number of allocated resource	PRBs	25	52	79	106	133		
blocks	TINDS	20	32	7.5	100	100		
Number of consecutive PDSCH								
symbols								
For Slot i, if $mod(i, 5) = 3$ for i		8	8	8	8	8		
from {0,,19}		_	_	-	-			
For Slot i, if $mod(i, 5) = \{0,1,2\}$		12	12	12	12	12		
for i from {1,,19}	Clata	4.5	4.5	45	45	4.5		
Allocated slots per 2 frames	Slots	15	15	15	15	15		
MCS table		64QAM	64QAM	64QAM	64QAM	64QAM		
MCS index		13	13	13	13	13		
Modulation Target Coding Rate		16QAM 0.48	16QAM 0.48	16QAM 0.48	16QAM 0.48	16QAM 0.48		
Number of MIMO layers		2	2	2	2	2		
Number of DMRS REs								
For Slot i, if $mod(i, 5) = 3$ for i								
from $\{0,,19\}$		12	12	12	12	12		
For Slot i, if $mod(i, 5) = \{0,1,2\}$								
for i from $\{1,,19\}$		12	12	12	12	12		
Overhead for TBS								
determination		0	0	0	0	0		
Information Bit Payload per Slot								
For Slot i = 0	Bits	N/A	N/A	N/A	N/A	N/A		
For Slot i, if $mod(i, 5) = 3$ for i								
from {0,,19}	Bits	8064	16896	25608	33816	43032		
For Slot i, if $mod(i, 5) = \{0,1,2\}$	Bits	12552	26120	39936	52200	67584		
for i from {1,,19}	DIIS	12552	20120	39930	53288	07364		
Transport block CRC per Slot								
For Slot i = 0	Bits	N/A	N/A	N/A	N/A	N/A		
For Slot i, if $mod(i, 5) = 3$ for i	Bits	24	24	24	24	24		
from {0,,19}	Dito		2 '			21		
For Slot i, if $mod(i, 5) = \{0,1,2\}$	Bits	24	24	24	24	24		
for i from {1,,19}								
Number of Code Blocks per								
Slot For Slot i = 0	CBs	N/A	N/A	N/A	N/A	N/A		
For Slot i, if $mod(i, 5) = 3$ for i		IN/A	IN/A	IN/A	IN/A	IN/A		
from $\{0,,19\}$	CBs	1	3	4	5	6		
For Slot i, if $mod(i, 5) = \{0,1,2\}$								
for i from $\{1,,19\}$	CBs	2	4	5	7	9		
Binary Channel Bits Per Slot								
For Slot i = 0	Bits	N/A	N/A	N/A	N/A	N/A		
For Slots i = 10, 11	Bits	25200	52416	79632	106848	134064		
For Slot i, if $mod(i, 5) = 3$ for i								
from {0,,19}	Bits	16800	34944	53088	71232	89376		
For Slot i, if $mod(i, 5) = \{0,1,2\}$	Dito	26400	E4040	02424	111026	140440		
for i from {1,,9,12,,19}	Bits	20400	54912	83424	111936	140448		
Max. Throughput averaged	Mbps	8.516	17.745	27.086	36.072	45.778		
over 2 frames	•			21.000	30.072	45.770		
Note 1: SS/PBCH block is tran			eriodicity 20 ms					
Note 2: Slot i is slot index per 2 frames								

Table A.3.2.2.1-3: PDSCH Reference Channel for TDD CC with UL-DL pattern FR1.15-1 and CA scenario

Parameter	Unit			Value	
Reference channel		R.PDSCH.1-	R.PDSCH.1-	R.PDSCH.1-	
Reference channel		3.1 TDD	3.2 TDD	3.3 TDD	
Channel bandwidth	MHz	30	40	50	
Subcarrier spacing	kHz	15	15	15	
Number of allocated resource	PRBs	160	246	270	
blocks	PRDS	160	216	270	
Number of consecutive PDSCH					
symbols					
For Slot i, if $mod(i, 5) = 3$ for i		8	8	8	
from {0,,19}		0	0	0	
For Slot i, if $mod(i, 5) = \{0,1,2\}$		12	12	12	
for i from {1,,19}			12		
Allocated slots per 2 frames	Slots	15	15	15	
MCS table		64QAM	64QAM	64QAM	
MCS index		13	13	13	_
Modulation		16QAM	16QAM	16QAM	
Target Coding Rate		0.48	0.48	0.48	
Number of MIMO layers		2	2	2	
Number of DMRS REs					
For Slot i, if $mod(i, 5) = 3$ for i		10	40	10	
from {0,,19}		12	12	12	
For Slot i, if $mod(i, 5) = \{0,1,2\}$		40	40	40	
for i from {1,,19}		12	12	12	
Overhead for TBS		0	0	0	
determination		U	0	U	
Information Bit Payload per Slot					
For Slot i = 0	Bits	N/A	N/A	N/A	
For Slot i, if mod(i, 5) = 3 for i	Bits	51216	69672	86040	
from {0,,19}	DIIS	31210	09072	00040	
For Slot i, if $mod(i, 5) = \{0,1,2\}$	Bits	79896	108552	125206	
for i from {1,,19}	DIIS	79090	100002	135296	
Transport block CRC per Slot					
For Slot i = 0	Bits	N/A	N/A	N/A	
For Slot i, if $mod(i, 5) = 3$ for i	Bits	24	24	24	
from {0,,19}	DIIS	24	24	24	
For Slot i, if $mod(i, 5) = \{0,1,2\}$	Bits	24	24	24	
for i from {1,,19}	Dita	24	24	27	
Number of Code Blocks per					
Slot					
For Slot i = 0	CBs	N/A	N/A	N/A	
For Slot i, if $mod(i, 5) = 3$ for i	CBs	7	9	11	
from {0,,19}	ODS	,	J		
For Slot i, if $mod(i, 5) = \{0,1,2\}$	CBs	10	13	17	
for i from {1,,19}	050	10	10	1,7	
Binary Channel Bits Per Slot					
For Slot i = 0	Bits	N/A	N/A	N/A	
For Slots i = 10, 11	Bits	161280	217728	272160	
For Slot i, if $mod(i, 5) = 3$ for i	Bits	107520	145152	181440	
from {0,,19}	210	107020	110102	101770	
For Slot i, if $mod(i, 5) = \{0,1,2\}$	Bits	168960	228096	285120	
for i from {1,,9,12,,19}	210	100000	220000	200120	
Max. Throughput averaged	Mbps	54.186	73.638	91.621	
over 2 frames					
Note 1: SS/PBCH block is tran		•	eriodicity 20 ms		
Note 2: Slot i is slot index per :	2 frames				

A.3.2.2.2 Reference measurement channels for SCS 30 kHz FR1

Table A.3.2.2.2-1: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-1 and FR1.30-1A (QPSK)

Parameter	Unit			Value		
Deference channel		R.PDSCH.2-	R.PDSCH.2-	R.PDSCH.2-	R.PDSCH.2-	
Reference channel		1.1 TDD	1.2 TDD	1.3 TDD	1.4 TDD	
Channel bandwidth	MHz	40	40	40	40	
Subcarrier spacing	kHz	30	30	30	30	
Allocated resource blocks	PRBs	106	6	106	106	
Number of consecutive PDSCH						
symbols						
For Slot i, if mod(i, 10) = 7 for i from		4	4	N/A	N/A	
{0,,39}		·	•		. 47.	
For Slot i, if mod(i, 10) =		12	12	7	12	
{0,1,2,3,4,5,6} for i from {1,,39}						
Allocated slots per 2 frames	<u> </u>	31	31	27	27	
MCS table	<u> </u>	64QAM	64QAM	64QAM	64QAMLowSE	
MCS index		4 QPSK	4	4	14	
Modulation Towart Coding Date			QPSK	QPSK	QPSK	
Target Coding Rate		0.30	0.30	0.30 1	0.59	
Number of MIMO layers Number of DMRS REs		1	1	1	ı ı	
For Slot i, if mod(i, 10) = 7 for i from						
$\{0,,39\}$		6	6	N/A	N/A	
For Slot i, if mod(i, 10) =						
{0,1,2,3,4,5,6} for i from {1,,39}		18	12	12	12	
Overhead for TBS determination		0	0	0	0	
Information Bit Payload per Slot		Ŭ	•	·	Ŭ	
For Slots 0 and Slot i, if mod(i, 10)						
$= \{8,9\}$ for i from $\{0,,39\}$	Bits	N/A	N/A	N/A	N/A	
For Slot i, if $mod(i, 10) = 7$ for i from	D::	2224	4.4.4	21/2	21/2	
{0,,39}	Bits	2664	144	N/A	N/A	
For Slot i, if mod(i, 10) =	D:4-	0004	400	4000	40000	
{0,1,2,3,4,5,6} for i from {1,,39}	Bits	8064	480	4608	16392	
Transport block CRC per Slot						
For Slots 0 and Slot i, if mod(i, 10)	Bits	N/A	N/A	N/A	N/A	
$= \{8,9\}$ for i from $\{0,,39\}$	Dita	IN//A	IN//A	IN//A	14/74	
For Slot i, if $mod(i, 10) = 7$ for i from	Bits	16	16	N/A	N/A	
{0,,39}	Dito	10	10	14/71	14/71	
For Slot i, if mod(i, 10) =	Bits	24	16	24	24	
{0,1,2,3,4,5,6} for i from {1,,39}						
Number of Code Blocks per Slot						
For Slots 0 and Slot i, if mod(i, 10)	CBs	N/A	N/A	N/A	N/A	
= {8,9} for i from {0,,39}						
For Slot i, if mod(i, 10) = 7 for i from $\{0,,39\}$	CBs	1	1	N/A	N/A	
For Slot i, if mod(i, 10) =						
$\{0,1,2,3,4,5,6\}$ for i from $\{1,,39\}$	CBs	1	1	1	2	
Binary Channel Bits Per Slot						
For Slots 0 and Slot i, if mod(i, 10)						
$= \{8,9\}$ for i from $\{0,,39\}$	Bits	N/A	N/A	N/A	N/A	
For Slots i = 20, 21	Bits	25440	1512	13992	26712	
For Slot i, if $mod(i, 10) = 7$ for i from						
{0,,39}	Bits	8904	504	N/A	N/A	
For Slot i, if mod(i, 10) =						
{0,1,2,3,4,5,6} for i from	Bits	26712	1584	15264	27984	
{1,,19,22,,39}						
Max. Throughput averaged over 2	Mbps	11.419	0.677	6.221	22.129	
frames	·			0.221	22.123	
Note 1: SS/PBCH block is transmitted	ed in slot	t #0 with periodi	city 20 ms			

Table A.3.2.2.2-2: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-1 (16QAM)

Parameter	Unit			Value		
Reference channel		R.PDSCH.2-	R.PDSCH.2-	R.PDSCH.2-	R.PDSCH.2-	R.PDSCH.2-
Reference channel		2.1 TDD	2.2 TDD	2.3 TDD	2.4 TDD	2.5 TDD
Channel bandwidth	MHz	40	40	40	40	40
Subcarrier spacing	kHz	30	30	30	30	30
Allocated resource blocks	PRBs	106	106	106	106	106
Number of consecutive						
PDSCH symbols						
For Slot i, if $mod(i, 10) = 7$		4	4	4	4	4
for i from {0,,39}		4	4	4	4	
For Slot i, if mod(i, 10) =						12
{0,1,2,3,4,5,6} for i from		12	12	12	12	
{1,,39}						
Allocated slots per 2 frames		31	31	31	31	31
MCS table		64QAM	64QAM	64QAM	64QAM	64QAMLowS
MCS index		13	13	13	13	19
Modulation		16QAM	16QAM	16QAM	16QAM	16QAM
Target Coding Rate		0.48	0.48	0.48	0.48	0.54
Number of MIMO layers		1	2	3	4	2
Number of DMRS REs						
For Slot i, if $mod(i, 10) = 7$		-	- 6	10	40	6
for i from {0,,39}		6	6	12	12	
For Slot i, if mod(i, 10) =						12
{0,1,2,3,4,5,6} for i from		12	12	24	24	
{1,,39}	<u> </u>		<u> </u>			
Overhead for TBS		0		0	0	0
determination		0	0	0	U	
Information Bit Payload per						
Slot						
For Slots 0 and Slot i, if						N/A
$mod(i, 10) = \{8,9\}$ for i from	Bits	N/A	N/A	N/A	N/A	
{0,,39}						
For Slot i, if $mod(i, 10) = 7$	Dito	0.456	16006	22022	20102	19464
for i from {0,,39}	Bits	8456	16896	22032	29192	
For Slot i, if mod(i, 10) =						60456
{0,1,2,3,4,5,6} for i from	Bits	26632	53288	73776	98376	
{1,,39}						
Transport block CRC per Slot						
For Slots 0 and Slot i, if						N/A
$mod(i, 10) = \{8,9\}$ for i from	Bits	N/A	N/A	N/A	N/A	
{0,,39}						
$\{0,,39\}$ For Slot i, if mod(i, 10) = 7	Bits	24	24	24	24	24
for i from {0,,39}	Dito	27	27	27	24	
For Slot i, if mod(i, 10) =						24
{0,1,2,3,4,5,6}for i from	Bits	24	24	24	24	
{1,,39}						
Number of Code Blocks per						
Slot						
For Slots 0 and Slot i, if						N/A
$mod(i, 10) = \{8,9\}$ for i from	CBs	N/A	N/A	N/A	N/A	
{0,,39}	1					
For Slot i, if $mod(i, 10) = 7$	CBs	2	3	3	4	3
for i from {0,,39}	000				'	
For Slot i, if mod(i, 10) =			_	_		8
{0,1,2,3,4,5,6} for i from	CBs	4	7	9	12	
{1,,39}	ļ					
Binary Channel Bits Per Slot	1					/-
For Slots 0 and Slot i, if						N/A
$mod(i, 10) = \{8,9\}$ for i from	Bits	N/A	N/A	N/A	N/A	
{0,,39}	<u> </u>		1			
For Slots i = 20, 21	Bits	53424	106848	144008	193344	101760
For Slot i, if $mod(i, 10) = 7$	Bits	17808	35616	45792	61056	35616
for i from {0,,39}	2.10	.,,,,,,	30010	10.102	3.000	
For Slot i, if $mod(i, 10) =$						111936
{0,1,2,3,4,5,6} for i from	Bits	55968	111936	152640	203520	
{1,,19,22,,39}						

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Max. Thro	oughput averaged ames	Mbps	37.644	75.318	104.004	138.646	85.508	
Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms								
Note 2:	Slot i is slot index pe	r 2 frame	es					

Table A.3.2.2.2-3: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-1 (64QAM)

Parameter	Unit			Value		
		R.PDSCH.2-	R.PDSCH.2-	R.PDSCH.2-	R.PDSCH.2-	
Reference channel		3.1 TDD	3.2 TDD	3.3 TDD	3.4 TDD	
Channel bandwidth	MHz	40	40	40	40	
Subcarrier spacing	kHz	30	30	30	30	
Allocated resource blocks	PRBs	106	106	53 (Note 3)	53 (Note 4)	-
Number of consecutive PDSCH						
symbols						
For Slot i, if mod(i, 10) = 7 for i from		4	4	4	4	
{0,,39}		7				
For Slot i, if mod(i, 10) =		12	12	12	12	
{0,1,2,3,4,5,6} for i from {1,,39}						
Allocated slots per 2 frames		31	31	31	31	
MCS table		64QAM	64QAM	64QAM	64QAM	
MCS index		19	19	19	19	
Modulation		64QAM	64QAM	64QAM	64QAM	
Target Coding Rate		0.51	0.51	0.51	0.51	
Number of MIMO layers	1	2	2	2	2	
Number of DMRS REs	1					
For Slot i, if $mod(i, 10) = 7$ for i from		6	12	12	12	
{0,,39}		_	0.4	2.4	0.1	
For Slot i, if mod(i, 10) =		12	24	24	24	
{0,1,2,3,4,5,6} for i from {1,,39}			0	0	0	
Overhead for TBS determination		0	0	0	0	
Information Bit Payload per Slot			N1/A	N1/A	NI/A	
For Slots 0 and Slot i, if $mod(i, 10) =$	Bits	N/A	N/A	N/A	N/A	
{8,9} for i from {0,,39} For Slot i, if mod(i, 10) = 7 for i from			23040	11500	11528	
	Bits	27144	23040	11528	11528	
{0,,39} For Slot i, if mod(i, 10) =			77896	38936	38936	
$\{0,1,2,3,4,5,6\}$ for i from $\{1,,39\}$	Bits	83976	11090	30930	30930	
Transport block CRC per Slot						
For Slots 0 and Slot i, if mod(i, 10) =			N/A	N/A	N/A	
{8,9} for i from {0,,39}	Bits	N/A	IN/A	IN/A	IN/A	
For Slot i, if $mod(i, 10) = 7$ for i from			24	24	24	
{0,,39}	Bits	24				
For Slot i, if mod(i, 10) =			24	24	24	
{0,1,2,3,4,5,6}for i from {1,,39}	Bits	24				
Number of Code Blocks per Slot						
For Slots 0 and Slot i, if mod(i, 10) =	CD-	NI/A	N/A	N/A	N/A	
{8,9} for i from {0,,39}	CBs	N/A				
For Slot i, if $mod(i, 10) = 7$ for i from	CBs	4	3	2	2	
{0,,39}	CDS	4				
For Slot i, if mod(i, 10) =	CBs	10	10	5	5	
{0,1,2,3,4,5,6} for i from {1,,39}	CDS	10				
Binary Channel Bits Per Slot						
For Slots 0 and Slot i, if mod(i, 10) =	Bits	N/A	N/A	N/A	N/A	
{8,9} for i from {0,,39}		IN/A				
For Slots i = 20, 21	Bits	160272	137376	68688	68688	
For Slot i, if $mod(i, 10) = 7$ for i from	Bits	53424	45792	22896	22896	
{0,,39}	2.10	00121				
For Slot i, if mod(i, 10) =	F.:.	40700:	152640	76320	76320	
{0,1,2,3,4,5,6} for i from	Bits	167904				
{1,,19,22,,39}			400 700	F4 000	F 4 000	
Max. Throughput averaged over 2	Mbps	118.796	109.768	54.869	54.869	
frames Note 1: SS/PBCH block is transmitted.			lity 20 mg	<u> </u>		

Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms

Note 2: Slot i is slot index per 2 frames

Note 3: PDSCH is scheduled in PRB numbers from 0 to 52. Note 4: PDSCH is scheduled in PRB numbers from 53 to 105.

Table A.3.2.2.4: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-1 (256QAM)

Parameter	Unit		Valu	ie	
Reference channel		R.PDSCH.2- 4.1 TDD			
Channel bandwidth	MHz	40			
Subcarrier spacing	kHz	30			
Allocated resource blocks	PRBs	106			
Number of consecutive PDSCH					
symbols					
For Slot i, if mod(i, 10) = 7 for i from $\{0,,39\}$		4			
For Slot i, if mod(i, 10) = $\{0,1,2,3,4,5,6\}$ for i from $\{1,,39\}$		12			
Allocated slots per 2 frames		31			
MCS table		256QAM			
MCS index		24			
Modulation		256QAM			
Target Coding Rate		0.82			
Number of MIMO layers		1			
Number of DMRS REs					
For Slot i, if mod(i, 10) = 7 for i from $\{0,,39\}$		6			
For Slot i, if mod(i, 10) = $\{0,1,2,3,4,5,6\}$ for i from $\{1,,39\}$		12			
Overhead for TBS determination		0			
Information Bit Payload per Slot					
For Slots 0 and Slot i, if $mod(i, 10) = \{8,9\}$ for i from $\{0,,39\}$	Bits	N/A			
For Slot i, if $mod(i, 10) = 7$ for i from $\{0,,39\}$	Bits	29192			
For Slot i, if mod(i, 10) = $\{0,1,2,3,4,5,6\}$ for i from $\{1,,39\}$	Bits	92200			
Transport block CRC per Slot					
For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,,39}	Bits	N/A			
For Slot i, if mod(i, 10) = 7 for i from $\{0,,39\}$	Bits	24			
For Slot i, if $mod(i, 10) = \{0,1,2,3,4,5,6\}$	Bits	24			
for i from {1,,39}					
Number of Code Blocks per Slot For Slots 0 and Slot i, if mod(i, 10) =					
{8,9} for i from {0,,39}	CBs	N/A			
For Slot i, if mod(i, 10) = 7 for i from $\{0,,39\}$	CBs	4			
For Slot i, if mod(i, 10) = $\{0,1,2,3,4,5,6\}$ for i from $\{1,,39\}$	CBs	11			
Binary Channel Bits Per Slot					
For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,,39}	Bits	N/A			
For Slots i = 20, 21	Bits	106848			
For Slot i, if $mod(i, 10) = 7$ for i from $\{0,,39\}$	Bits	35616			
For Slot i, if mod(i, 10) = $\{0,1,2,3,4,5,6\}$ for i from $\{1,,19,22,,39\}$	Bits	111936			
Max. Throughput averaged over 2	Mbps	130.308			
frames Note 1: SS/PBCH block is transmitted i) mc		
Note 1: SS/PBCH block is transmitted i Note 2: Slot i is slot index per 2 frames	11 210t #U V	vitir periodicity 20	6 III 6		

Table A.3.2.2.5: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-2

Parameter	Unit		Value	
Reference channel		R.PDSCH.2- 5.1 TDD		
Channel bandwidth	MHz	40		
Subcarrier spacing	kHz	30		
Allocated resource blocks	PRBs	106		
Number of consecutive PDSCH				
symbols				
For Slot i, if $mod(i, 5) = 3$ for i from $\{0,,39\}$		8		
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i from $\{1,,39\}$		12		
Allocated slots per 2 frames		31		
MCS table		64QAM		
MCS index		4		
Modulation		QPSK		
Target Coding Rate		0.30		
Number of MIMO layers		1		
Number of DMRS REs				
For Slot i, if $mod(i, 5) = 3$ for i from		4.0		
{0,,39}		12		
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i		40		
from {1,,39}		12		
Overhead for TBS determination		0		
Information Bit Payload per Slot				
For Slot 0 and Slot i, if mod(i, 5) = 4 for	Dito	NI/A		
i from {0,,39}	Bits	N/A		
For Slot i, if $mod(i, 5) = 3$ for i from	Bits	5276		
{0,,39}	DIIS	5376		
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i	Bits	8456		
from {1,,39}	Dita	0430		
Transport block CRC per Slot				
For Slot 0 and Slot i, if $mod(i, 5) = 4$ for i from $\{0,,39\}$	Bits	N/A		
For Slot i, if $mod(i, 5) = 3$ for i from $\{0,,39\}$	Bits	24		
For Slot i, if mod(i, 5) = $\{0,1,2\}$ for i from $\{1,,39\}$	Bits	24		
Number of Code Blocks per Slot			 	
For Slot 0 and Slot i, if mod(i, 5) = 4 for	CBs	N/A		
i from $\{0,,39\}$ For Slot i, if mod(i, 5) = 3 for i from	CBs	1		
$\{0,,39\}$ For Slot i, if mod(i, 5) = $\{0,1,2\}$ for i				
from {1,,39}	CBs	2		
Binary Channel Bits Per Slot				
For Slot 0 and Slot i, if $mod(i, 5) = 4$ for i from $\{0,,39\}$	Bits	N/A		
For Slot i = 20, 21	Bits	26712		
For Slot i, if $mod(i, 5) = 3$ for i from $\{0,,39\}$	Bits	17808		
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i from $\{1,,19,22,,39\}$	Bits	27984		
Max. Throughput averaged over 2 frames	Mbps	11.875		
Note 1: SS/PBCH block is transmitted i	n slot #0 u	ith periodicity 20	0 ms	-
Note 2: Slot i is slot index per 2 frames	ii siul #U W	vian periodicity 20	o mo	

Table A.3.2.2.6: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-3

Parameter	Unit		Value	
Reference channel		R.PDSCH.2- 6.1 TDD		
Channel bandwidth	MHz	40		
Subcarrier spacing	kHz	30		
Allocated resource blocks	PRBs	106		
Number of consecutive PDSCH				
symbols				
For Slot i, if mod(i, 10) = $\{3,7\}$ for i from $\{0,,39\}$		8		
For Slot i, if $mod(i, 10) = \{0,1,2,5,6\}$ for i from $\{1,,39\}$		12		
Allocated slots per 2 frames		27		
MCS table		64QAM		
MCS index		4		
Modulation		QPSK		
Target Coding Rate		0.30		
Number of MIMO layers		1		
Number of DMRS REs				
For Slot i, if $mod(i, 10) = \{3,7\}$ for i from		12		
{0,,39}		12		
For Slot i, if $mod(i, 10) = \{0,1,2,5,6\}$ for		12		
i from {1,,39}				
Overhead for TBS determination		0		
Information Bit Payload per Slot				
For Slot 0 and Slot i, if mod(i, 10) =	Bits	N/A		
{4,8,9} for i from {0,,39}				
For Slot i, if $mod(i, 10) = \{3,7\}$ for i from	Bits	5376		
$\{0,,39\}$ For Slot i, if mod(i, 10) = $\{0,1,2,5,6\}$ for				
i from {1,,39}	Bits	8456		
Transport block CRC per Slot				
For Slot 0 and Slot i, if mod(i, 10) =				
{4,8,9} for i from {0,,39}	Bits	N/A		
For Slot i, if $mod(i, 10) = \{3,7\}$ for i from	D::	0.4		
{0,,39}	Bits	24		
For Slot i, if $mod(i, 10) = \{0,1,2,5,6\}$ for	Bits	24		
i from {1,,39}	סונס	24		
Number of Code Blocks per Slot				
For Slot 0 and Slot i, if mod(i, 10) =	CBs	N/A		
{4,8,9} for i from {0,,39}	ODS	IN/A		
For Slot i, if $mod(i, 10) = \{3,7\}$ for i from $\{0,,39\}$	CBs	1		
For Slot i, if $mod(i, 10) = \{0,1,2,5,6\}$ for	CBs	2		
i from {1,,39}	CD3	2		
Binary Channel Bits Per Slot				
For Slot 0 and Slot i, if mod(i, 10) =	Bits	N/A		
{4,8,9} for i from {0,,39}				
For Slot i = 20, 21	Bits	26712		
For Slot i, if mod(i, 10) = $\{3,7\}$ for i from $\{0,,39\}$	Bits	17808		
For Slot i, if $mod(i, 10) = \{0,1,2,5,6\}$ for i from $\{1,,19,22,,39\}$	Bits	27984		
Max. Throughput averaged over 2	Mhna	10 104		
frames	Mbps	10.184		
Note 1: SS/PBCH block is transmitted i	n slot #0 v	vith periodicity 20	0 ms	
Note 2: Slot i is slot index per 2 frames				

Table A.3.2.2.7: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-1 and CSI-RS overlapped with PDSCH

Parameter	Unit		Value	
Reference channel		R.PDSCH.2-		
		7.1 TDD		
Channel bandwidth	MHz	40		
Subcarrier spacing	kHz	30		
Allocated resource blocks	PRBs	106		
Number of consecutive PDSCH symbols				
For Slot i, if mod(i, 10) = 7 for i from				
{0,,39}		4		
For Slot i, if $mod(i, 10) = \{0,1,2,3,4,5,6\}$		40		
for i from {1,,39}		12		
Allocated slots per 2 frames		31		
MCS table		64QAM		
MCS index		13		
Modulation		16QAM		
Target Coding Rate		0.48		
Number of MIMO layers		2		
Number of DMRS REs For Slot i, if mod(i, 10) = 7 for i from				
$\{0,,39\}$		6		
For Slot i, if $mod(i, 10) = \{0,1,2,3,4,5,6\}$				
for i from {1,,39}		12		
Overhead for TBS determination		0		
Information Bit Payload per Slot				
For Slots 0 and Slot i, if mod(i, 10) =	Bits	N/A		
{8,9} for i from {0,,39}	סונס	IN/A		
For Slot i, if $mod(i, 10) = 7$ for i from	Bits	16896		
{0,,39}				
For Slot i, if $mod(i, 10) = \{0,1,2,3,4,5,6\}$ for i from $\{1,,39\}$	Bits	53288		
Transport block CRC per Slot				
For Slots 0 and Slot i, if mod(i, 10) =				
{8,9} for i from {0,,39}	Bits	N/A		
For Slot i, if mod(i, 10) = 7 for i from	Bits	24		
{0,,39}	DIIS	24		
For Slot i, if $mod(i, 10) = \{0,1,2,3,4,5,6\}$	Bits	24		
for i from {1,,39}	D 110			
Number of Code Blocks per Slot				
For Slots 0 and Slot i, if mod(i, 10) =	CBs	N/A		
$\{8,9\}$ for i from $\{0,,39\}$ For Slot i, if mod(i, 10) = 7 for i from				
{0,,39}	CBs	3		
For Slot i, if $mod(i, 10) = \{0,1,2,3,4,5,6\}$	0.5	_		
for i from {1,,39}	CBs	7		
Binary Channel Bits Per Slot				
For Slots 0 and Slot i, if mod(i, 10) =	Bits	N/A		
{8,9} for i from {0,,39}	סווט	11//\		
For Slot i, if mod(i, 10) = $\{0,5\}$ for i from	Bits	103456		
{1,,19,22,,39}				
For Slots i = 20 For Slots i = 21	Bits Bits	98368 106848		
For Slots i = 21 For Slot i, if mod(i, 10) = 7 for i from				
{0,,39}	Bits	35616		
For Slot i, if $mod(i, 10) = \{1,2,3,4,6\}$ for	5	444555		
i from {1,,19,22,,39}	Bits	111936		
Max. Throughput averaged over 2	Mbps	75.318		
frames	-			
Note 1: SS/PBCH block is transmitted i	n slot #0 v	vith periodicity $\overline{20}$) ms	
Note 2: Slot i is slot index per 2 frames				

Table A.3.2.2.2-8: PDSCH Reference Channel for TDD PMI reporting requirements with UL-DL pattern FR1.30-1

Parameter	Unit			Value	
Reference channel		R.PDSCH.2-	R.PDSCH.2-	R.PDSCH.2-	
Reference channel		8.1 TDD	8.2 TDD	8.3 TDD	
Channel bandwidth	MHz	40	40	40	
Subcarrier spacing	kHz	30	30	30	
Allocated resource blocks	PRBs	106	106	106	
Number of consecutive PDSCH		12	12	12	
symbols					
Allocated slots per 2 frames		23	23	23	
MCS table		64QAM	64QAM	64QAM	
MCS index		13	13	20	
Modulation		16QAM	16QAM	64QAM	
Target Coding Rate		0.48	0.48	0.55	
Number of MIMO layers		1	2	2	
Number of DMRS REs (Note 3)		24	24	24	
Overhead for TBS determination		0	0	0	
Information Bit Payload per Slot					
For Slots 0 and Slot i, if mod(i, 10) =	Bits	N/A	N/A	N/A	
{7,8,9} for i from {0,,39}	סווט	1 11/7	1 11/7	1 11/7	
For CSI-RS Slot i, if mod(i,10) =1 for i	Bits	N/A	N/A	N/A	
from {0,,39}	Dita				
For Slot i = 20	Bits	24576	49176	83976	
For Slot i, if $mod(i, 10) = \{0,2,3,4,5,6\}$	Bits	24576	49176	83976	
for i from {1,,19,22,,39}	Dito	24070	43170	00070	
Transport block CRC per Slot					
For Slots 0 and Slot i, if mod(i, 10) =	Bits	N/A	N/A	N/A	
{7,8,9} for i from {0,,39}	Dito	14/71	14// (14/7 (
For CSI-RS Slot i, if $mod(i,10) = 1$ for i	Bits	N/A	N/A	N/A	
from {0,,39}		·			
For Slot i = 20	Bits	24	24	24	
For Slot i, if $mod(i, 10) = \{0,2,3,4,5,6\}$	Bits	24	24	24	
for i from {1,,19,22,,39}	5.1.0				
Number of Code Blocks per Slot					
For Slots 0 and Slot i, if mod(i, 10) =	CBs	N/A	N/A	N/A	
{7,8,9} for i from {0,,39}					
For CSI-RS Slot i, if mod(i,10) =1 for i	CBs	N/A	N/A	N/A	
from {0,,39}					
For Slot i = 20	CBs	3	6	10	
For Slot i, if $mod(i, 10) = \{0,2,3,4,5,6\}$	CBs	3	6	10	
for i from {1,,19,22,,39}			_		
Binary Channel Bits Per Slot	1				
For Slots 0 and Slot i, if mod(i, 10) =	Bits	N/A	N/A	N/A	
{7,8,9} for i from {0,,39}	ļ				
For CSI-RS Slot i, if mod(i,10) =1 for i	Bits	N/A	N/A	N/A	
from {0,,39}					
For Slot i = 20	Bits	48336	96672	145008	
For Slot i, if mod(i, 10) = $\{0,2,3,4,5,6\}$	Bits	50880	101760	152640	
for i from {1,,19,22,,39}					
Max. Throughput averaged over 2	Mbps	28.2624	56.5524	96.5724	
frames Note 1: SS/PBCH block is transmitted	, i				

Note 1:

Note 2:

SS/PBCH block is transmitted in slot #0 with periodicity 20 ms
Slot i is slot index per 2 frames
Number of DMRS REs includes the overhead of the DM-RS CDM groups without data Note 3:

Table A.3.2.2.2-9: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-4 (64QAM)

Parameter	Unit		Value	
Reference channel		R.PDSCH.2- 9.1 TDD		
Channel bandwidth	MHz	20		
Subcarrier spacing	kHz	30		
Allocated resource blocks	PRBs	51		
Number of consecutive PDSCH				
symbols				
For Slot i, if mod(i, 10) = 3 for i from $\{0,,39\}$		4		
For Slot i, if $mod(i, 10) = \{0,1,2,6,7,8,9\}$ for i from $\{1,,39\}$		12		
Allocated slots per 2 frames		31		
MCS table		64QAM		
MCS index		19		
Modulation		64QAM		
Target Coding Rate		0.51		
Number of MIMO layers		2		
Number of DMRS REs				
For Slot i, if $mod(i, 10) = 3$ for i from $\{0,,39\}$		6		
For Slot i, if mod(i, 10) = $\{0,1,2,6,7,8,9\}$ for i from $\{1,,39\}$		12		
Overhead for TBS determination		0		
Information Bit Payload per Slot				
For Slots 0 and Slot i, if mod(i, 10) = {4,5} for i from {0,,39}	Bits	N/A		
For Slot i, if mod(i, 10) = 3 for i from $\{0,,39\}$	Bits	13064		
For Slot i, if mod(i, 10) = $\{0,1,2,6,7,8,9\}$ for i from $\{1,,39\}$	Bits	40976		
Transport block CRC per Slot				
For Slots 0 and Slot i, if mod(i, 10) =	Bits	N/A		
$\{4,5\}$ for i from $\{0,,39\}$ For Slot i, if mod(i, 10) = 3 for i from	Bits	24		
$\{0,,39\}$ For Slot i, if mod(i, 10) = $\{0,1,2,6,7,8,9\}$	Bits	24		
for i from {1,,39}				
Number of Code Blocks per Slot				
For Slots 0 and Slot i, if mod(i, 10) = {4,5} for i from {0,,39}	CBs	N/A		
For Slot i, if $mod(i, 10) = 3$ for i from $\{0,,39\}$	CBs	2		
For Slot i, if $mod(i, 10) = \{0,1,2,6,7,8,9\}$ for i from $\{1,,39\}$	CBs	5		
Binary Channel Bits Per Slot				
For Slots 0 and Slot i, if mod(i, 10) = {4,5} for i from {0,,39}	Bits	N/A		
For Slots i = 20, 21	Bits	77112		
For Slot i, if mod(i, 10) = 3 for i from $\{0,,39\}$	Bits	25704		
For Slot i, if mod(i, 10) = $\{0,1,2,6,7,8,9\}$ for i from $\{1,,19,22,,39\}$	Bits	80784		
Max. Throughput averaged over 2	Mbps	57.930		
rames Note 1: SS/PBCH block is transmitted i		vith periodicity 20	0 ms	
Note 1: SS/PBCH block is transmitted in Note 2: Slot i is slot index per 2 frames	11 SIUL #U V	viiii periodicity 20	OIII O	

Table A.3.2.2.2-10: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-1 and HST scenario

Parameter	Unit			Value		
Reference channel		R.PDSCH.2-	R.PDSCH.2-	R.PDSCH.2-	R.PDSCH.2-	R.PDSCH.2-
		10.1 TDD	10.2 TDD	10.3 TDD	10.4 TDD	10.5 TDD
Channel bandwidth	MHz	40	40	40	40	40
Subcarrier spacing	kHz	30	30	30	30	30
Allocated resource blocks Number of consecutive PDSCH	PRBs	106	106	106	106	106
symbols						
For Slot i, if mod(i, 10) = 7 for i						
from {0,,39}		4	N/A	4	N/A	4
For Slot i, if mod(i, 10) =						
{0,1,2,3,4,5,6} for i from		12	12	12	12	12
{1,,39}						
Allocated slots per 2 frames		31	27	31	27	31
MCS table		64QAM	64QAM	64QAM	64QAM	64QAM
MCS index		13	13	17	13	17
Modulation		16QAM	16QAM	64QAM	16QAM	64QAM
Target Coding Rate		0.48	0.48	0.43	0.48	0.43
Number of MIMO layers		1	1	1	2	2
Number of DMRS REs	1					
For Slot i, if mod(i, 10) = 7 for i from $\{0,,39\}$		6	N/A	6	N/A	6
For Slot i, if mod(i, 10) =						
{0,1,2,3,4,5,6} for i from		18	18	18	18	18
{1,,39}						
Overhead for TBS						_
determination		0	0	0	0	0
Information Bit Payload per Slot						
For Slots 0 and Slot i, if mod(i,	Bits	N/A	N/A	N/A	N/A	N/A
$10) = \{8,9\}$ for i from $\{0,,39\}$	Dito	14/71	14/71	14/71	14/71	14//
For Slot i, if $mod(i, 10) = 7$ for i	Bits	8456	N/A	11528	N/A	19464
from {0,,39} For Slot i, if mod(i, 10) =						
{0,1,2,3,4,5,6} for i from	Bits	25608	25608	33816	51216	58384
{1,,39}	Dita	23000	23000	33010	31210	30304
Transport block CRC per Slot						
For Slots 0 and Slot i, if mod(i,	D:4-	NI/A	NI/A	NI/A	NI/A	NI/A
10) = $\{8,9\}$ for i from $\{0,,39\}$	Bits	N/A	N/A	N/A	N/A	N/A
For Slot i, if $mod(i, 10) = 7$ for i	Bits	24	N/A	24	N/A	24
from {0,,39}	Dito		14/71	21	14/71	
For Slot i, if mod(i, 10) =	D:4-	0.4	0.4	0.4	0.4	0.4
{0,1,2,3,4,5,6} for i from	Bits	24	24	24	24	24
{1,,39} Number of Code Blocks per						
Slot						
For Slots 0 and Slot i, if mod(i,	OD-	NI/A	NI/A	N1/A	N1/A	N1/A
$10) = \{8,9\}$ for i from $\{0,,39\}$	CBs	N/A	N/A	N/A	N/A	N/A
For Slot i, if $mod(i, 10) = 7$ for i	CBs	2	N/A	2	N/A	3
from {0,,39}	ODS		14/71		14/71	0
For Slot i, if mod(i, 10) =	00	_	4	_	-	7
{0,1,2,3,4,5,6} for i from {1,,39}	CBs	4	4	5	7	7
Binary Channel Bits Per Slot						
For Slots 0 and Slot i, if mod(i,						
$10) = \{8,9\}$ for i from $\{0,,39\}$	Bits	N/A	N/A	N/A	N/A	N/A
For Slots i = 1,2,21,22	Bits	52176 (Note 3)	50880	76320	104304	156456
For Slot i, if $mod(i, 10) = 7$ for i from $\{0,,39\}$	Bits	17808	N/A	26712	N/A	53424
For Slot i, if mod(i, 10) =						
{0,1,2,3,4,5,6} for i from	Bits	53424	53424	80136	106848	160272
{3,,20,23,,39}						
Max. Throughput averaged	Mbps	36.262	34.5708	47.9572	69.1416	82.7112
over 2 frames Note 1: SS/PBCH block is tran	•					

Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms
Note 2: Slot i is slot index per 2 frames
Note 3: Binary Channel Bits are calculated under assumption of 52 PRBs TRS allocation.

Table A.3.2.2.2-11: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-5

Parameter	Unit		Value	
Reference channel		R.PDSCH.2-		
		11.1 TDD		
Channel bandwidth	MHz	40		
Subcarrier spacing	kHz	30		
Allocated resource blocks	PRBs	106		
Number of consecutive PDSCH				
symbols				
For Slot i, if $mod(i, 4) = 0$ for i from		12		
$\{1,,39\}$ For Slot i, if mod(i, 4) = 1 for i from				
{0,,39}		10		
Allocated slots per 2 frames		31		
MCS table		64QAM		
MCS index		4		
Modulation		QPSK		
Target Coding Rate		0.30		
Number of MIMO layers		1		
Number of DMRS REs				
For Slot i, if $mod(i, 4) = 0$ for i from		10		
{1,,39}		18		
For Slot i, if mod(i, 4) = 1 for i from		18		
{0,,39}		_		
Overhead for TBS determination		0		
Information Bit Payload per Slot				
For Slot 0 and Slot i, if $mod(i, 4) = \{2,3\}$	Bits	N/A		
for i from {0,,39}	5.10	14//		
For Slot i, if $mod(i, 4) = 0$ for i from	Bits	8064		
{1,,39}				
For Slot i, if $mod(i, 4) = 1$ for i from $\{0,,39\}$	Bits	6528		
Transport block CRC per Slot				
For Slot 0 and Slot i, if $mod(i, 4) = \{2,3\}$				
	Bits	N/A		
for i from $\{0,,39\}$ For Slot i, if mod(i, 4) = 0 for i from	D:1-	0.4		
{1,,39}	Bits	24		
For Slot i, if mod(i, 4) = 1 for i from	Bits	24		
{0,,39}	סונס	24		
Number of Code Blocks per Slot				
For Slot 0 and Slot i, if $mod(i, 4) = \{2,3\}$	CBs	N/A		
for i from {0,,39}				
For Slot i, if $mod(i, 4) = 0$ for i from	CBs	1		
$\{1,,39\}$ For Slot i, if mod(i, 4) = 1 for i from				
{0,,39}	CBs	1		
Binary Channel Bits Per Slot				
For Slot 0 and Slot i, if $mod(i, 4) = \{2,3\}$				
for i from $\{0,,39\}$	Bits	N/A		
For Slot i = 20	Bits	25440		
For Slot i = 21	Bits	20352		
For Slot i, if $mod(i, 4) = 0$ for i from				
{1,,19,22,,39}	Bits	26712		
For Slot i, if mod(i, 4) = 1 for i from	Bits	21624		
{0,,19,22,,39}	סום	21024		
Max. Throughput averaged over 2	Mbps	6.893		
frames	•			
Note 1: SS/PBCH block is transmitted i Note 2: Slot i is slot index per 2 frames	n siot #0 v	vitn periodicity 20	u ms	

Table A.3.2.2.2-12: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-6

Parameter	Unit		Value		
Reference channel		R.PDSCH.2-			
Channel bandwidth	MHz	12.1 TDD 40			
Subcarrier spacing	kHz	30			
Allocated resource blocks	PRBs	106			
Number of consecutive PDSCH		,,,,,			
symbols					
For Slot i, if mod(i, 4) = 0 for i from		12			
{1,,39}		12			
For Slot i, if $mod(i, 4) = 1$ for i from		8			
$\{0,,39\}$ For Slot i, if mod(i, 4) = 2 for i from					
$\{0,,39\}$		10			
Allocated slots per 2 frames		31			
MCS table		64QAM			
MCS index		4			
Modulation		QPSK			
Target Coding Rate		0.30			
Number of MIMO layers		1			
Number of DMRS REs				1	
For Slot i, if $mod(i, 4) = 0$ for i from		18			
$\{0,,39\}$		18			
For Slot i, if $mod(i, 4) = 2$ for i from					
{0,,39}		18			
Overhead for TBS determination		0			
Information Bit Payload per Slot					
For Slot 0 and Slot i, if $mod(i, 4) = 3$ for	Bits	N/A			
i from {0,,39}	Dito	1471			
For Slot i, if $mod(i, 4) = 0$ for i from	Bits	8064			
$\frac{\{1,,39\}}{\text{For Slot i, if mod(i, 4)} = 1 \text{ for i from}}$					
{0,,39}	Bits	4992			
For Slot i, if $mod(i, 4) = 2$ for i from	Bits	0500			
{0,,39}	DIIS	6528			
Transport block CRC per Slot					
For Slot 0 and Slot i, if $mod(i, 4) = 3$ for	Bits	N/A			
i from $\{0,,39\}$ For Slot i, if mod(i, 4) = 0 for i from					
{1,,39}	Bits	24			
For Slot i, if $mod(i, 4) = 1$ for i from					
{0,,39}	Bits	24			
For Slot i, if $mod(i, 4) = 2$ for i from	Bits	24			
{0,,39}	טוט	24			
Number of Code Blocks per Slot					
For Slot 0 and Slot i, if $mod(i, 4) = 3$ for	CBs	N/A			
i from $\{0,,39\}$ For Slot i, if mod(i, 4) = 0 for i from				+	
{1,,39}	CBs	1			
For Slot i, if $mod(i, 4) = 1$ for i from	0.0	4			
{0,,39}	CBs	1			
For Slot i, if mod(i, 4) = 2 for i from	CBs	1			
{0,,39}	555	<u>'</u>			
Binary Channel Bits Per Slot					
For Slot 0 and Slot i, if $mod(i, 4) = 3$ for i from $\{0,,39\}$	Bits	N/A			
For Slot i = 20	Bits	25440		1	
For Slot i = 21	Bits	15264		1	
For Slot i, if $mod(i, 4) = 0$ for i from					
{1,,19,22,,39}	Bits	26712			
For Slot i, if $mod(i, 4) = 1$ for i from	Bits	16536			
{1,,19,22,,39}	טונט	10000			
For Slot i, if $mod(i, 4) = 2$ for i from	Bits	21624			
{0,,39}					

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Max. Thro	oughput averaged over 2	Mbps	9.389			
Note 1:	SS/PBCH block is transmitted i	n slot #0 w	ith periodicity 20) ms		
Note 2:	Slot i is slot index per 2 frames					

Table A.3.2.2.13: PDSCH Reference Channel for TDD CC with UL-DL pattern FR1.30-1 and CA scenario

13.1 TDD	Parameter	Unit			Value		
13,1100	Potorono channel		R.PDSCH.2-	R.PDSCH.2-	R.PDSCH.2-	R.PDSCH.2-	R.PDSCH.2-
Subcarrier spacing			13.1 TDD	13.2 TDD	13.3 TDD	13.4 TDD	13.5 TDD
Allocated resource blocks Number of consecutive PDSCH symbols For Slot i, if mod(i, 10) = 7 for i for i (0,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (0,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (0,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (0,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (1,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (1,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (1,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (1,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (1,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (1,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (1,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (1,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (1,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (1,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (1,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (1,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (1,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (1,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (1,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (1,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (1,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (1,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (1,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (1,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (1,, 39) For Slot i, if mod(i, 10) = (0, 1, 2, 3, 4, 5, 6) for i from (1,, 39) For Slot i, if mod(i, 10)							
Number of Consecutive PDSCH symbols For Slot i, if mod(i, 10) = 7 for i from (0,39) For Slot i, if mod(i, 10) = 7 for i from (0,39) Allocated slots per 2 frames MCS table 640AM 64							
Symbols For Slot i, Irmod(i, 10) = 7 for i from (0,,39) For Slot i, Irmod(i, 10) = (6, 12, 3.4.5.6) for i from (1, 13.4.5.6) for i fr		PRBs	11	24	38	51	65
For Slot i, if mod(i, 10) = 7 for i from (039) For Slot i, if mod(i, 10) = (0, 1.2.3.4.5.6) for i from (039) For Slot i, if mod(i, 10) = (0, 1.2.3.4.5.6) for i from (039) For Slot i, if mod(i, 10) = (0, 1.2.3.4.5.6) for i from (039) For Slot i, if mod(i, 10) = (0, 1.2.3.4.5.6) for i from (039) For Slot i, if mod(i, 10) = 7 for i from (039) For Slot i, if mod(i, 10) = 7 for i from (039) For Slot i, if mod(i, 10) = 7 for i from (039) For Slot i, if mod(i, 10) = 7 for i from (039) For Slot i, if mod(i, 10) = 7 for i from (039) For Slot i, if mod(i, 10) = 7 for i from (039) For Slot i, if mod(i, 10) = 7 for i from (039) For Slot i, if mod(i, 10) = 7 for i from (039) For Slot i, if mod(i, 10) = 7 for i from (039) For Slot i, if mod(i, 10) = 7 for i from (039) For Slot i, if mod(i, 10) = 7 for i from (039) For Slot i, if mod(i, 10) = 7 for i from (039) For Slot i, if mod(i, 10) = 7 for i from (039) For Slot i, if mod(i, 10) = 7 for i from (039) For Slot i, if mod(i, 10) = 7 for i from (039) For Slot i, if mod(i, 10) = 8 jits i ships							
Trom (0,,39)			4	4	4	4	4
(0,1,2,3,4,5,6) for i from 12 12 12 12 12 12 12 1	from {0,,39}						
(139)			10	40	10	10	10
Allocated slots per 2 frames Alloca	• • • • • • •		12	12	12	12	12
MCS table MCS table MCS index 13 13 13 13 13 13 13 13 13 1	Allocated clots per 2 frames		31	31	31	31	31
MCS index 13							
Modulation							
Target Coding Rate							_
Number of MIMO layers Number of DMRS RES For Slot i, if mod(i, 10) = 7 for i from (0,,39) Overhead for TBS determination information Bit Payload per Slot For Slot i, if mod(i, 10) = 7 for i from (0,,39) Overhead for TBS determination Bit Payload per Slot For Slot i, if mod(i, 10) = 7 for i from (0,,39) For Slot i, if mod(i, 10) = 7 for i from (0,,39) For Slot i, if mod(i, 10) = 8,0 for i from (1,,39) For Slot i, if mod(i, 10) = 8,0 for i from (0,,39) For Slot i, if mod(i,							
Number of DMRS RES For Slot1, if mod(i, 10) = 7 for i from (0,,39) For Slot1, if mod(i, 10) = 12 12 12 12 12 12 12 12 12 12 12 12 12 1							
For Slot i, if mod(i, 10) = 7 for i from (0,,39) For Slot i, if mod(i, 10) = (0,1,2,3,4,5,6) for i from (1,,39) Overhead for TBS determination Information Bit Payload per Slot For Slot i, if mod(i, 10) = 7 for i from (0,,39) For Slot i, if mod(i, 10) = 8,9) for i from (0,,39) For Slot i, if mod(i, 10) = 8,9) for i from (0,,39) For Slot i, if mod(i, 10) = 8,9) for i from (0,,39) For Slot i, if mod(i, 10) = 8,9) for i from (0,,39) For Slot i, if mod(i, 10) = 8,9) for i from (0,,39) For Slot i, if mod(i, 10) = 8,9) for i from (0,,39) For Slot i, if mod(i, 10) = 8,9) for i from (0,,39) For Slot i, if mod(i, 10) = 8,9) for i from (0,,39) For Slot i, if mod(i, 10) = 8,9) for i from (0,,39) For Slot i, if mod(i, 10) = 8,9) for i from (0,,39) For Slot i, if mod(i, 10) = 8,9) for i from (0,,39) For Slot i, if mod(i, 10) = 8,9) for i from (0,,39) For Slot i, if mod(i, 10) = 8,9) for i from (0,,39) For Slot i, if mod(i, 10) = 8,9) for i from (0,,39) For Slot i, if mod(i, 10) = 8,9) for i from (0,,39)				_	_	_	_
			_	_	_	_	_
For Slot i, if mod(i, 10) = (0,1,2,3,4,5,6) for i from (0,,39)			6	6	6	6	6
(0,1,2,3,4,5,6) for i from 12							
Overhead for TBS determination Information Bit Payload per Slot For Slots 0 and Slot i, if mod(i, 10) = (8,9) for i from (0,,39)	{0,1,2,3,4,5,6} for i from		12	12	12	12	12
Determination Determinatio	{1,,39}						
Determination Determinatio	Overhead for TBS		0	0	0	0	0
For Slots Q and Slot i, if mod(i, 10) = {8,9} for i from {0,,39} For Slot i, if mod(i, 10) = 7 for i from {0,,39} For Slot i, if mod(i, 10) = 7 for i from {0,,39} For Slot i, if mod(i, 10) = 8 Gold, 1,2,3,4,5,6) for i from Bits	determination		U	U	U	U	U
10) = {8,9} for i from {0,,39} Bits IVA	Information Bit Payload per Slot						
10 = (8,9) for 1 from (0,,39) Bits 1800 3840 6144 8192 10504		Rits	N/A	N/A	N/A	N/A	N/A
From (0,,39) Bits 1800 3840 6144 8192 10304 For Slot i, if mod(i, 10) = (0,1,2,3,4,5,6) for i from (1,,39) For Slot s) and Slot i, if mod(i, 10) = 7 for i from (0,,39) For Slot s) and Slot i, if mod(i, 10) = (0,1,2,3,4,5,6) for i from (0,,39) For Slot s) and Slot i, if mod(i, 10) = (0,1,2,3,4,5,6) for i from (0,,39) For Slot i, if mod(i, 10) = (0,1,2,3,4,5,6) for i from (0,,39) For Slot i, if mod(i, 10) = 7 for i from (0,,39) For Slot i, if mod(i, 10) = 7 for i from (0,,39) For Slot i, if mod(i, 10) = 7 for i from (0,1,2,3,4,5,6) f		Ditto	14// (14// (14//	14//	14//
Irion (n,,39)		Bits	1800	3840	6144	8192	10504
[0,1,2,3,4,5,6] for i from [1,,39] Transport block CRC per Slot For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from [0,,39] For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from [0,,39] Number of Code Blocks per Slot For Slot i, if mod(i, 10) = 7 for i from [0,,39] For Slot i, if mod(i, 10) = (0,1,2,3,4,5,6) for i from [0,,39] For Slot i, if mod(i, 10) = (0,1,2,3,4,5,6) for i from [0,,39] For Slot i, if mod(i, 10) = (0,1,2,3,4,5,6) for i from [0,,39] For Slot i, if mod(i, 10) = (0,1,2,3,4,5,6) for i from [0,,39] For Slot i, if mod(i, 10) = (0,1,2,3,4,5,6) for i from [0,,39] For Slot i, if mod(i, 10) = (0,1,2,3,4,5,6) for i from [0,,39] Binary Channel Bits Per Slot For Slots 0 and Slot i, if mod(i, 10) = (0,1,2,3,4,5,6) for i from [0,,39] Binary Channel Bits Per Slot For Slots i = 20, 21 For Slot i, if mod(i, 10) = 7 for i from [0,,39] For Slot i, if mod(i, 10) = 7 for i from [0,,39] For Slot i, if mod(i, 10) = 7 for i from [0,,39] For Slot i, if mod(i, 10) = 7 for i from [0,,39] For Slot i, if mod(i, 10) = 7 for i from [0,,39] For Slot i, if mod(i, 10) = 8 lits 11616 25344 40128 53856 68640 41,19,22,,39 Max. Throughput averaged Maps. 7,700 17,022 36,835 36,000 46,348	from {0,,39}				_		
1,,39 Transport block CRC per Slot		Dita	5504	40040	40000	25000	20770
Transport block CRC per Slot For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,,39} For Slot i, if mod(i, 10) = 7 for i from {0,,39} For Slot i, if mod(i, 10) = 8		Bits	5504	12040	18960	25608	32776
For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,,39} For Slot i, if mod(i, 10) = 7 for i from {0,,39} For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,,39} For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,,39} For Slot 0 and Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,,39} For Slot 0 and Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,,39} For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,,39} For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,,39} For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,,39} For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,,39} For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,,39} For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,,39} For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,,39} For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,,39} For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,,39} Bits							
10) = {8,9} for i from {0,,39} For Slot i, if mod(i, 10) = 7 for i from {0,,39} For Slot i, if mod(i, 10) = 7 for i from {0,,39} For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from Bits							
For Slot i, if mod(i, 10) = 7 for i from {0,,39} For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,1,2,3,4,5,6} for i from {0,,39} Number of Code Blocks per Slot For Slot i, if mod(i, 10) = 7 for i from {0,,39} For Slot i, if mod(i, 10) = 7 for i from {0,,39} For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,,39} For Slots 0 and Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,,39} Binary Channel Bits Per Slot For Slots 0 and Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,,39} Binary Channel Bits Per Slot For Slots 0 and Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,,39} For Slots i = 20, 21 Bits 11088 24192 38304 51408 65520 For Slot i, if mod(i, 10) = 7 for i from {0,,39} For Slot i, if mod(i, 10) = 7 for i from {0,,39} For Slot i, if mod(i, 10) = 8 lits 11616 25344 40128 53856 68640 {1,,19,2,,39} Max. Throughput averaged Mbps 7,700 17,702 26,835 36,209 46,348		Bits	N/A	N/A	N/A	N/A	N/A
from {0,,39} Bits 16 24							
For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,1,2,3,4,5,6} for i from {0,1,2,3,4,5,6} for i from {0,1,39}		Bits	16	24	24	24	24
{0,1,2,3,4,5,6} for i from {1,,39} Bits 24 24 24 24 24 {1,,39} Number of Code Blocks per Slot Slot N/A	For Slot i, if mod(i, 10) =						
Number of Code Blocks per Slot		Bits	24	24	24	24	24
Slot For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,,39} CBs N/A	{1,,39}						
For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,,39} For Slot i, if mod(i, 10) = 7 for i from {0,,39} For Slot i, if mod(i, 10) = 7 for i from {0,,39} For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,1,2,	Number of Code Blocks per						
10) = {8,9} for i from {0,,39} CBS N/A A	Slot						
For Slot i, if mod(i, 10) = 7 for i from {0,,39} For Slot i, if mod(i, 10) = 7 for i from {0,,39} For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,1,2,3,4,5,6} for i	,	CBs	N/A	N/A	N/A	N/A	N/A
from {0,,39} CBS 1 1 2 For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0		CD3	11/73	19/73	19/73	IN/A	IN/A
For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from CBs 1 2 3 4 4 4 {1,,39} Binary Channel Bits Per Slot For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,,39} For Slots i = 20, 21 Bits 11088 24192 38304 51408 65520 For Slot i, if mod(i, 10) = 7 for i from {0,,39} For Slot i, if mod(i, 10) = 7 for i from {0,,39} For Slot i, if mod(i, 10) = 8064 12768 17136 21840 For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from Bits 11616 25344 40128 53856 68640 {1,,19,22,,39} Max. Throughput averaged Max. Through		CBs	1	1	1	1	2
{0,1,2,3,4,5,6} for i from CBs 1 2 3 4 4 4 {1,,39} Binary Channel Bits Per Slot For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,,39} For Slots i = 20, 21 Bits 11088 24192 38304 51408 65520 For Slot i, if mod(i, 10) = 7 for i from {0,,39} For Slot i, if mod(i, 10) = 8 8064 12768 17136 21840 For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from Bits 11616 25344 40128 53856 68640 {1,,19,22,,39} Max. Throughput averaged Max. Throughput		020		•	•		_
Sinary Channel Bits Per Slot		0.0				_	_
Binary Channel Bits Per Slot For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,,39} Bits N/A N		CBs	1	2	3	4	4
For Slots 0 and Slot i, if mod(i, 10) = {8,9} for i from {0,,39} For Slots i = 20, 21 For Slot i, if mod(i, 10) = 7 for i from {0,,39} Bits 11088 24192 38304 51408 65520 For Slot i, if mod(i, 10) = 7 for i from {0,,39} For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,1,2,3,4,5,6} for i from {0,1,2,3,4,5,6} for i from {0,1,2,3,4,5,6} for i from {1,,19,22,,39} Max. Throughput averaged Mbps 7,790 17,022 26,825 36,209 46,348							
10) = {8,9} for i from {0,,39} Bits N/A N/A N/A N/A For Slots i = 20, 21 Bits 11088 24192 38304 51408 65520 For Slot i, if mod(i, 10) = 7 for i from {0,,39} Bits 3696 8064 12768 17136 21840 For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,1,2,3,4,5,6} for i from {1,,19,22,,39} Bits 11616 25344 40128 53856 68640 Hax. Throughput averaged Max. Throughput averaged Max. Throughput averaged Max. Throughput averaged Max. Throughput averaged 17,022 26,825 36,209 46,348							
For Slots i = 20, 21 Bits 11088 24192 38304 51408 65520 For Slot i, if mod(i, 10) = 7 for i from {0,,39} Bits 3696 8064 12768 17136 21840 For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,1,2,3,4,5,6} for i from {1,1,1,2,2,,39} Bits 11616 25344 40128 53856 68640 1,,19,22,,39} Max. Throughput averaged Mbps 7,790 17,023 26,825 36,209 46,348		Bits	N/A	N/A	N/A	N/A	N/A
For Slot i, if mod(i, 10) = 7 for i from {0,,39} For Slot i, if mod(i, 10) = 7 for i from {0,,39} For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {0,1,2,3,4,5,6} for i		Rite	11088	24192	38304	51408	65520
from {0,,39} Bits 3696 8064 12768 17136 21840 For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from {1,,19,22,,39} Bits 11616 25344 40128 53856 68640 {1,,19,22,,39} Max. Throughput averaged Mbps 7,790 17,022 26,825 36,209 46,348							
For Slot i, if mod(i, 10) = {0,1,2,3,4,5,6} for i from Bits 11616 25344 40128 53856 68640 {1,,19,22,,39} Max. Throughput averaged Mbps 7,790 17,022 26,825 36,209 46,348		Bits	3696	8064	12768	17136	21840
{0,1,2,3,4,5,6} for i from Bits 11616 25344 40128 53856 68640 {1,,19,22,,39} Max. Throughput averaged Mbps 7,790 17,022 26,825 36,209 46,348	For Slot i, if mod(i, 10) =						
{1,,19,22,,39} Max. Throughput averaged Mbps 7,790 17,022 26,825 36,209 46,348		Bits	11616	25344	40128	53856	68640
Max. Throughput averaged Mbps 7,700 17,022 26,825 36,200 46,348	{1,,19,22,,39}				1		
	Max. Throughput averaged	Mess	7 700	47.000	26.025	26 200	46.040
	over 2 frames	sqaivi	7.790	17.022	∠6.825	36.209	46.348

Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms Note 2: Slot i is slot index per 2 frames

Table A.3.2.2.14: PDSCH Reference Channel for TDD CC with UL-DL pattern FR1.30-1 and CA scenario

Parameter	Unit			Value		
Reference channel		R.PDSCH.2-	R.PDSCH.2-	R.PDSCH.2-	R.PDSCH.2-	R.PDSCH.2-
		14.1 TDD	14.2 TDD	14.3 TDD	14.4 TDD	14.5 TDD
Channel bandwidth	MHz	30	50	60	80	90
Subcarrier spacing	kHz	30	30	30	30	30
Allocated resource blocks	PRBs	78	133	162	217	245
Number of consecutive PDSCH						
symbols For Slot i, if mod(i, 10) = 7 for i						
from $\{0,,39\}$		4	4	4	4	4
For Slot i, if mod(i, 10) =						
{0,1,2,3,4,5,6} for i from		12	12	12	12	12
{1,,39}						
Allocated slots per 2 frames		31	31	31	31	31
MCS table		64QAM	64QAM	64QAM	64QAM	64QAM
MCS index		13	13	13	13	13
Modulation		16QAM	16QAM	16QAM	16QAM	16QAM
Target Coding Rate		0.48	0.48	0.48	0.48	0.48
Number of MIMO layers		2	2	2	2	2
Number of DMRS REs						
For Slot i, if mod(i, 10) = 7 for i		6	6	6	6	6
from {0,,39}		O	0	O	0	b
For Slot i, if mod(i, 10) =						
{0,1,2,3,4,5,6} for i from		12	12	12	12	12
{1,,39}						
Overhead for TBS		0	0	0	0	0
determination				-		-
Information Bit Payload per Slot						
For Slots 0 and Slot i, if mod(i,	Bits	N/A	N/A	N/A	N/A	N/A
10) = $\{8,9\}$ for i from $\{0,,39\}$ For Slot i, if mod(i, 10) = 7 for i						
from $\{0,,39\}$	Bits	12552	21504	26120	34816	38936
For Slot i, if mod(i, 10) =						
{0,1,2,3,4,5,6} for i from	Bits	38936	67584	81976	110632	122976
{1,,39}		00000	0.00.	0.0.0		
Transport block CRC per Slot						
For Slots 0 and Slot i, if mod(i,	Bits	N/A	NI/A	NI/A	NI/A	NI/A
10) = $\{8,9\}$ for i from $\{0,,39\}$	DIIS	IN/A	N/A	N/A	N/A	N/A
For Slot i, if $mod(i, 10) = 7$ for i	Bits	24	24	24	24	24
from {0,,39}	Dita	24	24	24	24	24
For Slot i, if mod(i, 10) =						
{0,1,2,3,4,5,6} for i from	Bits	24	24	24	24	24
{1,,39}						
Number of Code Blocks per						
Slot For Slots 0 and Slot i, if mod(i,						
$10) = \{8,9\}$ for i from $\{0,,39\}$	CBs	N/A	N/A	N/A	N/A	N/A
For Slot i, if $mod(i, 10) = 7$ for i						
from {0,,39}	CBs	2	3	4	5	5
For Slot i, if mod(i, 10) =						
{0,1,2,3,4,5,6} for i from	CBs	5	9	10	14	15
{1,,39}						
Binary Channel Bits Per Slot						
For Slots 0 and Slot i, if mod(i,	Bits	N/A	N/A	N/A	N/A	N/A
$10) = \{8,9\}$ for i from $\{0,,39\}$						
For Slots i = 20, 21	Bits	78624	134064	163296	218736	246960
For Slot i, if $mod(i, 10) = 7$ for i	Bits	26208	44688	54432	72912	82320
from {0,,39}						
For Slot i, if mod(i, 10) =	Dito	82368	140449	171070	220452	250720
		เดวเทก	140448	171072	229152	258720
{0,1,2,3,4,5,6} for i from	Bits	02000				
{1,,19,22,,39}						
	Mbps	55.074	95.539	115.892	156.316	173.805

Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms Note 2: Slot i is slot index per 2 frames

Table A.3.2.2.2-15: PDSCH Reference Channel for TDD CC with UL-DL pattern FR1.30-1 and CA scenario

Parameter	Unit		Valu	ıe	
Reference channel		R.PDSCH.2-			
		15.1 TDD			
Channel bandwidth	MHz	100			
Subcarrier spacing	kHz	30			
Allocated resource blocks	PRBs	273			
Number of consecutive PDSCH					
symbols For Slot i, if mod(i, 10) = 7 for i					
from $\{0,,39\}$		4			
For Slot i, if mod(i, 10) =					
{0,1,2,3,4,5,6} for i from		12			
{1,,39}					
Allocated slots per 2 frames		31			
MCS table		64QAM			
MCS index		13			
Modulation		16QAM			
Target Coding Rate		0.48			
Number of MIMO layers		2			
Number of DMRS REs					
For Slot i, if $mod(i, 10) = 7$ for i		6			
from {0,,39} For Slot i, if mod(i, 10) =					
For Slot i, if $mod(i, 10) = \{0,1,2,3,4,5,6\}$ for i from		12			
{1,,39}		12			
Overhead for TBS		_			
determination		0			
Information Bit Payload per Slot					
For Slots 0 and Slot i, if mod(i,	Bits	N/A			
10) = $\{8,9\}$ for i from $\{0,,39\}$	DIIS	IN/A			
For Slot i, if $mod(i, 10) = 7$ for i	Bits	44040			
from {0,,39}	5.10	11010			
For Slot i, if mod(i, 10) =	D:4-	420270			
{0,1,2,3,4,5,6} for i from {1,,39}	Bits	139376			
Transport block CRC per Slot					
For Slots 0 and Slot i, if mod(i,					
10) = {8,9} for i from {0,,39}	Bits	N/A			
For Slot i, if $mod(i, 10) = 7$ for i	D:4-	0.4			
from {0,,39}	Bits	24			
For Slot i, if mod(i, 10) =					
{0,1,2,3,4,5,6} for i from	Bits	24			
{1,,39}					
Number of Code Blocks per					
Slot For Slots 0 and Slot i, if mod(i,		N/A			
$10) = \{8,9\}$ for i from $\{0,,39\}$	CBs	IN/A			
For Slot i, if $mod(i, 10) = 7$ for i		_			
from {0,,39}	CBs	6			
For Slot i, if mod(i, 10) =					
{0,1,2,3,4,5,6} for i from	CBs	17			
{1,,39}					
Binary Channel Bits Per Slot					
For Slots 0 and Slot i, if mod(i,	Bits	N/A			
10) = {8,9} for i from {0,,39}					
For Slots $i = 20, 21$ For Slot i, if mod(i, 10) = 7 for i	Bits	275184			
from $\{0,,39\}$	Bits	91728			
For Slot i, if mod(i, 10) =					
{0,1,2,3,4,5,6} for i from	Bits	288288			
{1,,19,22,,39}					
Max. Throughput averaged	Mbps	196.966			
over 2 frames					
Note 1: SS/PBCH block is tran			riodicity 20 ms		
Note 2: Slot i is slot index per 2	2 frames				

Table A.3.2.2.2-16: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-1

Parameter	Unit		,	/alue	
Reference channel		R.PDSCH.1-	R.PDSCH.1-		
Reference charmer		16.1 TDD	16.2 TDD		
Channel bandwidth	MHz	40	40		
Subcarrier spacing	kHz	30	30		
Allocated resource blocks	PRBs	106	106		
Number of consecutive PDSCH					
symbols					
For Slot i, if $mod(i, 10) = \{0, 7\}$ for i		N/A	N/A		
from {0,,39}		IN/A			
For Slot i, if mod(i, 10) =		12	12		
{1,2,3,4,5,6} for i from {1,,39}					
Allocated slots per 2 frames		24	24		
MCS table		64QAMLowSE	64QAMLowSE		
MCS index		19	19		
Modulation		16QAM	16QAM		
Target Coding Rate		0.54	0.54		
Number of MIMO layers		1	1		
Number of DMRS REs			12		
For Slot i, if $mod(i, 10) = \{0, 7\}$ for i		N/A	N/A		
from {0,,39}		IN/A			
For Slot i, if mod(i, 10) =		12	12		
{0,1,2,3,4,5,6} for i from {1,,39}		12			
Overhead for TBS determination		0	0		
Information Bit Payload per Slot					
For Slot i, if $mod(i, 10) = \{0,7,8,9\}$	Bits	N/A	N/A		
for i from {0,,39}	Dito	14/71			
For Slot i, if mod(i, 10) =	Bits	30216	30216		
{1,2,3,4,5,6} for i from {1,,39}	Dito	00210			
Transport block CRC per Slot					
For Slot i, if $mod(i, 10) = \{0,7,8,9\}$	Bits	N/A	N/A		
for i from {0,,39}	Dito	14/71			
For Slot i, if mod(i, 10) =	Bits	24	24		
{1,2,3,4,5,6} for i from {1,,39}	Dito				
Number of Code Blocks per Slot					
For Slot i, if $mod(i, 10) = \{0,7,8,9\}$	CBs	N/A	N/A		
for i from {0,,39}	050	14/71			
For Slot i, if $mod(i, 10) =$	CBs	2	2		
{1,2,3,4,5,6} for i from {1,,39}		<u>-</u>		1	
Binary Channel Bits Per Slot			21/4		
For Slot i, if $mod(i, 10) = \{0,7,8,9\}$	Bits	N/A	N/A		
for i from {0,,39}			#0555		
For Slot i = 21	Bits	53424	50880	 	
For Slot i, if $mod(i, 10) =$		=====	55968		
{1,2,3,4,5,6} for i from	Bits	55968			
{1,,19,22,,39}		10 : 55	40 : 22		
Max. Throughput averaged over 2	Mbps	18.130	18.130		
frames Note 1: SS/PBCH block is transmi	-	(NOTE 3)	(NOTE 4)		

SS/PBCH block is transmitted in slot #0 with periodicity 20 ms Slot i is slot index per 2 frames Note 1:

Note 2:

Throughput is calculated under assumption of aggregation factor 2. Throughput is calculated under assumption of repetition number 2 Note 3: Note 4:

Table A.3.2.2.2-17: PDSCH Reference Channel for TDD UL-DL pattern FR1.30-2

Parameter	Unit		Value
Reference channel		R.PDSCH.1- 17.1 TDD	
Channel bandwidth	MHz	40	
Subcarrier spacing	kHz	30	
Allocated resource blocks	PRBs	106	
Number of consecutive PDSCH			
symbols			
For Slot i, if $mod(i, 5) = 3$ for i from $\{0,,39\}$		2	
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i from $\{1,,39\}$		N/A	
Allocated slots per 2 frames		8	
MCS table			
MCS index		4	
Modulation		QPSK	
Target Coding Rate		0.3	
Number of MIMO layers		1	
Number of DMRS REs			
For Slot i, if $mod(i, 5) = 3$ for i from		•	
{0,,39}		6	
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i from $\{1,,39\}$		N/A	
Overhead for TBS determination		0	
Information Bit Payload per Slot		•	
For Slot i, if $mod(i, 5) = 3$ for i from $\{0,,39\}$	Bits	1160	
For Slot i, if mod(i, 5) = $\{0,1,2\}$ for i from $\{1,,39\}$	Bits	N/A	
Transport block CRC per Slot			
For Slot i, if $mod(i, 5) = 3$ for i from $\{0,,39\}$	Bits	16	
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i from $\{1,,39\}$	Bits	N/A	
Number of Code Blocks per Slot			
For Slot i, if $mod(i, 5) = 3$ for i from $\{0,,39\}$	CBs	1	
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i from $\{1,,39\}$	CBs	N/A	
Binary Channel Bits Per Slot			
For Slot i, if $mod(i, 5) = 3$ for i from $\{0,,39\}$	Bits	3816	
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i from $\{1,,39\}$	Bits	N/A	
Max. Throughput averaged over 2 frames	Mbps	0.464	
Note 1: SS/PBCH block is transmit	ted in slo	t #0 with periodic	ity 20 ms

Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms Note 2: Slot i is slot index per 2 frames

A.3.2.2.3 Reference measurement channels for SCS 60 kHz FR1

A.3.2.2.4 Reference measurement channels for SCS 60 kHz FR2

Table A.3.2.2.4-1: PDSCH Reference Channel for TDD UL-DL pattern FR2.60-1 (16QAM)

Parameter	Unit		Value	
Reference channel		R.PDSCH.4-		
		1.1 TDD		
Channel bandwidth	MHz	50		
Subcarrier spacing	kHz	60		
Allocated resource blocks	PRBs	66		
Number of consecutive PDSCH				
symbols				
For Slot i, if $mod(i, 4) = 2$ for i from		10		
$\{1,, 79\}$ For Slot i, if mod(i, 4) = $\{0,1\}$ for i from				
		13		
{1,,79}		50		
Allocated slots per 2 frames		59		
MCS table		64QAM		
MCS index		13		
Modulation		16QAM		
Target Coding Rate Number of MIMO layers		0.48		
Number of DMRS REs				
For Slot i, if mod(i, 4) = 2 for i from				
{1,, 79}		12		
For Slot i, if $mod(i, 4) = \{0,1\}$ for i from				
{1,,79}		12		
Overhead for TBS determination		6		
Information Bit Payload per Slot		<u> </u>		
For Slots 0 and Slot i, if $mod(i, 4) = 3$				
for i from {0,,79}	Bits	N/A		
For Slot i, if $mod(i, 4) = 2$ for i from	D.,	05000		
{1,, 79}	Bits	25608		
For Slot i, if $mod(i, 4) = \{0,1\}$ for i from	D:4-	0.404.0		
{1,,79}	Bits	34816		
Transport block CRC per Slot				
For Slots 0 and Slot i, if mod(i, 4) = 3	Bits	N/A		
for i from {0,,79}	Dita	14/74		
For Slot i, if mod(i, 4) = 2 for i from	Bits	24		
{1,, 79}	Dito			
For Slot i, if $mod(i, 4) = \{0,1\}$ for i from	Bits	24		
{1,,79}				
Number of Code Blocks per Slot				
For Slots 0 and Slot i, if $mod(i, 4) = 3$	CBs	N/A		
for i from {0,,79}				
For Slot i, if $mod(i, 4) = 2$ for i from	CBs	4		
$\{1,,79\}$ For Slot i, if mod(i, 4) = $\{0,1\}$ for i from			+ + + + + + + + + + + + + + + + + + + +	
$\{1,,79\}$	CBs	5		
Binary Channel Bits Per Slot			+ + + + + + + + + + + + + + + + + + + +	
For Slots 0 and Slot i, if $mod(i, 4) = 3$			+ + + + + + + + + + + + + + + + + + + +	
for i from $\{0,,79\}$	Bits	N/A		
For Slot i = 40, 41	Bits	69960		
For Slot i, if $mod(i, 4) = 2$ for i from				
{4,, 79}	Bits	54912		
For Slot i, if $mod(i, 4) = \{0,1\}$ for i from	D:+=	72400		
{1,,39,42,,79}	Bits	73128		
Max. Throughput averaged over 2	Mbps	93.499		
frames	•			
Note 1: SS/PBCH block is transmitted	in slot #0 v	vith periodicity 2	20 ms	

A.3.2.2.5 Reference measurement channels for SCS 120 kHz FR2

Table A.3.2.2.5-1: PDSCH Reference Channel for TDD UL-DL pattern FR2.120-1 and FR2.120-1A (QPSK)

Parameter	Unit			Value	
Defended should		R.PDSCH.5-	R.PDSCH.5-		
Reference channel		1.1 TDD	1.2 TDD		
Channel bandwidth	MHz	100	100		
Subcarrier spacing	kHz	120	120		
Allocated resource blocks	PRBs	66	66		
Number of consecutive PDSCH					
symbols					
For Slot i, if mod(i, 5) = 3 for i from		9	2		
$\{0,, 159\}$ For Slot i, if mod(i, 5) = $\{0,1,2\}$ for i		,	2		
from {1,,159}		13	_		
Allocated slots per 2 frames		127	127		
MCS table		64QAM	64QAM		
MCS index		4	4		
Modulation		QPSK	QPSK		
Target Coding Rate		0.30	0.30		
Number of MIMO layers		1	1		
Number of DMRS REs					
For Slot i, if $mod(i, 5) = 3$ for i from		40	6		
{0,, 159}		12			
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i		4.0	6		
from {1,,159}		12			
Overhead for TBS determination		6	0		
Information Bit Payload per Slot					
For Slots 0 and Slot i, if $mod(i, 5) = 4$	5.4	21/2	N/A		
for i from {0,,159}	Bits	N/A	,		
For Slot i, if $mod(i, 5) = 3$ for i from	5.4	2224	736		
{0,, 159}	Bits	3624			
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i	D:4-	5504	736		
from {1,,159}	Bits	5504			
Transport block CRC per Slot					
For Slots 0 and Slot i, if mod(i, 5) = 4	D:4-	NI/A	N/A		
for i from {0,,159}	Bits	N/A			
For Slot i, if $mod(i, 5) = 3$ for i from	D:4-	40	16		
{0,, 159}	Bits	16			
For Slot i, if $mod(i, 5) = \{0, 1, 2\}$ for i	Dito	24	16		
from {1,,159}	Bits	24			
Number of Code Blocks per Slot					
For Slots 0 and Slot i, if mod(i, 5) = 4	CPo	NI/A	N/A		
for i from {0,,159}	CBs	N/A			
for i from $\{0,,159\}$ For Slot i, if mod(i, 5) = 3 for i from	CBs	1	1		
{0,, 159}	CDS	'			
For Slot i, if $mod(i, 5) = \{0, 1, 2\}$ for i	CDo	4	1		
from {1,,159}	CBs	1			
Binary Channel Bits Per Slot					
For Slots 0 and Slot i, if mod(i, 5) = 4	Bits	N/A	N/A		
for i from {0,,159}	Bits	IN/A			
For Slots i = 80, 81	Bits	17490	2310		
For Slot i, if $mod(i, 5) = 3$ for i from	Dito		2310		
{0,, 159}	Bits	12210			
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i	Dito	10000	2310		
from {1,,79,82,,159}	Bits	18282			
Max. Throughput averaged over 2	Mhaa	24.040	4.673		
frames	Mbps	31.942			
Note 1: SS/PBCH block is transmitted	in slot #0	with periodicity 2	20 ms		· <u></u>

Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms

Table A.3.2.2.5-2: PDSCH Reference Channel for TDD UL-DL pattern FR2.120-1 (16QAM)

Parameter	Unit			Value	
Reference channel		R.PDSCH.5- 2.1 TDD	R.PDSCH.5- 2.2 TDD	R.PDSCH.5- 2.3 TDD	
Channel bandwidth	MHz	100	100	200	
Subcarrier spacing	kHz	120	120	120	
Allocated resource blocks	PRBs	66	66	132	
Number of consecutive PDSCH					
symbols					
For Slot i, if $mod(i, 5) = 3$ for i from $\{0,, 159\}$		9	9	9	
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i from $\{1,,159\}$		13	13	13	
Allocated slots per 2 frames		127	127	127	
MCS table		64QAM	64QAM	64QAM	
MCS index		13	13	13	
Modulation		16QAM	16QAM	16QAM	
Target Coding Rate		0.48	0.48	0.48	
Number of MIMO layers		1	2	2	
Number of DMRS REs					
For Slot i, if $mod(i, 5) = 3$ for i from $\{0,, 159\}$		12	12	12	
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i from $\{1,,159\}$		12	12	12	
Overhead for TBS determination		6	6	6	
Information Bit Payload per Slot		-	-		
For Slots 0 and Slot i, if $mod(i, 5) = 4$ for i from $(0, 159)$	Bits	N/A	N/A	N/A	
For Slot i, if mod(i, 5) = 3 for i from $\{0,, 159\}$	Bits	11272	22536	45096	
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i from $\{1,,159\}$	Bits	17424	34816	69672	
Transport block CRC per Slot					
For Slots 0 and Slot i, if $mod(i, 5) = 4$ for i from $\{0,,159\}$	Bits	N/A	N/A	N/A	
For Slot i, if mod(i, 5) = 3 for i from $\{0,, 159\}$	Bits	24	24	24	
For Slot i, if mod(i, 5) = $\{0,1,2\}$ for i from $\{1,,159\}$	Bits	24	24	24	
Number of Code Blocks per Slot					
For Slots 0 and Slot i, if $mod(i, 5) = 4$ for i from $\{0,,159\}$	CBs	N/A	N/A	N/A	
For Slot i, if mod(i, 5) = 3 for i from $\{0,, 159\}$	CBs	2	3	6	
For Slot i, if mod(i, 5) = $\{0,1,2\}$ for i from $\{1,,159\}$	CBs	3	5	9	
Binary Channel Bits Per Slot					
For Slots 0 and Slot i, if $mod(i, 5) = 4$ for i from $\{0,,159\}$	Bits	N/A	N/A	N/A	
For Slots i = 80, 81	Bits	36564	69960	139920	
For Slots i = 82, 83	Bits	34980	73128	146256	
For Slot i, if mod(i, 5) = 3 for i from {0,, 159}	Bits	24420	48840	97680	
For Slot i, if mod(i, 5) = $\{0,1,2\}$ for i from $\{1,,79,84,,159\}$	Bits	36564	73128	146256	
Max. Throughput averaged over 2	Mbps	100.799	201.434	403.096	
frames Note 1: SS/PBCH block is transmitted		l D with periodicity			

Table A.3.2.2.5-3: PDSCH Reference Channel for TDD UL-DL pattern FR2.120-1 (64QAM)

Parameter	Unit		Vi	alue	
Reference channel		R.PDSCH.5-			
Reference charmer		3.1 TDD			
Channel bandwidth	MHz	100			
Subcarrier spacing	kHz	120			
Allocated resource blocks	PRBs	66			
Number of consecutive PDSCH					
symbols					
For Slot i, if $mod(i, 5) = 3$ for i from		9			
{0,, 159}		_			
For Slot i, if $mod(i, 5) = \{0, 1, 2\}$ for i		13			
from {1,,159}		107			
Allocated slots per 2 frames MCS table		127 64QAM			
MCS index		18			
Modulation		64QAM			
Target Coding Rate		0.46			
Number of MIMO layers		1			
Number of DMRS REs		'			
For Slot i, if mod(i, 5) = 3 for i from					
{0,, 159}		12			
For Slot i, if $mod(i, 5) = \{0, 1, 2\}$ for i					
from {1,,159}		12			
Overhead for TBS determination		6			
Information Bit Payload per Slot					
For Slots 0 and Slot i, if mod(i, 5) = 4	Dita	N/A			
for i from {0,,159}	Bits				
For Slot i, if $mod(i, 5) = 3$ for i from	Bits	16136			
{0,, 159}	DIIS	10130			
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i	Bits	25104			
from {1,,159}	Dito	20104			
Transport block CRC per Slot					
For Slots 0 and Slot i, if $mod(i, 5) = 4$	Bits	N/A			
for i from {0,,159}					
For Slot i, if mod(i, 5) = 3 for i from $(0, 150)$	Bits	24			
$\{0,, 159\}$ For Slot i, if mod(i, 5) = $\{0,1,2\}$ for i					
from $\{1,,159\}$	Bits	24			
Number of Code Blocks per Slot					
For Slots 0 and Slot i, if $mod(i, 5) = 4$					
for i from {0,,159}	CBs	N/A			
For Slot i, if $mod(i, 5) = 3$ for i from		_			
{0,, 159}	CBs	2			
For Slot i, if $mod(i, 5) = \{0, 1, 2\}$ for i	OD-	0			
from {1,,159}	CBs	3			
Binary Channel Bits Per Slot					
For Slots 0 and Slot i, if mod(i, 5) = 4	Bits	N/A			
for i from {0,,159}					
For Slots i = 80, 81	Bits	52470			
For Slot i, if $mod(i, 5) = 3$ for i from	Bits	36630			
$\{0,, 159\}$ For Slot i, if mod(i, 5) = $\{0,1,2\}$ for i		1			
from $\{1,,79,82,,159\}$	Bits	54846			
Max. Throughput averaged over 2		145.062			
frames	Mbps	1 10.002			
Note 1: SS/PBCH block is transmitted	in slot #0 w	vith periodicity 20	0 ms	I	1
Note 2: Slot i is slot index per 2 frames		1	-		

Table A.3.2.2.5-4: PDSCH Reference Channel for TDD UL-DL pattern FR2.120-2 (QPSK)

Parameter	Unit		Value			
Reference channel		R.PDSCH.5- 4.1 TDD				
Channel bandwidth	MHz	100				
Subcarrier spacing	kHz	120				
Allocated resource blocks	PRBs	6				
Number of consecutive PDSCH						
symbols						
For Slot i, if mod(i, 4) = 2 for i from $\{1,, 159\}$		10				
For Slot i, if $mod(i, 4) = \{0,1\}$ for i from $\{1,,159\}$		13				
Allocated slots per 2 frames		119				
MCS table		64QAM				
MCS index		4				
Modulation		QPSK				
Target Coding Rate		0.30				
Number of MIMO layers		2				
Number of DMRS REs						
For Slot i, if mod(i, 4) = 2 for i from $\{1,, 159\}$		12				
For Slot i, if $mod(i, 4) = \{0,1\}$ for i from $\{1,,159\}$		12				
Overhead for TBS determination		6				
Information Bit Payload per Slot						
For Slots 0 and Slot i, if mod(i, 4) = 3	Dita	NI/A				
for i from {0,,159}	Bits	N/A				
For Slot i, if $mod(i, 4) = 2$ for i from $\{1,, 159\}$	Bits	736				
For Slot i, if $mod(i, 4) = \{0,1\}$ for i from $\{1,,159\}$	Bits	1032				
Transport block CRC per Slot						
For Slots 0 and Slot i, if $mod(i, 4) = 3$ for i from $\{0,,159\}$	Bits	N/A				
For Slot i, if mod(i, 4) = 2 for i from {1,, 159}	Bits	16				
For Slot i, if $mod(i, 4) = \{0,1\}$ for i from	Bits	16				
{1,,159}						
Number of Code Blocks per Slot For Slots 0 and Slot i, if mod(i, 4) = 3	CBs	N/A				
for i from $\{0,,159\}$ For Slot i, if mod(i, 4) = 2 for i from	CBs	1				
$\{1,, 159\}$ For Slot i, if mod(i, 4) = $\{0,1\}$ for i from						
{1,,159} Binary Channel Bits Per Slot	CBs	1				
For Slots 0 and Slot i, if mod(i, 4) = 3						
for i from {0,,159}	Bits	N/A				
For Slot i = 80, 81	Bits	3180				
For Slot i, if mod(i, 4) = 2 for i from $\{4,, 159\}$	Bits	2496				
For Slot i, if $mod(i, 4) = \{0,1\}$ for i from $\{1,,79,82,,159\}$	Bits	3324				
Max. Throughput averaged over 2 frames	Mbps	5.548				
Note 1: SS/PBCH block is transmitted	in slot #0 w	ith periodicity 20	1			
Note 2: Slot i is slot index per 2 frames						

Table A.3.2.2.5-5: PDSCH Reference Channel for TDD UL-DL pattern FR2.120-2 (16QAM)

Parameter	Unit			Value		
Reference channel		R.PDSCH.5-	R.PDSCH.5-			
Reference charmer		5.1 TDD	5.2 TDD			
Channel bandwidth	MHz	100	50			
Subcarrier spacing	kHz	120	120			
Allocated resource blocks	PRBs	66	32			
Number of consecutive PDSCH						
symbols						
For Slot i, if $mod(i, 4) = 2$ for i from		10	10			
{1,, 159}						
For Slot i, if $mod(i, 4) = \{0,1\}$ for i from		13	13			
{1,,159}				+		
Allocated slots per 2 frames		119	119			
MCS table		64QAM	64QAM			
MCS index		13	13			
Modulation		16QAM	16QAM			
Target Coding Rate		0.48	0.48	+		
Number of MIMO layers		2	2	+		
Number of DMRS REs				+	-	
For Slot i, if $mod(i, 4) = 2$ for i from		12	12			
$\{1,, 159\}$ For Slot i, if mod(i, 4) = $\{0,1\}$ for i from				+	+	
		12	12			
{1,,159} Overhead for TBS determination		6	6	+		
Information Bit Payload per Slot		0	0	+		
For Slots 0 and Slot i, if $mod(i, 4) = 3$						
for i from $\{0,,159\}$	Bits	N/A	N/A			
For Slot i, if $mod(i, 4) = 2$ for i from						
{1,, 159}	Bits	25608	12552			
For Slot i, if $mod(i, 4) = \{0,1\}$ for i from				†	+	
{1,,159}	Bits	34816	16896			
Transport block CRC per Slot						
For Slots 0 and Slot i, if $mod(i, 4) = 3$	D.,	21/2	21/0			
for i from {0,,159}	Bits	N/A	N/A			
For Slot i, if $mod(i, 4) = 2$ for i from	Dita	0.4	24			
{1,, 159}	Bits	24	24			
For Slot i, if $mod(i, 4) = \{0,1\}$ for i from	Dito	24	24			
{1,,159}	Bits	24	24			
Number of Code Blocks per Slot						
For Slots 0 and Slot i, if $mod(i, 4) = 3$	CBs	N/A	N/A			
for i from {0,,159}	CDS	IN/A	IN/A			
For Slot i, if mod(i, 4) = 2 for i from	CBs	4	2			
{1,, 159}	020		_			
For Slot i, if $mod(i, 4) = \{0,1\}$ for i from	CBs	5	3			
{1,,159}	050	Ŭ	Ŭ			
Binary Channel Bits Per Slot				1		
For Slots 0 and Slot i, if $mod(i, 4) = 3$	Bits	N/A	N/A			
for i from {0,,159}				+		
For Slot i = 80, 81	Bits	69960	33920	1		
For Slot i, if $mod(i, 4) = 2$ for i from	Bits	54912	26624			
$\{4,, 159\}$ For Slot i, if mod(i, 4) = $\{0,1\}$ for i from	-			+		
	Bits	73128	35456			
{1,,79,82,,159} Max. Throughput averaged over 2				+	+	
frames	Mbps	188.739	91.843			
Note 1: SS/PBCH block is transmitted	in slot #0	with periodicity	20 ms	1		
Note 2: Slot i is slot index per 2 frames		portodioity /				

Table A.3.2.2.5-6: PDSCH Reference Channel for TDD UL-DL pattern FR2.120-2 (64QAM)

Parameter	Unit		Value				
Reference channel		R.PDSCH.5- 6.1 TDD					
Channel bandwidth	MHz	100					
Subcarrier spacing	kHz	120					
Allocated resource blocks	PRBs	66					
Number of consecutive PDSCH							
symbols							
For Slot i, if mod(i, 4) = 2 for i from {1,, 159}		10					
For Slot i, if $mod(i, 4) = \{0,1\}$ for i from $\{1,,159\}$		13					
Allocated slots per 2 frames		119					
MCS table		64QAM					
MCS index		17					
Modulation		64QAM					
Target Coding Rate		0.43					
Number of MIMO layers		2					
Number of DMRS REs							
For Slot i, if $mod(i, 4) = 2$ for i from $\{1,, 159\}$		12					
For Slot i, if $mod(i, 4) = \{0,1\}$ for i from $\{1,,159\}$		12					
Overhead for TBS determination		6					
Information Bit Payload per Slot							
For Slots 0 and Slot i, if $mod(i, 4) = 3$ for i from $\{0,,159\}$	Bits	N/A					
For Slot i, if $mod(i, 4) = 2$ for i from	Bits	34816					
$\{1,, 159\}$ For Slot i, if mod(i, 4) = $\{0,1\}$ for i from	Bits	47112					
{1,,159}							
Transport block CRC per Slot							
For Slots 0 and Slot i, if $mod(i, 4) = 3$ for i from $\{0,,159\}$	Bits	N/A					
For Slot i, if mod(i, 4) = 2 for i from $\{1,, 159\}$	Bits	24					
For Slot i, if $mod(i, 4) = \{0,1\}$ for i from $\{1,,159\}$	Bits	24					
Number of Code Blocks per Slot							
For Slots 0 and Slot i, if $mod(i, 4) = 3$ for i from $\{0,,159\}$	CBs	N/A					
For Slot i, if $mod(i, 4) = 2$ for i from $\{1,, 159\}$	CBs	5					
For Slot i, if mod(i, 4) = $\{0,1\}$ for i from $\{1,,159\}$	CBs	6					
Binary Channel Bits Per Slot							
For Slots 0 and Slot i, if $mod(i, 4) = 3$							
for i from {0,,159}	Bits	N/A					
For Slot i = 80, 81	Bits	114940					
For Slot i, if mod(i, 4) = 2 for i from {4,, 159}	Bits	82368					
For Slot i, if mod(i, 4) = $\{0,1\}$ for i from $\{1,,79,82,,159\}$	Bits	109692					
Max. Throughput averaged over 2	Mbps	255.724					
frames	-		0 mg				
Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms Note 2: Slot i is slot index per 2 frames							

Table A.3.2.2.5-7: PDSCH Reference Channel for TDD PMI reporting requirements with UL-DL pattern FR2.120-1 (16QAM)

Parameter	Unit		Value
Reference channel		R.PDSCH.5- 7.1 TDD	
Channel bandwidth	MHz	100	
Subcarrier spacing	kHz	120	
Allocated resource blocks	PRBs	66	
Number of consecutive PDSCH symbols		12	
Allocated slots per 2 frames		63	
MCS table		64QAM	
MCS index		13	
Modulation		16QAM	
Target Coding Rate		0.48	
Number of MIMO layers		1	
Number of DMRS REs (Note 3)		24	
Overhead for TBS determination		6	
Information Bit Payload per Slot			
For Slots 0 and Slot i, if mod(i, 5) = {3,4} for i from {0,,159}	Bits	N/A	
For CSI-RS Slot i, if $mod(i,5) = 1$ for i from $\{0,,159\}$	Bits	N/A	
For Slot i = 80	Bits	14344	
For Slot i, if $mod(i, 5) = \{0,2\}$ for i from $\{1,,79,82,,159\}$	Bits	14344	
Transport block CRC per Slot			
For Slots 0 and Slot i, if $mod(i, 5) = {3,4}$ for i from ${0,,159}$	Bits	N/A	
For CSI-RS Slot i, if mod(i,5) =1 for i from {0,,159}	Bits	N/A	
For Slot i = 80	Bits	24	
For Slot i, if $mod(i, 5) = \{0,2\}$ for i from $\{1,,79,82,,159\}$	Bits	24	
Number of Code Blocks per Slot			
For Slots 0 and Slot i, if mod(i, 5) = {3,4} for i from {0,,159}	CBs	N/A	
For CSI-RS Slot i, if $mod(i,5) = 1$ for i from $\{0,,159\}$	CBs	N/A	
For Slot i = 80	CBs	2	
For Slot i, if $mod(i, 5) = \{0,2\}$ for i from $\{1,,79,82,,159\}$	CBs	2	
Binary Channel Bits Per Slot			
For Slots 0 and Slot i, if $mod(i, 5) = {3,4}$ for i from ${0,,159}$	Bits	N/A	
For CSI-RS Slot i, if mod(i,5) =1 for i from {0,,159}	Bits	N/A	
For Slot i = 80	Bits	28776	
For Slot i, if $mod(i, 5) = \{0,2\}$ for i from $\{1,,79,82,,159\}$	Bits	30360	
Max. Throughput averaged over 2 frames Note 1: SS/PBCH block is transmitted in	Mbps	45.1836	

SS/PBCH block is transmitted in slot #0 with periodicity 20 ms Note 1:

Note 2:

Slot i is slot index per 2 frames
Number of DMRS REs includes the overhead of the DM-RS CDM groups without data Note 3:

Table A.3.2.2.5-8: PDSCH Reference Channel for TDD PMI reporting requirements with UL-DL pattern FR2.120-2 (16QAM)

Parameter	Unit		Value
Reference channel		R.PDSCH.5- 8.1 TDD	
Channel bandwidth	MHz	100	
Subcarrier spacing	kHz	120	
Allocated resource blocks	PRBs	66	
Number of consecutive PDSCH symbols		12	
Allocated slots per 2 frames		59	
MCS table		64QAM	
MCS index		13	
Modulation		16QAM	
Target Coding Rate		0.48	
Number of MIMO layers		1	
Number of DMRS REs (Note 3)		24	
Overhead for TBS determination		6	
Information Bit Payload per Slot			
For Slots 0 and Slot i, if $mod(i, 4) = \{2,3\}$ for i from $\{0,,159\}$	Bits	N/A	
For CSI-RS Slot i, if mod(i,8) =1 for i from {0,,159}	Bits	N/A	
For Slot i = 80	Bits	14344	
For Slot i, if $mod(i, 8) = \{0,4,5\}$ for i from $\{1,,79,82,,159\}$	Bits	14344	
Transport block CRC per Slot			
For Slots 0 and Slot i, if mod(i, 4) = {2,3} for i from {0,,159}	Bits	N/A	
For CSI-RS Slot i, if $mod(i,8) = 1$ for i from $\{0,,159\}$	Bits	N/A	
For Slot i = 80	Bits	24	
For Slot i, if $mod(i, 8) = \{0,4,5\}$ for i from $\{1,,79,82,,159\}$	Bits	24	
Number of Code Blocks per Slot			
For Slots 0 and Slot i, if $mod(i, 4) = \{2,3\}$ for i from $\{0,,159\}$	CBs	N/A	
For CSI-RS Slot i, if $mod(i,8) = 1$ for i from $\{0,,159\}$	CBs	N/A	
For Slot i = 80	CBs	2	
For Slot i, if $mod(i, 8) = \{0,4,5\}$ for i from $\{1,,79,82,,159\}$	CBs	2	
Binary Channel Bits Per Slot			
For Slots 0 and Slot i, if $mod(i, 4) = \{2,3\}$ for i from $\{0,,159\}$	Bits	N/A	
For CSI-RS Slot i, if mod(i,8) =1 for i from {0,,159}	Bits	N/A	
For Slot i = 80	Bits	28776	
For Slot i, if $mod(i, 8) = \{0,4,5\}$ for i from $\{1,,79,82,,159\}$	Bits	30360	
Max. Throughput averaged over 2 frames Note 1: SS/PBCH block is transmitted in	Mbps	42.3148	

SS/PBCH block is transmitted in slot #0 with periodicity 20 ms Note 1:

Note 2:

Slot i is slot index per 2 frames
Number of DMRS REs includes the overhead of the DM-RS CDM groups without data Note 3:

Table A.3.2.2.5-9: PDSCH Reference Channel for TDD CC with UL-DL pattern FR2.120-1 and CA scenario

Parameter	Unit			Value			
Reference channel		R.PDSCH.5-	R.PDSCH.5-	R.PDSCH.5-	R.PDSCH.5-		
Reference channel		9.1 TDD	9.2 TDD	9.3 TDD	9.4 TDD		
Channel bandwidth	MHz	50	100	200	400		
Subcarrier spacing	kHz	120	120	120	120		
Allocated resource blocks	PRBs	32	66	132	264		
Number of consecutive PDSCH							
symbols							
For Slot i, if mod(i, 5) = 3 for i from $\{0,, 159\}$		9	9	9	9		
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i from $\{1,,159\}$		13	13	13	13		
Allocated slots per 2 frames		127	127	127	127		
MCS table		64QAM	64QAM	64QAM	64QAM		
MCS index		10	10	10	10		
Modulation		16QAM	16QAM	16QAM	16QAM		
Target Coding Rate		0.33	0.33	0.33	0.33		
Number of MIMO layers		2	2	2	2		
Number of DMRS REs							
For Slot i, if $mod(i, 5) = 3$ for i from $\{0,, 159\}$		12	12	12	12		
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i		12	12	12	12		
from {1,,159}							
Overhead for TBS determination		6	6	6	6		
Information Bit Payload per Slot							
For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,,159}	Bits	N/A	N/A	N/A	N/A		
For Slot i, if $mod(i, 5) = 3$ for i from $\{0,, 159\}$	Bits	7680	15880	31752	63528		
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i from $\{1,,159\}$	Bits	11784	24072	48168	96264		
Transport block CRC per Slot							
For Slots 0 and Slot i, if mod(i, 5) =	Bits	N/A	N/A	N/A	N/A		
4 for i from {0,,159} For Slot i, if mod(i, 5) = 3 for i from							
{0,, 159}	Bits	24	24	24	24		
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i from $\{1,,159\}$	Bits	24	24	24	24		
Number of Code Blocks per Slot							
For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,,159}	CBs	N/A	N/A	N/A	N/A		
For Slot i, if $mod(i, 5) = 3$ for i from $\{0,, 159\}$	CBs	1	2	4	8		
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i	CBs	2	3	6	12		
from {1,,159}	020	_					
Binary Channel Bits Per Slot	1						
For Slots 0 and Slot i, if mod(i, 5) = 4 for i from {0,,159}	Bits	N/A	N/A	N/A	N/A		
For Slots i = 80, 81	Bits	33920	69960	139920	279840		
For Slot i, if $mod(i, 5) = 3$ for i from $\{0,, 159\}$	Bits	23680	48840	97680	195360		
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i	Bits	35456	73128	146256	292512		
from {1,,79,84,,159} Max. Throughput averaged over 2	1						
frames	Mbps	68.262	139.750	279.601	558.899		
Note 1: SS/PBCH block is transmitte		#0 with periodic	city 20 ms				
Note 2: Slot i is slot index per 2 frames							

Table A.3.2.2.5-10: PDSCH Reference Channel for TDD UL-DL pattern FR2.120-1 (256QAM)

Parameter	Unit		Value	
Reference channel		R.PDSCH.5- 9.1 TDD		
Channel bandwidth	MHz	50		
Subcarrier spacing	kHz	120		
Allocated resource blocks	PRBs	32		
Number of consecutive PDSCH				
symbols				
For Slot i, if mod(i, 5) = 3 for i from $\{0,, 159\}$		9		
For Slot i, if mod(i, 5) = $\{0,1,2\}$ for i from $\{1,,159\}$		13		
Allocated slots per 2 frames		127		
MCS table		256QAM		
MCS index		20		
Modulation		256QAM		
Target Coding Rate		0.67		
Number of MIMO layers		1		
Number of DMRS REs For Slot i, if mod(i, 5) = 3 for i from		12		
{0,, 159}		12		
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i from $\{1,,159\}$		12		
Overhead for TBS determination		6		
Information Bit Payload per Slot				
For Slots 0 and Slot i, if $mod(i, 5) = 4$ for i from $\{0,,159\}$	Bits	N/A		
For Slot i, if $mod(i, 5) = 3$ for i from $\{0,, 159\}$	Bits	15368		
For Slot i, if mod(i, 5) = $\{0,1,2\}$ for i from $\{1,,159\}$	Bits	23568		
Transport block CRC per Slot				
For Slots 0 and Slot i, if $mod(i, 5) = 4$ for i from $\{0,,159\}$	Bits	N/A		
For Slot i, if mod(i, 5) = 3 for i from {0,, 159}	Bits	24		
For Slot i, if mod(i, 5) = $\{0,1,2\}$ for i from $\{1,,159\}$	Bits	24		
Number of Code Blocks per Slot				
For Slots 0 and Slot i, if $mod(i, 5) = 4$ for i from $\{0,,159\}$	CBs	N/A		
For Slot i, if $mod(i, 5) = 3$ for i from $\{0,, 159\}$	CBs	2		
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i from $\{1,,159\}$	CBs	3		
Binary Channel Bits Per Slot				
For Slots 0 and Slot i, if $mod(i, 5) = 4$ for i from $\{0,,159\}$	Bits	N/A		
For Slots i = 80, 81	Bits	33920		
For Slot i, if $mod(i, 5) = 3$ for i from $\{0,, 159\}$	Bits	23680		
For Slot i, if $mod(i, 5) = \{0,1,2\}$ for i from $\{1,,79,82,,159\}$	Bits	35456		
Max. Throughput averaged over 2 frames	Mbps	136.537		
Note 1: SS/PBCH block is transmitted	in slot #0 w	ith periodicity 20	l) ms	<u> </u>
Note 2: Slot i is slot index per 2 frames		porrodionly 20		

Table A.3.2.2.5-11: PDSCH Reference Channel for TDD UL-DL pattern FR2.120-2

Parameter	Unit		Value	
Reference channel		R.PDSCH.5-10.1 TDD		
Channel bandwidth	MHz	100		
Subcarrier spacing	kHz	120		
Allocated resource blocks	PRBs	66		
Number of consecutive PDSCH				
symbols				
For Slot i, if $mod(i, 4) = \{0,1\}$ for i		40		
from {2,,159}		13		
Allocated slots per 2 frames		78		
MCS table		64QAMLowSE		
MCS index		16		
Modulation		16QAM		
Target Coding Rate		0.37		
Number of MIMO layers		1		
Number of DMRS REs				
For Slot i, if $mod(i, 4) = \{0,1\}$ for i		40		
from {2,,159}		12		
Overhead for TBS determination		6		
Information Bit Payload per Slot				
For Slots 0, 1 and Slot i, if mod(i, 4)	Bits	N/A		
$= \{2,3\}$ for i from $\{0,,159\}$	DIIS	IN/A		
For Slot i, if $mod(i, 4) = \{0,1\}$ for i	Bits	13320		
from {2,,159}	Dita	13320		
Transport block CRC per Slot				
For Slots 0, 1 and Slot i, if mod(i, 4)	Bits	N/A		
$= \{2,3\}$ for i from $\{0,,159\}$	Dita	IN/A		
For Slot i, if $mod(i, 4) = \{0,1\}$ for i	Bits	24		
from {2,,159}	Dito	27		
Number of Code Blocks per Slot				
For Slots 0, 1 and Slot i, if mod(i, 4)	CBs	N/A		
= {2,3} for i from {0,,159}	050			
For Slot i, if mod(i, 4) = $\{0,1\}$ for i	CBs	2		
from {2,,159}		_		
Binary Channel Bits Per Slot				
For Slots 0,1 and Slot i, if $mod(i, 4) =$	Bits	N/A		
{2, 3} for i from {0,,159}	D::	•		
For Slot i = 80, 81	Bits	34980		
For Slot i, if $mod(i, 4) = \{0,1\}$ for i	Bits	36564		
from {2,,159}				
Max. Throughput averaged over 2	Mbps	25.974 (Note 3)		
frames Note 1: SS/PRCH block is transmitted	d in clot t	(Note 3)		

SS/PBCH block is transmitted in slot #0 with periodicity 20 ms

Note 2: Note 3:

Slot i is slot index per 2 frames
Throughput is calculated under assumption of aggregation factor 2.

A.3.2.2.6 Reference measurement channels for E-UTRA

Table A.3.2.2.6-1: PDSCH Reference Channel for sustained data-rate test (64QAM, 2 MIMO layers)

Parameter	Unit		Valu	е	
Reference channel		R.PDSCH.6-	R.PDSCH.6-	R.PDSCH.6-	
		1.1 TDD	1.2 TDD	1.3 TDD	
Channel bandwidth	MHz	10	15	20	
Allocated resource blocks		Note 7	Note 8	Note 9	
Uplink-Downlink Configuration (Note 3)		2	2	2	
Number of HARQ Processes per component		10	10	10	
carrier					
Allocated subframes per Radio Frame (D+S)		6	6	6	
Modulation		64QAM	64QAM	64QAM	
Coding Rate					
For Sub-Frames 1,2,6,7		N/A	N/A	N/A	
For Sub-Frames 3,4,8,9		0.85	0.85	0.88	
For Sub-Frame 5		0.88	0.87	0.87	
For Sub-Frame 0		0.90	0.88	0.90	
Information Bit Payload (Note 4)					
For Sub-Frames 1,2,6,7	Bits	N/A	N/A	N/A	
For Sub-Frames 3,4,8,9	Bits	36696	55056	75376	
For Sub-Frame 5	Bits	35160	52752	71112	
For Sub-Frame 0	Bits	36696	55056	75376	
Number of Code Blocks					
(Notes 4 and 5)					
For Sub-Frames 1,2,6,7	CBs	N/A	N/A	N/A	
For Sub-Frames 3,4,8,9	CBs	6	9	13	
For Sub-Frame 5	CBs	6	9	12	
For Sub-Frame 0	CBs	6	9	13	
Binary Channel Bits (Note 4)					
For Sub-Frames 1,2,6,7	Bits	N/A	N/A	N/A	
For Sub-Frames 3,4,8,9	Bits	43200	64800	86400	
For Sub-Frame 5	Bits	40176	60912	82512	
For Sub-Frame 0	Bits	41184	62784	84384	
Number of layers		2	2	2	
Max. Throughput averaged over 1 frame (Note 4)	Mbps	21.864	32.803	44.799	

- Note 1: 1 symbol allocated to PDCCH for all tests.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [15].
- Note 3: As per Table 4.2-2 in TS 36.211 [15].
- Note 4: Given per component carrier per codeword.
- Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 6: Resource blocks n_{PRB} = 0..2 are allocated for SIB transmissions in sub-frame 5 for all bandwidths.
- Note 7: Resource blocks n_{PRB} = 3..49 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..49 in sub-frames 0,3,4,8,9.
- Note 8: Resource blocks n_{PRB} = 4..74 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..74 in sub-frames 0,3,4,8,9.
- Note 9: Resource blocks n_{PRB} = 4..99 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..99 in sub-frames 0.3,4,8,9.

Table A.3.2.2.6-2: PDSCH Reference Channel for sustained data-rate test (64QAM, 4 MIMO layers)

Parameter	Unit		Valu	е
Reference channel		R.PDSCH.6-	R.PDSCH.6-	R.PDSCH.6-
		2.1 TDD	2.2 TDD	2.3 TDD
Channel bandwidth	MHz	10	15	20
Allocated resource blocks		Note 7	Note 8	Note 9
Uplink-Downlink Configuration (Note 3)		2	2	2
Number of HARQ Processes per component		10	10	10
carrier				
Allocated subframes per Radio Frame (D+S)		6	6	6
Modulation		64QAM	64QAM	64QAM
Coding Rate				
For Sub-Frames 1,2,6,7		N/A	N/A	N/A
For Sub-Frames 3,4,8,9		0.78	0.77	0.79
For Sub-Frame 5		0.79	0.79	0.80
For Sub-Frame 0		0.82	0.79	0.81
Information Bit Payload (Note 4)				
For Sub-Frames 1,2,6,7	Bits	N/A	N/A	N/A
For Sub-Frames 3,4,8,9	Bits	63776	93800	128496
For Sub-Frame 5	Bits	59256	90816	124464
For Sub-Frame 0	Bits	63776	93800	128496
Number of Code Blocks				
(Notes 4 and 5)				
For Sub-Frames 1,2,6,7	CBs	N/A	N/A	N/A
For Sub-Frames 3,4,8,9	CBs	11	16	21
For Sub-Frame 5	CBs	10	15	21
For Sub-Frame 0	CBs	11	16	21
Binary Channel Bits (Note 4)				
For Sub-Frames 1,2,6,7	Bits	N/A	N/A	N/A
For Sub-Frames 3,4,8,9	Bits	81600	122400	163200
For Sub-Frame 5	Bits	75840	115008	155808
For Sub-Frame 0	Bits	77856	118656	159456
Number of layers		4	4	4
Max. Throughput averaged over 1 frame (Note 4)	Mbps	37.813	55.981	76.694

- Note 1: 1 symbol allocated to PDCCH for all tests.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [15].
- Note 3: As per Table 4.2-2 in TS 36.211 [15].
- Note 4: Given per component carrier per codeword.
- Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 6: Resource blocks n_{PRB} = 0..2 are allocated for SIB transmissions in sub-frame 5 for all bandwidths.
- Note 7: Resource blocks n_{PRB} = 3..49 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..49 in sub-frames 0,3,4,8,9.
- Note 8: Resource blocks n_{PRB} = 4..74 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..74 in sub-frames 0,3,4,8,9.
- Note 9: Resource blocks n_{PRB} = 4..99 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..99 in sub-frames 0,3,4,8,9.

Table A.3.2.2.6-3: PDSCH Reference Channel for sustained data-rate test (256QAM, 2 MIMO layers)

Parameter	Unit		Value		
Reference channel		R.PDSCH.6-	R.PDSCH.6-	R.PDSCH.6-	
		3.1 TDD	3.2 TDD	3.3 TDD	
Channel bandwidth	MHz	10	15	20	
Allocated resource blocks		Note 7	Note 8	Note 9	
Uplink-Downlink Configuration (Note 3)		2	2	2	
Number of HARQ Processes per component		10	10	10	
carrier					
Allocated subframes per Radio Frame (D+S)		6	6	6	
Modulation		256QAM	256QAM	256QAM	
Coding Rate					
For Sub-Frames 1,2,6,7		N/A	N/A	N/A	
For Sub-Frames 3,4		0.74	0.79	0.74	
For Sub-Frames 8,9		0.85	0.88	0.85	
For Sub-Frame 5		0.76	0.76	0.74	
For Sub-Frame 0		0.78	0.77	0.76	
Information Bit Payload (Note 4)					
For Sub-Frames 1,2,6,7	Bits	N/A	N/A	N/A	
For Sub-Frames 3,4	Bits	42368	63776	84760	
For Sub-Frames 8,9	Bits	48936	75376	97896	
For Sub-Frame 5	Bits	40576	61664	81176	
For Sub-Frame 0	Bits	42368	63776	84760	
Number of Code Blocks					
(Notes 4 and 5)					
For Sub-Frames 1,2,6,7	CBs	N/A	N/A	N/A	
For Sub-Frames 3,4	CBs	7	11	14	
For Sub-Frames 8,9	CBs	8	13	16	
For Sub-Frame 5	CBs	7	11	14	
For Sub-Frame 0	CBs	7	11	14	
Binary Channel Bits (Note 4)					
For Sub-Frames 1,2,6,7	Bits	N/A	N/A	N/A	
For Sub-Frames 3,4	Bits	57600	86400	115200	
For Sub-Frames 8,9	Bits	57600	86400	115200	
For Sub-Frame 5	Bits	53568	81216	110016	
For Sub-Frame 0	Bits	54912	83712	112512	
Number of layers		2	2	2	
Max. Throughput averaged over 1 frame (Note 4)	Mbps	26.555	40.374	53.125	

- Note 1: 1 symbol allocated to PDCCH for all tests.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [15].
- Note 3: As per Table 4.2-2 in TS 36.211 [15].
- Note 4: Given per component carrier per codeword.
- Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 6: Resource blocks n_{PRB} = 0..2 are allocated for SIB transmissions in sub-frame 5 for all bandwidths.
- Note 7: Resource blocks $n_{PRB} = 3..49$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..49$ in sub-frames 0,3,4,8,9.
- Note 8: Resource blocks n_{PRB} = 4..74 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..74 in sub-frames 0,3,4,8,9.
- Note 9: Resource blocks n_{PRB} = 4..99 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..99 in sub-frames 0,3,4,8,9.

Table A.3.2.2.6-4: PDSCH Reference Channel for sustained data-rate test (256QAM, 4 MIMO layers)

Parameter	Unit	Value			
Reference channel		R.PDSCH.6-	R.PDSCH.6-	R.PDSCH.6-	
		4.1 TDD	4.2 TDD	4.3 TDD	
Channel bandwidth	MHz	10	15	20	
Allocated resource blocks		Note 7	Note 8	Note 9	
Uplink-Downlink Configuration (Note 3)		2	2	2	
Number of HARQ Processes per component		10	10	10	
carrier					
Allocated subframes per Radio Frame (D+S)		6	6	6	
Modulation		256QAM	256QAM	256QAM	
Coding Rate					
For Sub-Frames 1,2,6,7		N/A	N/A	N/A	
For Sub-Frames 3,4		0.78	0.79	0.78	
For Sub-Frames 8,9		0.78	0.79	0.78	
For Sub-Frame 5		0.81	0.82	0.78	
For Sub-Frame 0		0.82	0.82	0.80	
Information Bit Payload (Note 4)					
For Sub-Frames 1,2,6,7	Bits	N/A	N/A	N/A	
For Sub-Frames 3,4	Bits	84760	128496	169544	
For Sub-Frames 8,9	Bits	84760	128496	169544	
For Sub-Frame 5	Bits	81176	124464	161760	
For Sub-Frame 0	Bits	84760	128496	169544	
Number of Code Blocks					
(Notes 4 and 5)					
For Sub-Frames 1,2,6,7	CBs	N/A	N/A	N/A	
For Sub-Frames 3,4	CBs	14	21	28	
For Sub-Frames 8,9	CBs	14	21	28	
For Sub-Frame 5	CBs	14	21	27	
For Sub-Frame 0	CBs	14	21	28	
Binary Channel Bits (Note 4)					
For Sub-Frames 1,2,6,7	Bits	N/A	N/A	N/A	
For Sub-Frames 3,4	Bits	108800	163200	217600	
For Sub-Frames 8,9	Bits	108800	163200	217600	
For Sub-Frame 5	Bits	101120	153344	207744	
For Sub-Frame 0	Bits	103808	158208	212608	
Number of layers		4	4	4	
Max. Throughput averaged over 1 frame (Note 4)	Mbps	50.498	76.694	100.948	_

- Note 1: 1 symbol allocated to PDCCH for all tests.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [15].
- Note 3: As per Table 4.2-2 in TS 36.211 [15].
- Note 4: Given per component carrier per codeword.
- Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 6: Resource blocks n_{PRB} = 0..2 are allocated for SIB transmissions in sub-frame 5 for all bandwidths.
- Note 7: Resource blocks $n_{PRB} = 3..49$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..49$ in sub-frames 0,3,4,8,9.
- Note 8: Resource blocks n_{PRB} = 4..74 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..74 in sub-frames 0,3,4,8,9.
- Note 9: Resource blocks n_{PRB} = 4..99 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..99 in sub-frames 0,3,4,8,9.

Table A.3.2.2.6-5: PDSCH Reference Channel for sustained data-rate test (1024QAM, 2 MIMO layers)

Parameter	Unit		Valu	e	
Reference channel		R.PDSCH.6-	R.PDSCH.6-	R.PDSCH.6-	
		5.1 TDD	5.2 TDD	5.3 TDD	
Channel bandwidth	MHz	10	15	20	
Allocated resource blocks		Note 7	Note 8	Note 9	
Uplink-Downlink Configuration (Note 3)		2	2	2	
Number of HARQ Processes per component		10	10	10	
carrier					
Allocated subframes per Radio Frame (D+S)		6	6	6	
Modulation		1024QAM	1024QAM	1024QAM	
Coding Rate					
For Sub-Frames 1,2,6,7		N/A	N/A	N/A	
For Sub-Frames 3,4		0.76	0.75	0.76	
For Sub-Frames 8,9		0.76	0.75	0.76	
For Sub-Frame 5		0.76	0.78	0.77	
For Sub-Frame 0		0.80	0.78	0.78	
Information Bit Payload (Note 4)					
For Sub-Frames 1,2,6,7	Bits	N/A	N/A	N/A	
For Sub-Frames 3,4	Bits	55056	81176	110136	
For Sub-Frames 8,9	Bits	55056	81176	110136	
For Sub-Frame 5	Bits	51024	78704	105528	
For Sub-Frame 0	Bits	55056	81176	110136	
Number of Code Blocks					
(Notes 4 and 5)					
For Sub-Frames 1,2,6,7	CBs	N/A	N/A	N/A	
For Sub-Frames 3,4	CBs	9	14	18	
For Sub-Frames 8,9	CBs	9	14	18	
For Sub-Frame 5	CBs	9	13	18	
For Sub-Frame 0	CBs	9	14	18	
Binary Channel Bits (Note 4)					
For Sub-Frames 1,2,6,7	Bits	N/A	N/A	N/A	
For Sub-Frames 3,4	Bits	72000	108000	144000	
For Sub-Frames 8,9	Bits	72000	108000	144000	
For Sub-Frame 5	Bits	66960	101520	137520	
For Sub-Frame 0	Bits	68640	104640	140640	
Number of layers		2	2	2	
Max. Throughput averaged over 1 frame (Note 4)	Mbps	32.630	48.458	65.621	

- Note 1: 1 symbol allocated to PDCCH for all tests.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [15].
- Note 3: As per Table 4.2-2 in TS 36.211 [15].
- Note 4: Given per component carrier per codeword.
- Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 6: Resource blocks n_{PRB} = 0..2 are allocated for SIB transmissions in sub-frame 5 for all bandwidths.
- Note 7: Resource blocks n_{PRB} = 3..49 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..49 in sub-frames 0,3,4,8,9.
- Note 8: Resource blocks n_{PRB} = 4..74 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..74 in sub-frames 0,3,4,8,9.
- Note 9: Resource blocks $n_{PRB} = 4..99$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..99$ in sub-frames 0,3,4,8,9.

Table A.3.2.2.6-6: PDSCH Reference Channel for sustained data-rate test (1024QAM, 4 MIMO layers)

Parameter	Unit		Value			
Reference channel		R.PDSCH.6-	R.PDSCH.6-	R.PDSCH.6-		
		6.1 TDD	6.2 TDD	6.3 TDD		
Channel bandwidth	MHz	10	15	20		
Allocated resource blocks		Note 7	Note 8	Note 9		
Uplink-Downlink Configuration (Note 3)		2	2	2		
Number of HARQ Processes per component		10	10	10		
carrier						
Allocated subframes per Radio Frame (D+S)		6	6	6		
Modulation		1024QAM	1024QAM	1024QAM		
Coding Rate						
For Sub-Frames 1,2,6,7		N/A	N/A	N/A		
For Sub-Frames 3,4		0.81	0.79	0.81		
For Sub-Frames 8,9		0.81	0.79	0.81		
For Sub-Frame 5		0.81	0.82	0.82		
For Sub-Frame 0		0.85	0.82	0.83		
Information Bit Payload (Note 4)						
For Sub-Frames 1,2,6,7	Bits	N/A	N/A	N/A		
For Sub-Frames 3,4	Bits	110136	161760	220296		
For Sub-Frames 8,9	Bits	110136	161760	220296		
For Sub-Frame 5	Bits	101840	157432	211936		
For Sub-Frame 0	Bits	110136	161760	220296		
Number of Code Blocks						
(Notes 4 and 5)						
For Sub-Frames 1,2,6,7	CBs	N/A	N/A	N/A		
For Sub-Frames 3,4	CBs	18	27	36		
For Sub-Frames 8,9	CBs	18	27	36		
For Sub-Frame 5	CBs	17	26	35		
For Sub-Frame 0	CBs	18	27	36		
Binary Channel Bits (Note 4)						
For Sub-Frames 1,2,6,7	Bits	N/A	N/A	N/A		
For Sub-Frames 3,4	Bits	136000	204000	272000		
For Sub-Frames 8,9	Bits	136000	204000	272000		
For Sub-Frame 5	Bits	126400	191680	259680		
For Sub-Frame 0	Bits	129760	197760	265760		
Number of layers		2	2	2		
Max. Throughput averaged over 1 frame (Note 4)	Mbps	65.252	96.623	131.342		

- Note 1: 1 symbol allocated to PDCCH for all tests.
- Note 2: Reference signal, synchronization signals and PBCH allocated as per TS 36.211 [15].
- Note 3: As per Table 4.2-2 in TS 36.211 [15].
- Note 4: Given per component carrier per codeword.
- Note 5: If more than one Code Block is present, an additional CRC sequence of L = 24 Bits is attached to each Code Block (otherwise L = 0 Bit).
- Note 6: Resource blocks n_{PRB} = 0..2 are allocated for SIB transmissions in sub-frame 5 for all bandwidths.
- Note 7: Resource blocks n_{PRB} = 3..49 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..49 in sub-frames 0,3,4,8,9.
- Note 8: Resource blocks n_{PRB} = 4..74 are allocated for the user data in sub-frame 5, and resource blocks n_{PRB} = 0..74 in sub-frames 0,3,4,8,9.
- Note 9: Resource blocks $n_{PRB} = 4..99$ are allocated for the user data in sub-frame 5, and resource blocks $n_{PRB} = 0..99$ in sub-frames 0,3,4,8,9.

A.3.3 Reference measurement channels for PDCCH performance requirements

A.3.3.1 FDD

A.3.3.1.1 Reference measurement channels for SCS 15 kHz FR1

Table A.3.3.1.1-1: PDCCH Reference Channels (Time domain allocation 1 symbol)

Parameter	Unit		Value						
Reference		R.PDCCH.1-	R.PDCCH.1-	R.PDCCH.1-					
channel		1.1 FDD	1.2 FDD	1.3 FDD					
Subcarrier	kHz	15	15	15					
spacing									
CORESET		48	48	48					
frequency domain									
allocation									
CORESET time		1	1	1					
domain allocation									
Aggregation level		4	4	8					
DCI Format		1_0	1_1	1_1					
Payload (without	Bits	39	52	52					
CRC)									

Table A.3.3.1.1-2: PDCCH Reference Channel (Time domain allocation 2 symbols)

Paramete r	Uni t		Value							
Reference		R.PDCCH.								
channel		1-2.1 FDD	1-2.2 FDD	1-2.3 FDD	1-2.4 FDD	1-2.5 FDD	1-2.6 FDD	1-2.7 FDD		
Subcarrier spacing	kHz	15	15	15	15	15	15	15		
CORESET frequency domain allocation		24	24	24	48	48	48	48		
CORESET time domain allocation		2	2	2	2	2	2	2		
Aggregatio n level		2	4	2	4	8	16	8		
DCI Format		1_0	1_0	1_1	1_1	1_1	1_0	2_6		
Payload (without CRC)	Bits	39	39	52	52	52	39	12		

A.3.3.1.2 Reference measurement channels for SCS 30 kHz FR1

Table A.3.3.1.2-1: PDCCH Reference Channels (Time domain allocation 1 symbol)

Parameter	Unit			Valu	ıe	
Reference		R.PDCCH.2-	R.PDCCH.2-	R.PDCCH.2-		
channel		1.1 FDD	1.2 FDD	1.3 FDD		
Subcarrier	kHz	30	30	30		
spacing						
CORESET		102	102	90		
frequency domain						
allocation						
CORESET time		1	1	1		
domain allocation						
Aggregation level		2	4	8		
DCI Format		1_0	1_1	1_1		
Payload (without	Bits	41	53	53		
CRC)						

Table A.3.3.1.2-2: PDCCH Reference Channel (Time domain allocation 2 symbols)

Parameter	Unit		Va	lue	
Reference		R.PDCCH.2-			
channel		2.1 FDD			
Subcarrier	kHz	30			
spacing					
CORESET		48			
frequency domain					
allocation					
CORESET time		2			
domain allocation					
Aggregation level		16			
DCI Format		1_0			
Payload (without	Bits	41			
CRC)					

A.3.3.2 TDD

A.3.3.2.1 Reference measurement channels for SCS 15 kHz FR1

Table A.3.3.2.1-1: PDCCH Reference Channels (Time domain allocation 1 symbol)

Parameter	Unit			Valu	ne	
Reference		R.PDCCH.1-	R.PDCCH.1-	R.PDCCH.1-		
channel		1.1 TDD	1.2 TDD	1.3 TDD		
Subcarrier	kHz	15	15	15		
spacing						
CORESET		48	48	48		
frequency domain						
allocation						
CORESET time		1	1	1		
domain allocation						
Aggregation level		4	4	8		
DCI Format		1_0	1_1	1_1		
Payload (without	Bits	39	52	52		
CRC)						

Table A.3.3.2.1-2: PDCCH Reference Channel (Time domain allocation 2 symbols)

Parameter	Unit			Va	lue		
Reference		R.PDCCH.1-	R.PDCCH.1-	R.PDCCH.1-	R.PDCCH.1-	R.PDCCH.1-	R.PDCCH.1-
channel		2.1 TDD	2.2 TDD	2.3 TDD	2.4 TDD	2.5 TDD	2.6 TDD
Subcarrier	kHz	15	15	15	15	15	15
spacing							
CORESET		24	24	24	48	48	48
frequency							
domain							
allocation							
CORESET time		2	2	2	2	2	2
domain							
allocation							
Aggregation		2	4	2	4	8	16
level							
DCI Format		1_0	1_0	1_1	1_1	1_1	1_0
Payload (without CRC)	Bits	39	39	52	52	52	39

A.3.3.2.2 Reference measurement channels for SCS 30 kHz FR1

Table A.3.3.2.2-1: PDCCH Reference Channels (Time domain allocation 1 symbol)

Parameter	Unit			Val	ue	
Reference		R.PDCCH.2-	R.PDCCH.2-	R.PDCCH.2-	R.PDCCH.2-	
channel		1.1 TDD	1.2 TDD	1.3 TDD	1.4 TDD	
Subcarrier	kHz	30	30	30	30	
spacing						
CORESET		102	102	90	102	
frequency domain						
allocation						
CORESET time		1	1	1	1	
domain allocation						
Aggregation level		2	4	8	8	
DCI Format		1_0	1_1	1_1	2_6	
Payload (without CRC)	Bits	41	53	53	12	

Table A.3.3.2.2-2: PDCCH Reference Channel (Time domain allocation 2 symbols)

Parameter	Unit		Value
Reference		R.PDCCH.2-	
channel		2.1 TDD	
Subcarrier	kHz	30	
spacing			
CORESET		48	
frequency domain			
allocation			
CORESET time		2	
domain allocation			
Aggregation level		16	
DCI Format		1_0	
Payload (without	Bits	41	
CRC)			

A.3.3.2.3 Reference measurement channels for SCS 60 kHz FR1

A.3.3.2.4 Reference measurement channels for SCS 60 kHz FR2

A.3.3.2.5 Reference measurement channels for SCS 120 kHz FR2

Table A.3.3.2.5-1: PDCCH Reference Channels (Time domain allocation 1 symbol)

Parameter	Unit		Value								
Reference		R.PDCCH.5-	R.PDCCH.5-	R.PDCCH.5-	R.PDCCH.						
channel		1.1 TDD	1.2 TDD	1.3 TDD	5-1.4 TDD						
Subcarrier	kHz	120	120	120	120						
spacing											
CORESET		60	60	60	60						
frequency domain											
allocation											
CORESET time		1	1	1	1						
domain allocation											
Aggregation level		2	4	8	8						
DCI Format		1_0	1_1	1_1	2_6						
Payload (without	Bits	40	56	56	12						
CRC)											

Table A.3.3.2.5-2: PDCCH Reference Channel (Time domain allocation 2 symbols)

Parameter	Unit		Value
Reference		R.PDCCH.5-	
channel		2.1 TDD	
Subcarrier	kHz	120	
spacing			
CORESET		60	
frequency domain			
allocation			
CORESET time		2	
domain allocation			
Aggregation level		16	
DCI Format		1_0	
Payload (without	Bits	40	
CRC)			

A.3.4 Reference measurement channels for PBCH demodulation requirements

A.3.4.1 Reference measurement channels for FR1

Table A.3.4.1-1: PBCH Reference Channel

Parameter	Unit	Va	lue
Reference channel		R.PBCH.1	R.PBCH.2
SS/PBCH block subcarrier spacing	kHz	15	30
Modulation		QPSK	QPSK
Target coding rate		56/864	56/864
Payload (without CRC and timing	bits	24	24
related PBCH payload bits)			

A.3.4.2 Reference measurement channels for FR2

Table A.3.4.2-1: PBCH Reference Channel

Parameter	Unit	Va	lue
Reference channels		R.PBCH.5	R.PBCH.6
SS/PBCH block subcarrier spacing	kHz	120	240
Modulation		QPSK	QPSK
Target coding rate		56/864	56/864
Payload (without CRC and timing related PBCH payload bits)	bits	24	24

A.4 CSI reference measurement channels

This clause defines the DL signal applicable to the reporting of channel status information (Clauses 6 and 8).

Tables in this clause specifies the mapping of CQI index to Information Bit payload, which complies with the CQI definition specified in clause 5.2.2.1 of TS 38.214 [12] and with MCS definition specified in clause 5.1.3 of TS 38.214 [12].

Table A.4-1: Mapping of CQI Index to Information Bit payload (CQI table 1)

TBS Schem	е			TBS.1-1	TBS.1-2				
MCS table						640	QAM		
Number of a	allocated PDS	CH resource	blocks	66	66				
Number of c	consecutive PI	DSCH symbo	ls	12	12				
Number of F	PDSCH MIMO	layers		1	2				
Number of E	OMRS REs (N	24	24						
Overhead for	Overhead for TBS determination								
Available R	E-s		7590	7590					
CQI index	CQI index Spectral MCS Modulatio				Infor	mation Bit	Payload p	er Slot	
	efficiency	index	n						
0	OOR	OOR	OOR	N/A	N/A				
1	0.1523	0		1800	3624				
2	0.2344	0		1800	3624				
3	0.3770	2	ODCK	2856	5640				
4	0.6016	4	QPSK	4480	8968				
5	0.8770	6		6528	13064				
6	1.1758	8		8712	17928				
7	1.4766	11		11016	22032				
8	1.9141	13	16QAM	14343	28680				
9	2.4063	15		17928	35856				
10	2.7305	18		20496	40976				
11	3.3223	20		25104	50184				
12	3.9023	22	64QAM	29192	58384				
13	4.5234	24	04QAW	33816	67584				
14	5.1152	26		38936	77896				
15	5.5547	28		42016	83976				
Note 1: N	lumber of DMI	RS REs inclu	des the overhe	ead of the D	M-RS CDI	M groups v	ithout data	<u></u>	

Note 1: Number of DMRS REs includes the overhead of the DM-RS CDM groups without data Note 2: PDSCH is not scheduled on slots containing CSI-RS or slots which are not full DL Note 3: PDSCH is not scheduled on slots containing PBCH, i.e. slot#0 per 20ms periodicity

Table A.4-2: Mapping of CQI Index to Information Bit payload (CQI table 2, Rank 1 and Rank 2)

TBS Scher	ne			TBS.2-	TBS.2-	TBS.2-	TBS.2-	TBS.2-	TBS.2-	TBS.2-
				1	2	3	4	5	6	7
MCS table							256QAM			
Number of	allocated PD	SCH resour	ce blocks	52	52	106	106	8	16	32
Number of	consecutive	PDSCH syn	nbols	12	12	12	12	12	12	12
Number of	PDSCH MIM	IO layers		1	2	1	2	1	1	1
Number of	DMRS REs ((Note 1)		24	24	24	24	24	24	24
Overhead f	or TBS deter	mination		0	0	0	0	0	0	6
Available R	RE-s for PDS	CH		6240	6240	12720	12720	960	1920	3680
CQI					I	nformation	n Bit Paylo	ad per Slo	t	
index	efficiency	index	on							
0	OOR	OOR	OOR	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1	0.1523	0		1480	2976	2976	5896	224	456	848
2	0.3770	1	QPSK	2408	4744	4744	9480	368	736	1416
3	0.8770	3		5504	11016	11016	22536	848	1736	3240
4	1.4766	5		9224	18432	18960	37896	1416	2856	5376
5	1.9141	7	16QAM	12040	24072	24576	49176	1864	3752	6912
6	2.4063	9		15112	30216	30728	61480	2408	4608	8712
7	2.7305	11		16896	33816	34816	69672	2600	5248	9992
8	3.3223	13		20496	40976	42016	83976	3240	6400	12040
9	3.9023	15		24576	49176	49176	98376	3752	7424	14344
10	4.5234	17	64QAM	28168	56368	57376	11477	4352	8712	16392
							6			
11	5.1152	19		31752	63528	65576	13117	4864	9736	18432
							6			
12	5.5547	21		34816	69672	69672	13937	5248	10760	20496
40	0.0000			00000	77000	70000	6	0040	40040	00500
13	6.2266	23		38936	77896	79896	15988 0	6016	12040	22536
14	6.9141	25	256QAM	43032	86040	88064	17620	6656	13320	25104
14	0.9141	20		43032	00040	00004	8	0000	13320	20104
15	7.4063	27	1	46104	92200	94248	18857	7040	14088	27144
	71.000			10101	32200	3.2.3	6		1.000	
Note 1:	Number of D	MRS REs in	cludes the ov	verhead of	the DM-R	S CDM gr	oups with	out data		

Note 2:

PDSCH is not scheduled on slots containing CSI-RS or slots which are not full DL PDSCH is not scheduled on slots containing PBCH, i.e. slot#0 per 20ms periodicity Note 3:

Table A.4-3: Mapping of CQI Index to Information Bit payload (CQI table 2, Rank 3 and Rank 4)

TBS Schem	е			TBS.3-1	TBS.3-2	TBS.3-3	TBS.3-4		
MCS table						2560	QAM		
Number of a	Illocated PDS	CH resource	blocks	52	52	106	106		
Number of c	onsecutive PI	OSCH symbo	ls	12	12	12	12		
Number of F	DSCH MIMO	layers		3	4	3	4		
Number of D	24	24	24	24					
Overhead for	0	0	0	0					
Available RE	E-s for PDSCH		6240	6240	12720	12720			
CQI index Spectral MCS Modulation					Infor	mation Bit F	Payload per	r Slot	
	efficiency	index							
0	OOR	OOR	OOR	N/A	N/A	N/A	N/A		
1	0.1523	0		4360	5896	8976	11784		
2	0.3770	1	QPSK	7048	9480	14344	18976		
3	0.8770	3		16392	22032	33816	45096		
4	1.4766	5		27656	36896	56368	75792		
5	1.9141	7	16QAM	35856	48168	73776	98376		
6	2.4063	9		45096	60456	92200	122976		
7	2.7305	11		51216	67584	104496	139376		
8	3.3223	13		62504	81976	127080	167976		
9	3.9023	15	64QAM	73776	98376	147576	196776		
10	4.5234	17		83976	112648	172176	229576		
11	5.1152	19		96264	127080	196776	262376		
12	5.5547	21		104496	139376	213176	278776		
13	6.2266	23	256QAM	116792	155776	237776	319784		
14	6.9141	25	ZOOQAW	129128	172176	262376	352440		
15					184424	278776	376896		
	Note 1: Number of DMRS REs includes the overhead of the DM-RS CDM groups without data								
	Note 2: PDSCH is not scheduled on slots containing CSI-RS or slots which are not full DL								
Note 3: P	DSCH is not s	scheduled on	slots containir	ng PBCH, i.	e. slot#0 pe	er 20ms per	riodicity		

Table A.4-4: Mapping of CQI Index to Information Bit payload (CQI table 3)

TBS Schem	e			TBS.4-1	TBS.4-2				\Box
MCS table						64QAN	/ILowSE		
Number of a	allocated PDS	CH resource I	olocks	52	106				
Number of c	consecutive PI	DSCH symbol	ls	12	12				
Number of F	PDSCH MIMO	layers		1	1				
Number of E	Number of DMRS REs (Note 1)				24				
Overhead for TBS determination				0	0				
Available RE-s for PDSCH				6240	12720				
CQI index Spectral MCS Modulatio				Infor	mation Bit	Payload pe	er Slot		
	efficiency	index	n						
0	OOR	OOR	OOR	N/A	N/A				
1	0.0586	0		368	768				
2	0.0977	2		608	1256				
3	0.1523	4		984	2024				
4	0.2344	6	QPSK	1480	2976				
5	0.3770	8	QFSK	2408	4744				
6	0.6016	10		3752	7680				
7	0.8770	12		5504	11016				
8	1.1758	14		7296	14856				
9	1.4766	16		9224	18960				
10	1.9141	18	16QAM	12040	24576				
11	2.4063	20		15112	30728				
12	2.7305	22		16896	34816				
13	3.3223	24	64QAM	20496	42016				
14	3.9023	26	U4QAW	24576	49176				
15	4.5234	28		28168	57376				
	lumber of DMI							ì	
	3								
Note 3: P	DSCH is not s	scheduled on	slots containii	ng PBCH, i.	e. slot#0 pe	er 20ms pe	riodicity		

OFDMA Channel Noise Generator (OCNG) **A.5**

A.5.1 OCNG Patterns for FDD

A.5.1.1 OCNG FDD pattern 1: Generic OCNG FDD Pattern for all unused **REs**

Table A.5.1.1-1: OP.1 FDD: Generic OCNG FDD Pattern for all unused REs

OCNG Appliance	Control Region	Data Region	
OCNG Parameters	(CORESET)	-	
Resources allocated	All unused REs (Note 1)	All unused REs (Note 2)	
Structure	PDCCH	PDSCH	
Content	Uncorrelated pseudo random QPSK modulated data	Uncorrelated pseudo random QPSK modulated data	
Transmission scheme for multiple antennas ports transmission	Single Tx port transmission	Spatial multiplexing using any precoding matrix with dimensions same as the precoding matrix for PDSCH	
Subcarrier Spacing	Same as for RMC PDCCH in the active BWP	Same as for RMC PDSCH in the active BWP	
Power Level	Same as for RMC PDCCH	Same as for RMC PDSCH	
Note 1: All unused REs in the active CORESETS appointed by the search spaces in use.			

Unused available REs refer to REs in PRBs not allocated for any physical channels, CORESETs, Note 2: synchronization signals or reference signals, and excluding REs in all the available PDSCH DMRS CDM groups, in channel bandwidth.

A.5.2 OCNG Patterns for TDD

A.5.2.1 OCNG TDD pattern 1: Generic OCNG TDD Pattern for all unused **REs**

Table A.5.2.1-1: OP.1 TDD: Generic OCNG TDD Pattern for all unused REs

OCNG Appliance OCNG Parameters	Control Region (CORESET)	Data Region
Resources allocated	All unused REs (Note 1)	All unused REs (Note 2)
Structure	PDCCH	PDSCH
Content	Uncorrelated pseudo random QPSK modulated data	Uncorrelated pseudo random QPSK modulated data
Transmission scheme for multiple antennas ports transmission	Single Tx port transmission	Spatial multiplexing using any precoding matrix with dimensions same as the precoding matrix for PDSCH
Subcarrier Spacing	Same as for RMC PDCCH in the active BWP	Same as for RMC PDSCH in the active BWP
Power Level	Same as for RMC PDCCH	Same as for RMC PDSCH

All unused REs in the active CORESETS appointed by the search spaces in use. Note 1:

Unused available REs refer to REs in PRBs not allocated for any physical channels, CORESETs, Note 2: synchronization signals or reference signals, and excluding REs in all the available PDSCH DMRS CDM groups, in channel bandwidth.

Annex B (normative): Propagation conditions

B.1 Static propagation condition

B.1.1 UE Receiver with 2Rx

For 1 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}$$
.

For 2 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{pmatrix} 1 & j \\ 1 & -j \end{pmatrix}.$$

For 4 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{bmatrix} 1 & 1 & j & j \\ 1 & 1 - j - j \end{bmatrix}$$

For 8 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{bmatrix} 1 & 1 & 1 & 1 & j & j & j \\ 1 & 1 & 1 & 1 - j - j - j - j \end{bmatrix}$$

B.1.2 UE Receiver with 4Rx

For 1 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 1 \end{bmatrix}$$

For 2 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{bmatrix} 1 & j \\ 1 & -j \\ 1 & j \\ 1 & -j \end{bmatrix}$$

For 4 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{bmatrix} 1 & 1 & j & j \\ 1 & 1 & -j & -j \\ 1 & -1 & j & -j \\ 1 & -1 & -j & j \end{bmatrix}$$

For 8 port transmission the channel matrix is defined in the frequency domain by

$$\mathbf{H} = \begin{bmatrix} 1 & 1 & 1 & 1 & j & j & j & j \\ 1 & 1 & 1 & 1 & -j & -j & -j & -j \\ 1 & 1 & -1 & -1 & j & j & -j & -j \\ 1 & 1 & -1 & -1 & -j & -j & j & j \end{bmatrix}$$

B.2 Multi-path fading propagation conditions

The multipath propagation conditions consist of several parts:

- A delay profile in the form of a "tapped delay-lin", characterized by a number of taps at fixed positions on a sampling grid. The profile can be further characterized by the r.m.s. delay spread and the maximum delay spanned by the taps.
- A combination of channel model parameters that include the Delay profile and the Doppler spectrum that is characterized by a classical spectrum shape and a maximum Doppler frequency.
- Different models are used for FR1 (below 6 GHz) and FR2 (above 6 GHz).

B.2.1 Delay profiles

The delay profiles are simplified from the TR 38.901 [5] TDL models. The simplification steps are shown below for information. These steps are only used when new delay profiles are created. Otherwise, the delay profiles specified in B.2.1.1 and B.2.1.2 can be used as such.

- Step 1: Use the original TDL model from TR 38.901[5].
- Step 2: Re-order the taps in ascending delays
- Step 3: Perform delay scaling according to the procedure described in clause 7.7.3 in TR 38.901 [5].
- Step 4: Apply the quantization to the delay resolution 5 ns. This is done simply by rounding the tap delays to the nearest multiple of the delay resolution.
- Step 5: If multiple taps are rounded to the same delay bin, merge them by calculating their linear power sum.
- Step 6: If there are more than 12 taps in the quantized model, merge the taps as follows
- Find the weakest tap from all taps (both merged and unmerged taps are considered)
 - If there are two or more taps having the same value and are the weakest, select the tap with the smallest delay as the weakest tap.
- When the weakest tap is the first delay tap, merge taps as follows
 - Update the power of the first delay tap as the linear power sum of the weakest tap and the second delay tap.
 - Remove the second delay tap.
- When the weakest tap is the last delay tap, merge taps as follows
 - Update the power of the last delay tap as the linear power sum of the second-to-last tap and the last tap.
 - Remove the second-to-last tap.
- Otherwise
 - For each side of the weakest tap, identify the neighbour tap that has the smaller delay difference to the weakest tap.

- When the delay difference between the weakest tap and the identified neighbour tap on one side equals the delay difference between the weakest tap and the identified neighbour tap on the other side.
 - Select the neighbour tap that is weaker in power for merging.
- Otherwise, select the neighbour tap that has smaller delay difference for merging.
- To merge, the power of the merged tap is the linear sum of the power of the weakest tap and the selected tap.
- When the selected tap is the first tap, the location of the merged tap is the location of the first tap. The weakest tap is removed.
- When the selected tap is the last tap, the location of the merged tap is the location of the last tap. The weakest tap is removed.
- Otherwise, the location of the merged tap is based on the average delay of the weakest tap and selected tap. If the average delay is on the sampling grid, the location of the merged tap is the average delay. Merge two parallel taps with different delays (average delay, sum power) starting from the weakest ones. Otherwise, the location of the merged tap is rounded towards the direction of the selected tap (e.g. 10 ns & 20 ns → 15 ns, 10 ns & 25 ns → 20 ns, if 25 ns had higher or equal power; 15 ns, if 10 ns had higher power). The weakest tap and the selected tap are removed.
- Repeat step 6 until the final number of taps is 12.
- Step 7: Round the amplitudes of taps to one decimal (e.g. -8.78 dB \rightarrow -8.8 dB)
- Step 8: If the delay spread has slightly changed due to the tap merge, adjust the final delay spread by increasing or decreasing the power of the last tap so that the delay spread is corrected.
- Step 9: Re-normalize tap powers such that the strongest tap is at 0dB.
- Note: Some values of the delay profile created by the simplification steps may differ from the values in tables B.2.1.1-2, B.2.1.1-3, B.2.1.1-4, B.2.1.2-2, and B.2.1.1-3 for the corresponding model.
- Note: For Step 5 and Step 6, the power values are expressed in the linear domain using 6 digits of precision. The operations are in the linear domain.
- Note: Delay profile for TDLD30 is generated under assumption that Steps 1-8 are applied for taps with Rayleigh distribution.

B.2.1.1 Delay profiles for FR1

The delay profiles for FR1 are selected to be representative of low, medium and high delay spread environment. The resulting model parameters are specified in B.2.1.1-1 and the tapped delay line models are specified in Tables B.2.1.1-2 \sim Table B.2.1.1-4.

Table B.2.1.1-1: Delay profiles for NR channel models

Model	Number of channel taps	Delay spread (r.m.s.)	Maximum excess tap delay (span)	Delay resolution
TDLA30	12	30 ns	290 ns	5 ns
TDLB100	12	100 ns	480 ns	5 ns
TDLC300	12	300 ns	2595 ns	5 ns

Table B.2.1.1-2 TDLA30 (DS = 30 ns)

Tap#	Delay [ns]	Power [dB]	Fading distribution
1	0	-15.5	Rayleigh
2	10	0	Rayleigh
3	15	-5.1	Rayleigh
4	20	-5.1	Rayleigh
5	25	-9.6	Rayleigh
6	50	-8.2	Rayleigh
7	65	-13.1	Rayleigh
8	75	-11.5	Rayleigh
9	105	-11.0	Rayleigh
10	135	-16.2	Rayleigh
11	150	-16.6	Rayleigh
12	290	-26.2	Rayleigh

Table B.2.1.1-3 TDLB100 (DS = 100ns)

Tap#	Delay [ns]	Power [dB]	Fading distribution
1	0	0	Rayleigh
2	10	-2.2	Rayleigh
3	20	-0.6	Rayleigh
4	30	-0.6	Rayleigh
5	35	-0.3	Rayleigh
6	45	-1.2	Rayleigh
7	55	-5.9	Rayleigh
8	120	-2.2	Rayleigh
9	170	-0.8	Rayleigh
10	245	-6.3	Rayleigh
11	330	-7.5	Rayleigh
12	480	-7.1	Rayleigh

Table B.2.1.1-4 TDLC300 (DS = 300 ns)

Tap#	Delay [ns]	Power [dB]	Fading distribution
1	0	-6.9	Rayleigh
2	65	0	Rayleigh
3	70	-7.7	Rayleigh
4	190	-2.5	Rayleigh
5	195	-2.4	Rayleigh
6	200	-9.9	Rayleigh
7	240	-8.0	Rayleigh
8	325	-6.6	Rayleigh
9	520	-7.1	Rayleigh
10	1045	-13.0	Rayleigh
11	1510	-14.2	Rayleigh
12	2595	-16.0	Rayleigh

B.2.1.2 Delay profiles for FR2

The delay profiles for FR2 are specified in B.2.1.2-1 and the tapped delay line models are specified in Tables B.2.1.2-2 and table B.2.1.2-3.

Table B.2.1.2-1: Delay profiles for NR channel models

Model	Number of channel taps	Delay spread (r.m.s.)	Maximum excess tap delay (span)	Delay resolution
TDLA30	12	30 ns	290 ns	5 ns
TDLC60	12	60 ns	520 ns	5 ns
TDLD30	10	30 ns	375 ns	5 ns

Table B.2.1.2-2 TDLA30 (DS = 30 ns)

Tap#	Delay [ns]	Power [dB]	Fading distribution
1	0	-15.5	Rayleigh
2	10	0	Rayleigh
3	15	-5.1	Rayleigh
4	20	-5.1	Rayleigh
5	25	-9.6	Rayleigh
6	50	-8.2	Rayleigh
7	65	-13.1	Rayleigh
8	75	-11.5	Rayleigh
9	105	-11.0	Rayleigh
10	135	-16.2	Rayleigh
11	150	-16.6	Rayleigh
12	290	-26.2	Rayleigh

Table B.2.1.2-3 TDLC60 (DS = 60 ns)

Tap#	Delay [ns]	Power [dB]	Fading distribution
1	0	-7.8	Rayleigh
2	15	-0.3	Rayleigh
3	40	0	Rayleigh
4	50	-8.9	Rayleigh
5	55	-14.5	Rayleigh
6	75	-8.5	Rayleigh
7	80	-10.2	Rayleigh
8	130	-12.1	Rayleigh
9	210	-13.9	Rayleigh
10	300	-15.2	Rayleigh
11	360	-16.9	Rayleigh
12	520	-19.4	Rayleigh

Table B.2.1.2-4 TDLD30 (DS = 30 ns)

Tap#	Delay [ns]	Power [dB]	Fading distribution	
1	0	-0.2	LOS path	
Į.	0	-12.4	Rayleigh	
2	20	-21	Rayleigh	
3	40	-16.7	Rayleigh	
4	55	-18.3	Rayleigh	
5	80	-21.9	Rayleigh	
6	120	-27.8	Rayleigh	
7	240	-23.6	Rayleigh	
8	285	-24.8	Rayleigh	
9	290	-30.0	Rayleigh	
10	375	-27.6	Rayleigh	
Note 1:	Tap #1 fol	Tap #1 follows a Ricean distribution.		

B.2.2 Combinations of channel model parameters

The propagation conditions used for the performance measurements in multi-path fading environment are indicated as a combination of a channel model name and a maximum Doppler frequency, i.e., TDLA<DS>-<Doppler>, TDLB<DS>-<Doppler> or TDLC<DS>-<Doppler> where '<DS>' indicates the desired delay spread and '<Doppler>' indicates the maximum Doppler frequency (Hz).

Table B.2.2-1 and Table B.2.2-2 show the propagation conditions that are used for the performance measurements in multi-path fading environment for low, medium and high Doppler frequencies for FR1 and FR2, respectively.

Table B.2.2-1 Channel model parameters for FR1

Combination name	Model	Maximum Doppler frequency
TDLA30-5	TDLA30	5 Hz
TDLA30-10	TDLA30	10 Hz
TDLB100-400	TDLB100	400 Hz
TDLC300-100	TDLC300	100 Hz
TDLC300-600	TDLC300	600 Hz
TDLC300-1200	TDLC300	1200 Hz

Table B.2.2-2 Channel model parameters for FR2

Combination name	Model	Maximum Doppler frequency
TDLA30-35	TDLA30	35 Hz
TDLA30-75	TDLA30	75 Hz
TDLA30-300	TDLA30	300 Hz
TDLC60-300	TDLC60	300 Hz

B.2.3 MIMO Channel Correlation Matrices

The MIMO channel correlation matrices defined in B.2.3 apply for the antenna configuration using uniform linear arrays at both gNB and UE and for the antenna configuration using cross polarized antennas.

B.2.3.1 MIMO Correlation Matrices using Uniform Linear Array (ULA)

The MIMO channel correlation matrices defined in B.2.3.1 apply for the antenna configuration using uniform linear array (ULA) at both gNB and UE.

B.2.3.1.1 Definition of MIMO Correlation Matrices

Table B.2.3.1.1-1 defines the correlation matrix for the gNB.

Table B.2.3.1.1-1 gNB correlation matrix

	One antenna	Two antennas	Four antennas
gNB Correlation	$R_{gNB} = 1$	$R_{gNB} = \begin{pmatrix} 1 & \alpha \\ \alpha^* & 1 \end{pmatrix}$	$R_{gNB} = \begin{pmatrix} 1 & \alpha^{1/9} & \alpha^{4/9} & \alpha \\ \alpha^{1/9*} & 1 & \alpha^{1/9} & \alpha^{4/9} \\ \alpha^{4/9*} & \alpha^{1/9*} & 1 & \alpha^{1/9} \\ \alpha^* & \alpha^{4/9*} & \alpha^{1/9*} & 1 \end{pmatrix}$

Table B.2.3.1.1-2 defines the correlation matrix for the UE:

Table B.2.3.1.1-2 UE correlation matrix

	One antenna	Two antennas	Four antennas
UE Correlation	R_{UE} =1	$R_{UE} = \begin{pmatrix} 1 & \beta \\ \beta^* & 1 \end{pmatrix}$	$R_{UE} = \begin{pmatrix} 1 & \beta^{\frac{1}{9}} & \beta^{\frac{4}{9}} & \beta \\ \beta^{\frac{1}{9}^*} & 1 & \beta^{\frac{1}{9}} & \beta^{\frac{4}{9}} \\ \beta^{\frac{4}{9}^*} & \beta^{\frac{1}{9}^*} & 1 & \beta^{\frac{1}{9}} \\ \beta^* & \beta^{\frac{4}{9}^*} & \beta^{\frac{1}{9}^*} & 1 \end{pmatrix}$

Table B.2.3.1.1-3 defines the channel spatial correlation matrix R_{spat} . The parameters, α and β in Table B.2.3.1-3 defines the spatial correlation between the antennas at the gNB and UE.

Table B.2.3.1.1-3: R_{spat} correlation matrices

1x2 case	$R_{spat} = R_{UE} = \begin{bmatrix} 1 & \beta \\ \beta^* & 1 \end{bmatrix}$		
1x4 case	$R_{spat} = R_{UE} = \begin{pmatrix} 1 & \beta^{1/9} & \beta^{4/9} & \beta \\ \beta^{1/9} & 1 & \beta^{1/9} & \beta^{4/9} \\ \beta^{4/9} & \beta^{1/9} & 1 & \beta^{1/9} \\ \beta^* & \beta^{4/9} & \beta^{1/9} & 1 \end{pmatrix}$ $R_{spat} = R_{gNB} = \begin{bmatrix} 1 & \alpha \\ \alpha^* & 1 \end{bmatrix}$		
2x1 case	$R_{spat} = R_{gNB} = egin{bmatrix} 1 & lpha \ lpha^* & 1 \end{bmatrix}$		
2x2 case	$R_{spat} = R_{gNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha \\ \alpha^* & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta \end{bmatrix} = \begin{bmatrix} 1 & \beta & \alpha & \alpha\beta \\ \beta^* & 1 & \alpha\beta^* & \alpha \\ \alpha^* & \alpha^*\beta & 1 & \beta \\ \alpha^*\beta^* & \alpha^* & \beta^* & 1 \end{bmatrix}$		
2x4 case	$R_{spat} = R_{gNB} \otimes R_{UE} = egin{bmatrix} 1 & lpha \ lpha^* & 1 \end{bmatrix} \otimes egin{bmatrix} 1 & eta^{1/9} & eta^{4/9} & eta \ eta^{1/9^*} & 1 & eta^{1/9} & eta^{4/9} \ eta^{4/9^*} & eta^{1/9^*} & 1 & eta^{1/9} \ eta^* & eta^{4/9^*} & eta^{1/9^*} & 1 \end{bmatrix}$		
4x1 case	$R_{spat} = R_{gNB} = \begin{bmatrix} 1 & \alpha \\ \alpha^* & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta & \alpha & \alpha \beta \\ \beta^* & 1 & \alpha \beta^* & \alpha \\ \alpha^* & \alpha^* \beta & 1 & \beta \\ \alpha^* \beta^* & \alpha^* & \beta^* & 1 \end{bmatrix}$ $R_{spat} = R_{gNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha \\ \alpha^* & 1 \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta^{1/9} & \beta^{4/9} & \beta \\ \beta^{1/9} & 1 & \beta^{1/9} & \beta^{4/9} & \beta \\ \beta^{1/9} & 1 & \beta^{1/9} & \beta^{1/9} & \beta^{1/9} \\ \beta^{1/9} & \beta^{1/9} & 1 & \beta^{1/9} & \beta^{1/9} \\ \beta^{1/9} & \beta^{1/9} & 1 & \beta^{1/9} & \beta^{1/9} \\ \beta^{1/9} & \beta^{1/9} & \beta^{1/9} & 1 & \beta^{1/9} \\ \beta^{1/9} & \beta^{1/9} & \beta^{1/9} & 1 & \beta^{1/9} \\ \beta^{1/9} & \beta^{1/9} & \beta^{1/9} & 1 & \beta^{1/9} \\ \beta^{1/9} & \beta^{1/9} & \beta^{1/9} & 1 & \beta^{1/9} \\ \beta^{1/9} & \beta^{1/9} & \beta^{1/9} & \beta^{1/9} \\ \beta^{1/9} & \beta^{1/9} & \beta^{1/9} & 1 & \beta^{1/9} \\ \beta^{1/9} & \beta^{1/9} & \beta^{1/9} & 1 & \beta^{1/9} \\ \beta^{1/9} & \beta^{1/9} & \beta^{1/9} \beta^{1/9} & \beta^{$		
4x2 case	$R_{spat} = R_{gNB} \otimes R_{UE} = egin{bmatrix} lpha^{j_9} & 1 & lpha^{j_9} & lpha^{j_9} \ lpha^{j_9} & lpha^{j_9} & 1 & lpha^{j_9} \ lpha^* & lpha^{j_9} & lpha^{j_9} & 1 \end{bmatrix}$		
4x4 case	$R_{spat} = R_{gNB} \otimes R_{UE} = \begin{bmatrix} 1 & \alpha^{1/9} & \alpha^{4/9} & \alpha \\ \alpha^{1/9} & 1 & \alpha^{1/9} & \alpha^{4/9} \\ \alpha^{4/9} & \alpha^{1/9} & 1 & \alpha^{1/9} \end{bmatrix} \otimes \begin{bmatrix} 1 & \beta^{1/9} & \beta^{4/9} & \beta \\ \beta^{1/9*} & 1 & \beta^{1/9} & \beta^{4/9} \\ \beta^{4/9*} & \beta^{1/9*} & 1 & \beta^{1/9} \\ \beta^{*} & \beta^{4/9*} & \beta^{1/9*} & 1 \end{bmatrix}$		

For cases with more antennas at either gNB or UE or both, the channel spatial correlation matrix can still be expressed as the Kronecker product of R_{gNB} and R_{UE} according to $R_{spat} = R_{gNB} \otimes R_{UE}$.

B.2.3.1.2 MIMO Correlation Matrices at High, Medium and Low Level

The α and β for different correlation types are given in Table B.2.3.1.2-1.

Table B.2.3.1.2-1: The α and β parameters for ULA MIMO correlation matrices

Correlation Model	α	β
Low correlation	0	0
Medium	0.3	0.9
Correlation		
Medium	0.3	0.3874
Correlation A		
High Correlation	0.9	0.9

The correlation matrices for high, medium, medium A and low correlation are defined in Table B.2.3.1.2-2, B.2.3.1.2-3, B.2.3.1.2-4 and B.2.3.1.2-5 as below.

The values in Table B.2.3.1.2-2 have been adjusted for the 4x2 and 4x4 high correlation cases to insure the correlation matrix is positive semi-definite after round-off to 4 digit precision. This is done using the equation:

$$R_{high} = [R_{spat} + aI_n]/(1+a)$$

Where the value "a" is a scaling factor such that the smallest value is used to obtain a positive semi-definite result. For the 4x2 high correlation case, a=0.00010. For the 4x4 high correlation case, a=0.00012.

The same method is used to adjust the 2x4 and 4x4 medium correlation matrix in Table B.2.3.1.2-3 to insure the correlation matrix is positive semi-definite after round-off to 4 digit precision with a = 0.00010 and a = 0.00012.

Table B.2.3.1.2-2: MIMO correlation matrices for high correlation

1x2 case	$R_{high} = \begin{pmatrix} 1 & 0.9 \\ 0.9 & 1 \end{pmatrix}$							
2x1 case	$R_{high} = \begin{pmatrix} 1 & 0.9 \\ 0.9 & 1 \end{pmatrix}$							
2x2 case	$R_{high} = \begin{pmatrix} 1 & 0.9 & 0.9 & 0.81 \\ 0.9 & 1 & 0.81 & 0.9 \\ 0.9 & 0.81 & 1 & 0.9 \\ 0.81 & 0.9 & 0.9 & 1 \end{pmatrix}$							
4x2 case	$R_{high} = \begin{bmatrix} 1.0000 & 0.8999 & 0.9883 & 0.8894 & 0.9542 & 0.8587 & 0.8999 & 0.8099 \\ 0.8999 & 1.0000 & 0.8894 & 0.9883 & 0.8587 & 0.9542 & 0.8099 & 0.8999 \\ 0.9883 & 0.8894 & 1.0000 & 0.8999 & 0.9883 & 0.8894 & 0.9542 & 0.8587 \\ 0.8894 & 0.9883 & 0.8999 & 1.0000 & 0.8894 & 0.9883 & 0.8587 & 0.9542 \\ 0.9542 & 0.8587 & 0.9883 & 0.8894 & 1.0000 & 0.8999 & 0.9883 & 0.8894 \\ 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 & 0.8894 & 0.9883 \\ 0.8999 & 0.8099 & 0.9542 & 0.8587 & 0.9883 & 0.8894 & 1.0000 & 0.8999 \\ 0.8099 & 0.8999 & 0.8587 & 0.9542 & 0.8894 & 0.9883 & 0.8999 & 1.0000 \end{bmatrix}$							
4x4 case	$R_{high} = \begin{bmatrix} 1.0000 \ 0.9882 \ 0.9541 \ 0.8999 \ 0.9882 \ 0.9767 \ 0.9430 \ 0.8894 \ 0.9541 \ 0.9430 \ 0.9105 \ 0.8587 \ 0.8999 \ 0.8894 \ 0.9882 \ 1.0000 \ 0.9882 \ 0.9541 \ 0.9767 \ 0.9882 \ 0.9767 \ 0.9430 \ 0.9541 \ 0.9430 \ 0.9541 \ 0.9430 \ 0.9541 \ 0.9430 \ 0.8587 \ 0.8894 \ 0.8999 \ 0.9541 \ 0.9882 \ 1.0000 \ 0.8894 \ 0.9430 \ 0.9767 \ 0.9882 \ 0.8587 \ 0.9105 \ 0.9430 \ 0.9541 \ 0.9430 \ 0.9541 \ 0.8099 \ 0.8587 \ 0.8894 \ 0.9882 \ 0.9767 \ 0.9430 \ 0.8894 \ 1.0000 \ 0.9882 \ 0.9541 \ 0.8999 \ 0.9882 \ 0.9767 \ 0.9430 \ 0.8894 \ 0.9541 \ 0.9430 \ 0.9767 \ 0.9882 \ 0.9767 \ 0.9430 \ 0.9882 \ 0.9767 \ 0.9430 \ 0.9430 \ 0.9767 \ 0.9882 \ 0.9767$	0.8894 0.8587 0.8999 0.8894 0.8894 0.8999 0.9105 0.8587 0.9430 0.9105 0.9541 0.9430 0.9430 0.9541 0.9430 0.8894 0.9767 0.9430 0.9882 0.9767 0.9767 0.9882 0.9541 0.8999 0.9882 0.9541 1.0000 0.9882						

Table B.2.3.1.2-3: MIMO correlation matrices for medium correlation

1x2 case	N/A							
2x1	N/A							
case	(1 0.9 0.3 0.27)							
2x2	0.9 1 0.27 0.3							
case	$R_{medium} = \begin{vmatrix} 0.3 & 0.27 & 1 & 0.9 \end{vmatrix}$							
	(0.27 0.3 0.9 1)							
	(1.0000 0.9882 0.9541 0.8999 0.3000 0.2965 0.2862 0.2700)							
	0.9882 1.0000 0.9882 0.9541 0.2965 0.3000 0.2965 0.2862							
	0.9541 0.9882 1.0000 0.9882 0.2862 0.2965 0.3000 0.2965							
2x4 case	$R_{medium} = \begin{bmatrix} 0.8999 & 0.9541 & 0.9882 & 1.0000 & 0.2700 & 0.2862 & 0.2965 & 0.3000 \\ 0.2000 & 0.2065 & 0.2862 & 0.2700 & 1.0000 & 0.0002 & 0.0541 & 0.0000 \end{bmatrix}$							
case	0.3000 0.2965 0.2862 0.2700 1.0000 0.9882 0.9541 0.8999 0.2965 0.3000 0.2965 0.2862 0.9882 1.0000 0.9882 0.9541							
	0.2862 0.2965 0.3000 0.2965 0.9541 0.9882 1.0000 0.9882							
	0.2700 0.2862 0.2965 0.3000 0.8999 0.9541 0.9882 1.0000							
	(1.0000 0.9000 0.8748 0.7873 0.5856 0.5271 0.3000 0.2700)							
	0.9000 1.0000 0.7873 0.8748 0.5271 0.5856 0.2700 0.3000							
	0.8748 0.7873 1.0000 0.9000 0.8748 0.7873 0.5856 0.5271							
4x2	$R_{medium} = \begin{bmatrix} 0.7873 & 0.8748 & 0.9000 & 1.0000 & 0.7873 & 0.8748 & 0.5271 & 0.5856 \\ 0.5856 & 0.5271 & 0.8748 & 0.7873 & 1.0000 & 0.0000 & 0.8748 & 0.7873 \end{bmatrix}$							
case	0.5856 0.5271 0.8748 0.7873 1.0000 0.9000 0.8748 0.7873							
	0.5271 0.5856 0.7873 0.8748 0.9000 1.0000 0.7873 0.8748							
	0.3000 0.2700 0.5856 0.5271 0.8748 0.7873 1.0000 0.9000							
	(0.2700 0.3000 0.5271 0.5856 0.7873 0.8748 0.9000 1.0000)							
	(1.0000 0.9882 0.9541 0.8999 0.8747 0.8645 0.8347 0.7872 0.5855 0.5787 0.5588 0.5270 0.3000 0.2965 0.2862 0.2700)							
	0.9882 1.0000 0.9882 0.9541 0.8645 0.8747 0.8645 0.8347 0.5787 0.5855 0.5787 0.5858 0.2965 0.3000 0.2965 0.2862 0.9541 0.9882 1.0000 0.9882 0.8347 0.8645 0.8747 0.8645 0.5588 0.5787 0.5855 0.5787 0.2862 0.2965 0.3000 0.2965							
	0.8999 0.9541 0.9882 1.0000 0.7872 0.8347 0.8645 0.8747 0.5270 0.5588 0.5787 0.5855 0.2700 0.2862 0.2965 0.3000 0.2963							
	0.8747 0.8645 0.8347 0.7872 1.0000 0.9882 0.9541 0.8999 0.8747 0.8645 0.8347 0.7872 0.5855 0.5787 0.5588 0.5270							
	0.8645 0.8747 0.8645 0.8347 0.9882 1.0000 0.9882 0.9541 0.8645 0.8747 0.8645 0.8347 0.5787 0.5855 0.5787 0.5588							
44	0.8347 0.8645 0.8747 0.8645 0.9541 0.9882 1.0000 0.9882 0.8347 0.8645 0.8747 0.8645 0.5588 0.5787 0.5855 0.5787							
4x4 case	$ R_{medium} = \begin{bmatrix} 0.7872 & 0.8347 & 0.8645 & 0.8747 & 0.8999 & 0.9541 & 0.9882 & 1.0000 & 0.7872 & 0.8347 & 0.8645 & 0.8747 & 0.5270 & 0.5588 & 0.5787 & 0.5855 \\ 0.5855 & 0.5787 & 0.5588 & 0.5270 & 0.8747 & 0.8645 & 0.8347 & 0.7872 & 1.0000 & 0.9882 & 0.9541 & 0.8999 & 0.8747 & 0.8645 & 0.8347 & 0.7872 \\ 0.5855 & 0.5787 & 0.5588 & 0.5270 & 0.8747 & 0.8645 & 0.8347 & 0.7872 & 1.0000 & 0.9882 & 0.9541 & 0.8999 & 0.8747 & 0.8645 & 0.8347 & 0.7872 \\ 0.5855 & 0.5787 & 0.5588 & 0.5270 & 0.8747 & 0.8645 & 0.8347 & 0.7872 & 1.0000 & 0.9882 & 0.9541 & 0.8999 & 0.8747 & 0.8645 & 0.8347 & 0.7872 \\ 0.5855 & 0.5787 & 0.5588 & 0.5270 & 0.8747 & 0.8645 & 0.8347 & 0.7872 & 1.0000 & 0.9882 & 0.9541 & 0.8999 & 0.8747 & 0.8645 & 0.8347 & 0.7872 \\ 0.5855 & 0.5787 & 0.5588 & 0.5270 & 0.8747 & 0.8645 & 0.8347 & 0.7872 & 1.0000 & 0.9882 & 0.9541 & 0.8999 & 0.8747 & 0.8645 & 0.8347 & 0.7872 \\ 0.5855 & 0.5787 & 0.5588 & 0.5270 & 0.8747 & 0.8645 & 0.8347 & 0.7872 & 1.0000 & 0.9882 & 0.9541 & 0.8999 & 0.8747 & 0.8645 & 0.8347 & 0.7872 \\ 0.5855 & 0.5787 & 0.5588 & 0.5270 & 0.8747 & 0.8645 & 0.8347 & 0.7872 & 1.0000 & 0.9882 & 0.9541 & 0.8999 & 0.8747 & 0.8645 & 0.8347 & 0.7872 \\ 0.5855 & 0.5787 & 0.5588 & 0.5270 & 0.8747 & 0.8645 & 0.8347 & 0.7872 & 1.0000 & 0.9882 & 0.9541 & 0.8999 & 0.8747 & 0.8645 & 0.8347 & 0.7872 \\ 0.5855 & 0.5787 & 0.5588 & 0.5270 & 0.8747 & 0.8645 & 0.8347 & 0.7872 & 1.0000 & 0.9882 & 0.9541 & 0.8999 & 0.8747 & 0.8645 & 0.8347 & 0.8645 \\ 0.5855 & 0.5787 & 0.5588 & 0.5270 & 0.8747 & 0.8645 & 0.8347 & 0.7872 & 0.8347 & 0.8645 & 0.8347 & 0.8$							
ouse	0.5787 0.5855 0.5787 0.5588 0.8645 0.8747 0.8645 0.8347 0.9882 1.0000 0.9882 0.9541 0.8645 0.8747 0.8645 0.8347							
	0.5588 0.5787 0.5855 0.5787 0.8347 0.8645 0.8747 0.8645 0.9541 0.9882 1.0000 0.9882 0.8347 0.8645 0.8747 0.8645							
	0.5270 0.5588 0.5787 0.5855 0.7872 0.8347 0.8645 0.8747 0.8999 0.9541 0.9882 1.0000 0.7872 0.8347 0.8645 0.8747							
	0.3000 0.2965 0.2862 0.2700 0.5855 0.5787 0.5588 0.5270 0.8747 0.8645 0.8347 0.7872 1.0000 0.9882 0.9541 0.8999							
	0.2965 0.3000 0.2965 0.2862 0.5787 0.5855 0.5787 0.5588 0.8645 0.8747 0.8645 0.8347 0.9882 1.0000 0.9882 0.9541							
	0.2862 0.2965 0.3000 0.2965 0.5588 0.5787 0.5855 0.5787 0.8347 0.8645 0.8747 0.8645 0.9541 0.9882 1.0000 0.9882							
	(0.2700 0.2862 0.2965 0.3000 0.5270 0.5588 0.5787 0.5855 0.7872 0.8347 0.8645 0.8747 0.8999 0.9541 0.9882 1.0000)							

Table B.2.3.1.2-4: MIMO correlation matrices for medium correlation A

1x4 case						R _{mediu}	$_{mA} = $	1 0.9000 0.6561 0.3874	0.9000 1 0.9000 0.6561	0.90 0 1	00 0.6 0.9	3874 5561 9000 1					
2x4 case			$R_{\scriptscriptstyle med}$	ium A =	0.9000 0.9000 0.6561 0.3874 0.3000	0.90	000 0 000 1 561 0	.9000	0.3874 0.6561 0.9000 1.0000 0.1162	0.116	00 0.3 58 0.2 52 0.1	3000 2700 968	0.1968 0.2700 0.3000 0.2700 0.6561	0.1162 0.1968 0.2700 0.3000 0.3874	3		
					0.2700 0.1968 0.1162	0.30	000 (0 700 (0.2700	0.1968 0.2700 0.3000	0.900	00 1.0 51 0.9	0000	0.9000 1.0000 0.9000	0.656 0.9000 1.0000	1		
4x4 case	$R_{medium A} =$	0.9000 0.6561 0.3874 0.8748 0.7873 0.5739 0.3389 0.5856 0.5270 0.3842 0.2269 0.3000 0.2700 0.1968	1.0000 0.9000 0.6561 0.7873 0.8748 0.7873 0.5270 0.5856 0.5270 0.3842 0.2700 0.3000 0.2700	0.9000 1.0000 0.9000 0.5739 0.7873 0.8748 0.7873 0.3842 0.5270 0.5856 0.5270 0.1968 0.2700 0.3000	0.6561 0.9000 1.0000 0.3389 0.5739 0.7873 0.8748 0.2269 0.3842 0.5270 0.5856 0.1162 0.1968 0.2700	0.7873 0.5739 0.3389 1.0000 0.9000 0.6561 0.3874 0.7873 0.5739 0.3389 0.5856 0.5270 0.3842	0.8748 0.7873 0.5739 0.9000 1.0000 0.9000 0.6561 0.7873 0.5739 0.5270 0.5856	0.7873 0.8748 0.7873 0.6561 0.9000 1.0000 0.9000 3 0.5739 3 0.7873 3 0.8748 9 0.7873 0 0.3842 5 0.5270	0.5739 0.7873 0.8748 0.3874 0.6561 0.9000 1.0000 0.3389 0.5739 0.7873 0.8748 0.2269 0.3842 0.5270	0.5270 0.3842 0.2269 0.8748 0.7873 0.5739 0.3389 1.0000 0.9000 0.6561 0.3874 0.8748 0.7873	0.5856 0.5270 0.3842 0.7873 0.8748 0.7873 0.5739 0.9000 1.0000 0.9000 0.6561 0.7873 0.8748 0.7873	0.5270 0.5856 0.5270 0.5739 0.7873 0.8748 0.7873 0.6561 0.9000 0.9000 0.5739 0.7873	2 0.2269 0.3842 0.5270 0.5856 0.3389 0.5739 0.7873 0.8748 0.6561 0.9000 0 1.0000 9 0.3389 3 0.5739 3 0.7873 3 0.8748	0.2700 0.1968 0.1162 0.5856 0.5270 0.3842 0.2269 0.8748 0.7873 0.5739 0.3389 1.0000 0.9000 0.6561	0.3000 0.2700 0.1968 0.5270 0.5856 0.5270 0.3842 0.7873 0.8748 0.7873 0.5739 0.9000 1.0000	0.2700 0.3000 0.2700 0.3842 0.5270 0.5856 0.5270 0.5739 0.7873 0.8748 0.7873 0.6561 0.9000 1.0000	0.1968 0.2700 0.3000 0.2269 0.3842 0.5270 0.5856 0.3389 0.5739 0.7873 0.8748 0.3874 0.6561 0.9000

Table B.2.3.1.2-5: MIMO correlation matrices for low correlation

1x2 case	$R_{low} = \mathbf{I}_2$
1x4 case	$R_{low} = \mathbf{I}_4$
2x1 case	$R_{low} = \mathbf{I}_2$
2x2 case	$R_{low} = \mathbf{I}_4$
2x4 case	$R_{low} = \mathbf{I}_8$
4x1 case	$R_{low} = \mathbf{I}_4$
4x2 case	$R_{low} = \mathbf{I}_8$
4x4 case	$R_{low} = \mathbf{I}_{16}$

In Table B.2.3.1.2-5, \mathbf{I}_d is the $d \times d$ identity matrix.

B.2.3.2 MIMO Correlation Matrices using Cross Polarized Antennas (X-pol)

The MIMO channel correlation matrices defined in B.2.3.2 apply for the antenna configuration using cross polarized (XP/X-pol) antennas at both gNB and UE. The cross-polarized antenna elements with ± 1.45 degrees polarization slant angles are deployed at gNB and cross-polarized antenna elements with ± 1.45 degrees polarization slant angles are deployed at UE.

For the 2D cross-polarized antenna array at eNodeB, the N antennas are indexed by (N_1, N_2, P) , and total number of antennas is $N = P \cdot N_1 \cdot N_2$, where

- N_1 is the number of antenna elements in first dimension with same polarization,
- N_2 is the number of antenna elements in second dimension with same polarization, and
- *P* is the number of polarization groups.

For the 2D cross-polarized antennas at gNB, the N antennas are labelled such that antennas shall be in increasing order of the second dimension firstly, then the first dimension, and finally the polarization group. For a specific antenna element at p-th polarization, n_1 -th row, and n_2 -th column within the 2D antenna array, the following index number is used for antenna labelling:

$$Inde(p, n_1, n_2) = p \cdot N_1 \cdot N_2 + n_1 \cdot N_2 + n_2 + 1; \qquad p = 0, 1; \quad n_1 = 0, \dots, N_1 - 1; \quad n_2 = 0, \dots, N_2 - 1.$$

where N is the number of transmit antennas, p is the polarization group index, n_1 is the row index, and n_2 is the column index of the antenna element.

For the linear (single dimension, 1D) cross-polarized antenna, the N antennas are labelled following the above equations with $N_2=1$.

B.2.3.2.1 Definition of MIMO Correlation Matrices using cross polarized antennas

For the channel spatial correlation matrix, the following is used:

$$R_{spat} = P(R_{gNB} \otimes \Gamma \otimes R_{UE})P^{T}$$

where

- $R_{\!\scriptscriptstyle U\!E}$ is the spatial correlation matrix at the UE with same polarization,
- R_{eNB} is the spatial correlation matrix at the gNB with same polarization,
- Γ is a polarization correlation matrix, and
- $(\bullet)^T$ denotes transpose.

The matrix Γis defined as

$$\Gamma = \begin{bmatrix} 1 & 0 & -\gamma & 0 \\ 0 & 1 & 0 & \gamma \\ -\gamma & 0 & 1 & 0 \\ 0 & \gamma & 0 & 1 \end{bmatrix}$$

A permutation matrix P elements are defined as

$$P(a,b) = \begin{cases} 1 & \text{for } a = (j-1)Nr + i & \text{and } b = 2(j-1)Nr + i, & i = 1, \dots, Nr, j = 1, \dots Nt/2 \\ 1 & \text{for } a = (j-1)Nr + i & \text{and } b = 2(j-Nt/2)Nr - Nr + i, & i = 1, \dots, Nr, j = Nt/2 + 1, \dots, Nt + i, \\ 0 & \text{otherwise} \end{cases}$$

where *Nt* and *Nr* is the number of transmitter and receiver respectively. This is used to map the spatial correlation coefficients in accordance with the antenna element labelling system described in B.2.3.2.

For the 2D cross-polarized antenna array at gNB, the spatial correlation matrix at the gNB is further expressed as following for 2D cross-polarized antenna array at gNB:

$$R_{gNB} = R_{gNB \ Dim1} \otimes R_{gNB \ Dim2}$$

where

- - R_{gNB_Diml} is the correlation matrix of antenna elements in first dimension with same polarization, and
- - R_{gNB_Dim2} is the correlation matrix of antenna elements in second dimension with same polarization.

For the 2D cross polarized antenna array at gNB side, the spatial correlation matrices in one direction of antenna array are as follows:

- For 1 antenna element with the same polarization in one direction,

$$R_{QNB}$$
 Dim.i = 1.

- For 2 antenna elements with the same polarization in one direction,

$$R_{gNB_Dim,i} = \begin{pmatrix} 1 & \alpha_i \\ \alpha_i^* & 1 \end{pmatrix}.$$

- For 3 antenna elements with the same polarization in one direction,

$$R_{gNB_Dim,i} = egin{pmatrix} 1 & lpha_i^{1/4} & lpha_i \ lpha_i^{1/4^*} & 1 & lpha_i^{1/4} \ lpha_i^* & lpha_i^{1/4^*} & 1 \end{pmatrix} \cdot$$

- For 4 antenna elements with the same polarization in one direction,

$$R_{gNB_Dim,i} = \begin{pmatrix} 1 & \alpha_{i}^{\frac{1}{9}} & \alpha_{i}^{\frac{4}{9}} & \alpha_{i} \\ \alpha_{i}^{\frac{1}{9}*} & 1 & \alpha_{i}^{\frac{1}{9}} & \alpha_{i}^{\frac{4}{9}} \\ \alpha_{i}^{\frac{4}{9}*} & \alpha_{i}^{\frac{1}{9}*} & 1 & \alpha_{i}^{\frac{1}{9}} \\ \alpha_{i}^{*} & \alpha_{i}^{\frac{4}{9}*} & \alpha_{i}^{\frac{1}{9}*} & 1 \end{pmatrix}.$$

where the index i = 1,2 stands for first dimension and second dimension respectively.

For the 1D cross-polarized antenna array at gNB, the matrix of R_{gNB} is determined by follow the equations for 2D cross-polarized antenna array and letting $R_{gNB_Dim2} = 1$, i.e.,

$$R_{gNB} = R_{gNB_Dim,1}$$

The spatial correlation matrices at UE side are as follows:

- For 1 antenna element with the same polarization,

$$R_{UE}=1$$
.

- For 2 antenna elements with the same polarization,

$$R_{UE} = \begin{pmatrix} 1 & \beta \\ \beta^* & 1 \end{pmatrix}.$$

B.2.3.2.2 MIMO Correlation Matrices using cross polarized antennas

The values for parameters α_1 , α_2 , β and γ for the cross polarized antenna models are given in Table B.2.3.2.2-1.

Table B.2.3.2.2-1: The α and β parameters for cross-polarized MIMO correlation matrices

Corr	elation Model	α_1	02	β	γ	
Medi	um Correlation	0.3	0.3	0.6	0.2	
	h Correlation	0.9	0.9	0.9	0.3	
Note 1:	Note 1: Value of α_1 applies when more than one pair of cross-polarized					
	antenna elements in first dimension at gNB side.					
Note 2:	ote 2: Value of α2 applies when more than one pair of cross-polarized					
	antenna elements in second dimension at gNB side.					
Note 3:	Note 3: Value of β applies when more than one pair of cross-polarized antenna					
	elements at UE side.					

For the 1D cross polarized antenna array at gNB side, the correlation matrices for high spatial correlation and medium correlation are defined in Table B.2.3.2.2-2 and Table B.2.3.2.2-3 as below.

For the 2D cross polarized antenna array at gNB side, the correlation matrices for high spatial correlation are defined in Table B.2.3.2.2-4 as below.

The values in Table B.2.3.2.2-2, and Table B.2.3.2.2-4 have been adjusted to ensure the correlation matrix is positive semi-definite after round-off to 4 digit precision. This is done using the equation:

$$R_{high} = [R_{spat} + aI_n]/(1+a)$$
 or $R_{medium} = [R_{spat} + aI_n]/(1+a)$

Where the value "a" is a scaling factor such that the smallest value is used to obtain a positive semi-definite result. For the 8(4,1,2)x2 high spatial correlation case, a=0.00010. For the 16 (4,2,2)x2 high spatial correlation case, a=0.00012.

The same method is used to adjust the 16(4,2,2)x4, 32(4,4,2)x2 and 32(4,4,2)x4 high correlation matrix to insure the correlation matrix is positive semi-definite after round-off to 4 digit precision with a =0.00012, a =0.00022, and a=0.00022 resoectively.

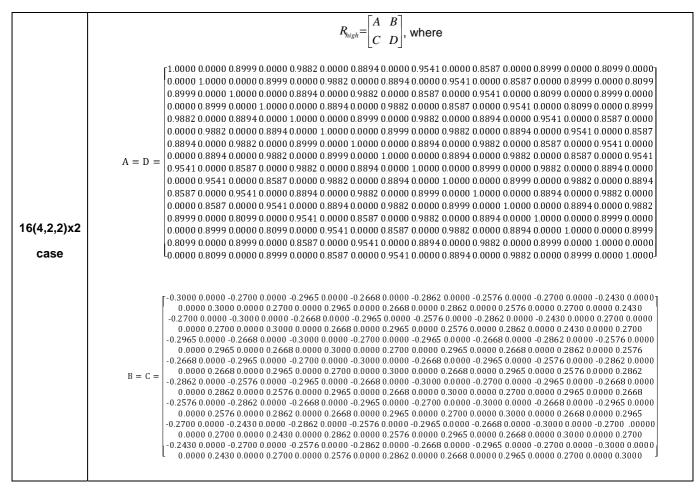
Table B.2.3.2.2-2: MIMO correlation matrices for high spatial correlation (1D cross polarized antenna array at gNB side)

				Г 1	0000	0.0000	0.00	200 (0000	0.20	100 0		0.00	700 0	0000	1	
						0.0000	0.90		0.0000	- 0.30		0.0000	-0.27		.0000		
				0	.0000	1.0000	0.00	000 (0.9000	0.00	000 0	0.3000	0.00	000 0	.2700		
				0	.9000	0.0000	1.00	000	0.0000	-0.27	00 0	.0000	-0.30	000	.0000		
4(2,1,2)x2				0	.0000	0.9000	0.0	000	1.0000	0.00	000 0	.2700	0.00	000 0	.3000		
case			$R_{high} =$:		0.0000			0.0000	1.00		.0000	0.90		.0000		
				0		0.3000		0000	0.2700	0.00		.0000	0.00		.9000		
				-0	.2700	0.0000	-0.3	000 (0.0000	0.90	00 0	.0000	1.00	00 0	.0000		
				0	.0000	0.2700	0.0	0000	0.3000	0.00	00 0	.9000	0.00	000 1	.0000		
				<u> </u>	0000	0.9000) ().()	000	0.0000	-0.30	000 -(0.2700	0.00	00 0.0	0000	_	
					9000	1.0000			0.0000	-0.27		0.3000	0.00		0000		
					0000	0.0000		000	0.9000			.0000	0.300		700		
2(1,1,2)x4			R_{high}	= 0.	.0000	0.0000	0.9	000	1.0000	0.00	00 0	.0000	0.270	0.3	000		
case			high	-0	.3000	-0.270	0.0	000	0.0000	0 1.00	00 0	.9000	0.000	0.0	000		
				-0	.2700	-0.300	0.0	000	0.0000	0.90	000 1	.0000	0.000	0.0	000		
				0.	0000	0.0000	0.3	000	0.2700	0.00	000 0	.0000	1.000	0.9	000		
					0000	0.0000		700	0.3000			.0000	0.900		000		
	ſ	1 0000	0.0000													0.0000	
		1.0000 0.9000		0.0000	0.0000	0.9000 0.8100	0.8100	0.0000	0.0000	-0.3000 -0.2700	-0.2700 -0.3000	0.0000	0.0000	-0.2700 -0.2430	-0.2430 -0.2700		0.0000
		0.0000		1.0000	0.9000	0.0000	0.0000	0.9000	0.8100	0.0000	0.0000	0.3000	0.2700	0.0000	0.0000	0.2700	0.2430
		0.0000	0.0000	0.9000	1.0000	0.0000	0.0000	0.8100	0.9000	0.0000	0.0000	0.2700	0.3000	0.0000	0.0000	0.2430	0.2700
		0.9000		0.0000	0.0000	1.0000	0.9000	0.0000	0.0000	-0.2700	-0.2430	0.0000	0.0000	-0.3000	-0.2700		0.0000
		0.8100		0.0000	0.0000	0.9000	1.0000	0.0000	0.0000	-0.2430	-0.2700	0.0000	0.0000	-0.2700	-0.3000		0.0000
4(2,1,2)x4		0.0000		0.9000 0.8100	0.8100 0.9000	0.0000	0.0000	1.0000 0.9000	0.9000 1.0000	0.0000	0.0000	0.2700 0.2430	0.2430 0.2700	0.0000	0.0000	0.3000 0.2700	0.2700 0.3000
case	$R_{ m high} =$			0.0000	0.0000	-0.2700	-0.2430	0.0000	0.0000	1.0000	0.9000	0.0000	0.0000	0.9000	0.8100	0.0000	0.0000
		-0.2700	-0.3000	0.0000	0.0000	-0.2430	-0.2700	0.0000	0.0000	0.9000	1.0000	0.0000	0.0000	0.8100	0.9000	0.0000	0.0000
		0.0000		0.3000	0.2700	0.0000	0.0000	0.2700	0.2430	0.0000	0.0000	1.0000	0.9000	0.0000	0.0000	0.9000	0.8100
		0.0000 -0.2700		0.2700 0.0000	0.3000	0.0000	0.0000	0.2430	0.2700 0.0000	0.0000	0.0000 0.8100	0.9000	1.0000	0.0000 1.0000	0.0000	0.8100	0.9000
				0.0000	0.0000	-0.2700	-0.3000	0.0000	0.0000	0.8100	0.9000	0.0000	0.0000	0.9000	1.0000	0.0000	0.0000
		0.0000		0.2700	0.2430	0.0000	0.0000	0.3000	0.2700	0.0000	0.0000	0.9000	0.8100	0.0000	0.0000	1.0000	0.9000
		0.0000	0.0000	0.2430	0.2700	0.0000	0.0000	0.2700	0.3000	0.0000	0.0000	0.8100	0.9000	0.0000	0.0000	0.9000	1.0000
		1.0000	0.0000	0.988	3 0.0000	0.9542	0.0000	0.8999	0.0000	-0.3000	0.0000	-0.2965	0.0000	-0.2862	0.0000	-0.2700	0.0000
		0.0000	1.0000	0.000	0.988	0.0000	0.9542	0.0000	0.8999	0.0000	0.3000	0.0000	0.2965	0.0000	0.2862	0.0000	0.2700
		0.9883	0.0000	1.000	0.000	0.9883	0.0000	0.9542	0.0000	-0.2965	0.0000	-0.3000	0.0000	-0.2965	0.0000	-0.2862	0.0000
		0.0000	0.9883	0.000	0 1.000	0.0000	0.9883	0.0000	0.9542	0.0000	0.2965	0.0000	0.3000	0.0000	0.2965	0.0000	0.2862
		0.9542	0.0000	0.988	3 0.0000	1.0000	0.0000	0.9883	0.0000	-0.2862	0.0000	-0.2965	0.0000	-0.3000	0.0000	-0.2965	0.0000
		0.0000	0.9542	0.000	0.988	0.0000	1.0000	0.0000	0.9883	0.0000	0.2862	0.0000	0.2965	0.0000	0.3000	0.0000	0.2965
		0.8999	0.0000	0.954	2 0.0000	0.9883	0.0000	1.0000	0.0000	-0.2700	0.0000	-0.2862	0.0000	-0.2965	0.0000	-0.3000	0.0000
8(4,1,2)x2	$R_{high} =$	0.0000	0.8999	0.000	0.9542	2 0.0000	0.9883	0.0000	1.0000	0.0000	0.2700	0.0000	0.2862	0.0000	0.2965	0.0000	0.3000
case	* Yugh	-0.3000	0.0000	-0.296	5 0.000	0 -0.2862	0.0000	-0.2700	0.0000	1.0000	0.0000	0.9883	0.0000	0.9542	0.0000	0.8999	0.0000
		0.0000				5 0.0000							0.9883	0.0000	0.9542	0.0000	0.8999
		-0.2965				0 -0.2965								0.9883		0.9542	
		0.0000				0.0000					0.9883				0.9883	0.0000	0.9542
		-0.2862				0 -0.3000					0.0000				0.0000	0.9883	0.0000
		0.0000				5 0.0000							0.9883			0.0000	
		-0.2700				0 -0.2965											
		0.0000	0.2700	0.000	0 0.286	2 0.0000	0.2965	0.0000	0.3000	0.0000	0.8999	0.0000	0.9542	0.0000	0.9883	0.0000	1.0000

Table B.2.3.2.2-3: MIMO correlation matrices for medium spatial correlation (1D cross polarized antenna array at gNB side)

2(1,1,2)x2	$ \begin{bmatrix} 1.0000 & 0.0000 & -0.2000 & 0.0000 \\ 0.0000 & 1.0000 & 0.0000 & 0.2000 \end{bmatrix} $
case	$\frac{\Lambda_{medium}}{\Lambda_{medium}} = \begin{bmatrix} -0.2000 & 0.0000 & 1.0000 & 0.0000 \end{bmatrix}$
	$\begin{bmatrix} 0.0000 & 0.2000 & 0.0000 & 1.0000 \end{bmatrix}$

Table 1 B.2.3.2.2-4: MIMO correlation matices for high spatial correlation (2D cross polarized antenna array at gNB side)



B.2.3.2.3 Beam steering approach

For the 2D cross-polarized antenna array at gNB, given the channel spatial correlation matrix in B.2.3.2.1 and B.2.3.2.2, the corresponding random channel matrix H can be calculated. The signal model for the k-th slot is denoted as

$$y = HD_{\theta_{k,1},\theta_{k,2}}Wx + n$$

And the steering matrix is further expressed as following:

$$D_{\theta_{k,1},\theta_{k,2}} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \otimes \left(D_{\theta_{k,1}}(N_1) \otimes D_{\theta_{k,2}}(N_2) \right)$$

where

- *H* is the *Nr×Nt* channel matrix per subcarrier.
- $D_{\theta_{k,1},\theta_{k,2}}$ is the steering matrix,

- $D_{\theta_{k,1}}(N_1)$ is the steering matrix in first dimension with same polarization,
- $D_{\theta_{k,2}}(N_2)$ is the steering matrix in second dimension with same polarization,
- N_1 is the number of antenna elements in first dimension with same polarization,
- N_2 is the number of antenna elements in second dimension with same polarization,
- For antenna array with only one direction, number of antenna element in second direction N_2 equals 1.

For 1 antenna element with the same polarization in one direction,

$$D_{\theta_{-}}(1) = 1$$
.

For 2 antenna elements with the same polarization in one direction,

$$D_{\theta_{k,i}}(2) = \begin{bmatrix} 1 & 0 \\ 0 & e^{j3\theta_{k,i}} \end{bmatrix}.$$

For 3 antenna elements with the same polarization in one direction,

$$D_{\theta_{k,i}}(3) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & e^{j1.5\theta_{k,i}} & 0 \\ 0 & 0 & e^{j3\theta_{k,i}} \end{bmatrix}.$$

For 4 antenna elements with the same polarization in one direction,

$$D_{ heta_{k,i}}(4) = egin{bmatrix} 1 & 0 & 0 & 0 \ 0 & e^{j heta_{k,i}} & 0 & 0 \ 0 & 0 & e^{j2 heta_{k,i}} & 0 \ 0 & 0 & 0 & e^{j3 heta_{k,i}} \end{bmatrix}.$$

where the index i=1,2 stands for first dimension and second dimension respectively.

- $\theta_{k,i}$ controls the phase variation in first dimension and second dimension respectively, and the phase for k-th subframe is denoted by $\theta_{k,i} = \theta_{0,i} + \Delta\theta \cdot k$, where $\theta_{0,i}$ is the random start value with the uniform distribution, i.e., $\theta_{0,i} \in [0,2\pi]$, $\Delta\theta$ is the step of phase variation, which is defined in Table B.2.3.2.3-1, and k is the linear increment of $2^{-\mu}$ for every slot throughout the simulation, the index i=1,2 stands for first dimension and second dimension respectively.
- W is the precoding matrix for Nt transmission antennas,
- y is the received signal, x is the transmitted signal, and n is AWGN.
- μ corresponds to subcarrier spacing configuration, $\Delta f = 2^{\mu} \cdot 15 \text{[kHz]}$

For the 1D cross-polarized antenna array at gNB, the corresponding random channel matrix H can be calculated by letting N_2 =1, i.e.,

$$D_{\theta_{k,1}} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \otimes D_{\theta_{k,1}}(N_1)$$

Table B.2.3.2.3-1: The step of phase variation

Variation Step	Value (rad/ms)
$\Delta \theta$	1.2566×10 ⁻³

B.2.3.2.3A Beam steering approach with dual cluster beams

For the 2D cross-polarized antenna array at gNB, given the channel spatial correlation matrix in B.2.3.2.1 and B.2.3.2.2, the corresponding random channel matrix H can be calculated. The signal model for the k-th slot is denoted as

$$y = \sqrt{\frac{1}{1+p^2}} H_m D_{\theta_{k,1},\theta_{k,2}}^{(m)} + \sqrt{\frac{p^2}{1+p^2}} H_s D_{\theta_{k,1},\theta_{k,2}}^{(s)} Wx + n$$

And the steering matrix is further expressed as following:

$$D_{\theta_{k,1},\theta_{k,2}} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \otimes \left(D_{\theta_{k,1}}(N_1) \otimes D_{\theta_{k,2}}(N_2) \right)$$

where

- H_{m} , H_{s} are independent channels for the first beam and second beam with the Nr xNt channel matrix per subcarrier.
- $D_{\theta_{k,1},\theta_{k,2}}^{(m)}$, $D_{\theta_{k,1},\theta_{k,2}}^{(s)}$ are the steering matrix for first beam and second beam
- $D_{\theta_{i,j}}(N_1)$ is the steering matrix in first dimension with same polarization,
- $D_{\theta_{k,2}}(N_2)$ is the steering matrix in second dimension with same polarization,
- N_1 is the number of antenna elements infirst dimension with same polarization,
- N_2 is the number of antenna elements in second dimension with same polarization,
- For antenna array with only one direction, number of antenna element in second direction N_2 equals 1,
- p is the relative power ratio of the second beam to the first beam, the value of p is specific to a test case,

For 1 antenna element of the same polarization in one direction, $D_{\theta_{k,i}}(1) = 1$.

For 2 antenna elements of the same polarization in one direction, $D_{\theta_{k,l}}(2) = \begin{bmatrix} 1 & 0 \\ 0 & e^{j3\theta_{k,l}} \end{bmatrix}$.

For 3 antenna elements of the same polarization in one direction, $D_{\theta_{k,i}}(3) = \begin{bmatrix} 1 & 0 & 0 \\ 0 & e^{j1.5\theta_{k,i}} & 0 \\ 0 & 0 & e^{j3\theta_{k,i}} \end{bmatrix}.$

For 4 antenna elements of the same polarization in one direction, $D_{\theta_{k,i}}(4) = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & e^{j\theta_{k,i}} & 0 & 0 \\ 0 & 0 & e^{j2\theta_{k,i}} & 0 \\ 0 & 0 & 0 & e^{j3\theta_{k,i}} \end{bmatrix}$.

where the index i=1,2 stands for first dimension and second dimension respectively.

- $\theta_{k,i}$ controls the phase variation in first dimension and second dimension respectively, and the phase for k-th subframe is denoted by $\theta_{k,i} = \theta_{0,i} + \Delta\theta \cdot k$, where $\theta_{0,i}$ is the random start value with the uniform distribution, i.e., $\theta_{0,i} \in [0,2\pi]$, $\Delta\theta$ is the step of phase variation, which is defined in Table B.2.3.2.3A-1, and k is the linear increment of $2^{-\mu}$ for every slot throughout the simulation, the index i=1,2 stands for first dimension and second dimension respectively.
- W is the precoding matrix for Nt transmission antennas,
- y is the received signal, x is the transmitted signal, and n is AWGN.
- μ corresponds to subcarrier spacing configuration, $\Delta f = 2^{\mu} \cdot 15 [\text{kHz}]$

For the 1D cross-polarized antenna array at gNB, the corresponding random channel matrix H can be calculated by letting N_2 =1, i.e.,

$$D_{\theta_{k,1}} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \otimes D_{\theta_{k,1}}(N_1)$$

Table B.2.3.2.3A-1: The step of phase variation

Variation Step	Value (rad/subframe)
$\Delta \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \! \!$	1.2566×10 ⁻³
$\Delta heta^{\!\!\!/\!\!\!/\!\!\!/}$	2.5132×10 ⁻³

B.2.4 Two-tap propagation conditions for CQI tests

For Channel Quality Indication (CQI) tests, the following additional multi-path profile is used:

$$h(t,\tau) = \delta(\tau) + a \exp(i2\pi f_D t)\delta(\tau - \tau_d)$$

in continuous time (t,τ) representation, with \mathcal{T}_d the delay, a constant value of a and f_D the Doppler frequency. The same $h(t,\tau)$ is used to describe the fading channel between every pair of Tx and Rx.

B.3 High Speed Train Scenario

B.3.1 Single Tap Channel Profile

The high speed train condition for the test of the baseband performance is a non fading propagation channel with one tap. Doppler shift is given by

$$f_s(t) = f_d \cos \theta(t) \tag{B.3.1.1}$$

where $f_s(t)$ is the Doppler shift and f_d is the maximum Doppler frequency. The cosine of angle $\theta(t)$ is given by

$$\cos\theta(t) = \frac{D_s/2 - vt}{\sqrt{D_{\min}^2 + (D_s/2 - vt)^2}}, \ 0 \le t \le D_s/v$$
(B.3.1.2)

$$\cos \theta(t) = \frac{-1.5D_s + vt}{\sqrt{D_{\min}^2 + (-1.5D_s + vt)^2}}, \ D_s/v < t \le 2D_s/v$$
(B.3.1.3)

$$\cos\theta(t) = \cos\theta(t) \mod(2D_s/v), t > 2D_s/v$$
(B.3.1.4)

where $D_s/2$ is the initial distance of the train from gNB, and D_{\min} is gNB Railway track distance, both in meters; v is the velocity of the train in m/s, t is time in seconds.

Doppler shift and cosine angle are given by equation B.3.1.1 and B.3.1.2-B.3.1.4 respectively, where the required input parameters listed in table B.3.1-1 and the resulting Doppler shift shown in Figures B.3.1-1, B.3.1-2, B.3.1-3, B.3.1-4 are applied for all frequency bands.

Value **Parameter** HST-750 HST-972 HST-1000 HST-1667 D_{s} 300 m 300 m 300 m 300 m D_{min} 2 m 2 m 2 m 2 m 300 km/h 500 km/h 300 km/h 500 km/h 972 Hz for 15 kHz SCS 750 Hz for 15 kHz SCS 1667 Hz for 30 kHz 1000 Hz for 30 kHz f_d SCS test test SCS test test

Table B.3.1-1: High speed train scenario

NOTE 1: Parameters for HST conditions in table B.3.1-1 including f_d and Doppler shift trajectories presented on figures B.3.1-1 for 750 Hz and B.3.1-3 for 972 Hz for 15 kHz SCS and figures B.3.1-2 for 1000 Hz and B.3.1-4 for 1667 Hz for 30 kHz SCS are applied for performance verification in all frequency bands.

NOTE 2: The propagation conditions used for the performance requirements under high speed train condition are indicated as a combination of "HST" and Doppler shift f_d , i.e. HST-<Doppler shift>, where '<Doppler shift>' indicates the maximum Doppler shift (Hz) .

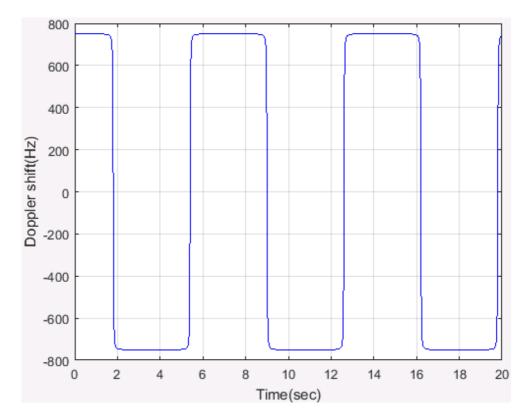


Figure B.3.1-1: Doppler shift trajectory ($f_{\scriptscriptstyle d}$



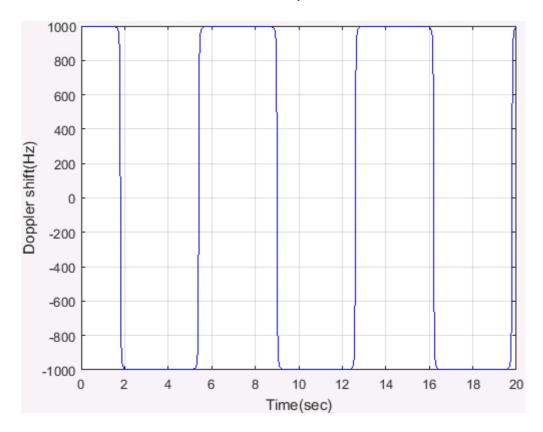


Figure B.3.1-2: Doppler shift trajectory ($f_{\scriptscriptstyle d}$

= 1000 Hz)

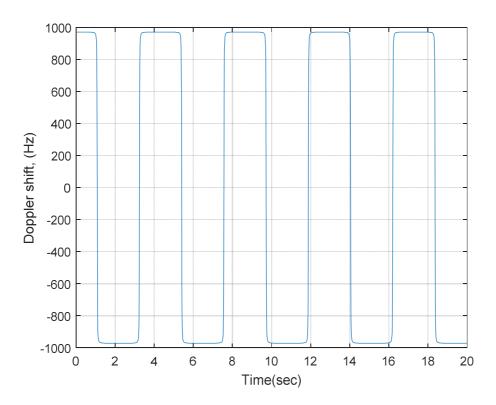


Figure B.3.1-3: Doppler shift trajectory (f_d = 972 Hz)

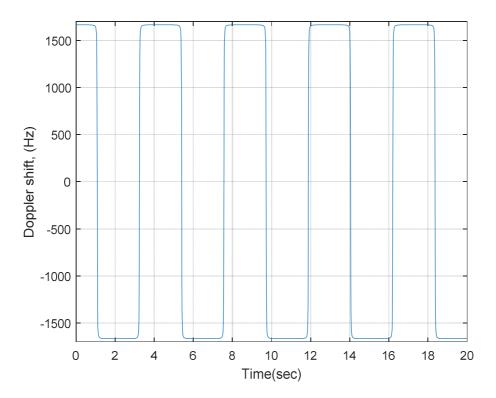


Figure B.3.1-4: Doppler shift trajectory (f_d = 1667 Hz)

For 1x2 antenna configuration, the same $h(t,\tau)$ is used to describe the channel between every pair of Tx and Rx.

For 1x4 antenna configuration, the same $h(t,\tau)$ is used to describe the channel between every pair of Tx and Rx.

Static channel matrix will be used as defined in Annex B.1.

B.3.2 HST-SFN Channel Profile

There is an infinite number of RRHs distributed equidistantly along the track with the same Cell ID as depicted in figure B.3.2-1.

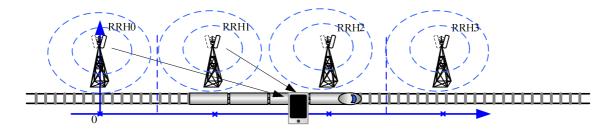


Figure B.3.2-1: Deployment of HST-SFN

The location of RRH *k* is given as:

$$x_k = k * D_s + j * D_{\min}$$
 (B.3.2.1)

where: $k \in [-\infty, \infty]$, j = sqrt(-1) and D_{mir} is the distance between the RRHs and railway track, while D_s is the distance of two RRHs, both in meters.

The train location is denoted as:

$$y = a + j * 0 (B.3.2.2)$$

where: $a \in [0, \infty]$ and a means distance in meters, which means the train is right on the track.

The HST-SFN scenario for the test of the baseband performance is a non fading propagation channel with four taps, namely the four nearest RRHs. Thus, RRH k is visible for the train only in the range:

$$k*D_s - 2*D_s \le a < k*D_s + 2*D_s$$
 (B.3.2.3)

Power level P_k (dB) for the signal from k^{th} RRH, normalized to the total power received from all visible RRHs, is given by:

$$P_{k} = -20 \lg (|y - x_{k}|) - 10 \lg \left(\sum_{i \in \{i \mid i^{*}D_{s} - 2^{*}D_{s} \le a < i^{*}D_{s} + 2^{*}D_{s}\}} \frac{1}{|y - x_{i}|^{2}} \right) \text{ for } k^{*}D_{s} - 2^{*}D_{s} \le a < k^{*}D_{s} + 2^{*}D_{s}$$
(B.3.2.4)

Doppler shift $F_{D,k}$ (Hz) from k^{th} RRH is given by:

$$F_{D,k} = f_C \times real \left[-v \times \frac{y - x_k}{|y - x_k| \times C} \right] \text{ for } k * D_s - 2 * D_s \le a < k * D_s + 2 * D_s$$
 (B.3.2.5)

The relative delay T_k (s) for the signal from $k^{\rm th}$ RRH can be derived as:

$$T_k = \frac{|y - x_k|}{C} \text{ for } k * D_s - 2 * D_s \le a < k * D_s + 2 * D_s$$
(B.3.2.6)

In the above v (m/s) is the moving speed of the train, f_C (Hz) is the center frequency, and C (m/s) is the velocity of light.

Power level, Doppler shift and relative delay are given by equations B.3.2.4 ~ B.3.2.6 respectively, where the required input parameters listed in table B.3.2-1 and the resulting Doppler shift shown in Figures B.3.2-3 and B.3.2-4 are applied for all requency bands.

Parameter	Value
D_s	700 m
D_{min}	150 m
v	500 km/h
f_d	870 Hz for 15 kHz SCS test;

Table B.3.2-1: HST-SFN scenario

NOTE 1: The trajectories of ralative power, Doppler shifts and absolute delays presented in Figures B.3.2-2, B.3.2-3, B.3.2-4 and B.3.2-5 are derived from the equations B.3.2.4 ~ B.3.2.6 respectively.

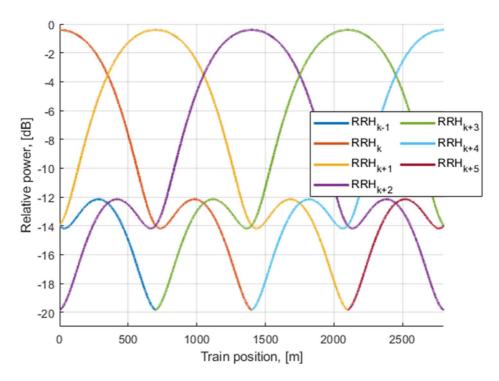


Figure B.3.2-2 Relative power level trajectories

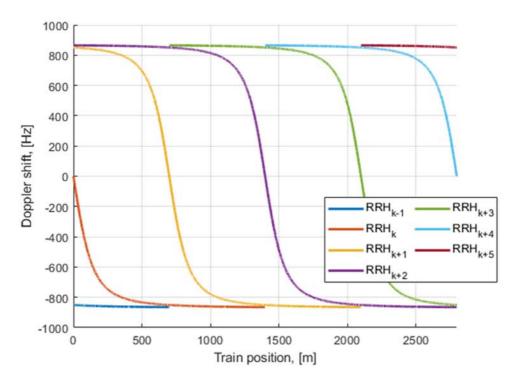


Figure B.3.2-3 Doppler shift trajectories (f_d = 870 Hz)

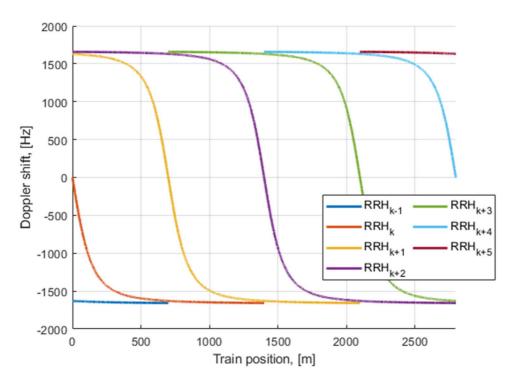


Figure B.3.2-4 Doppler shift trajectories (f_d = 1667 Hz)

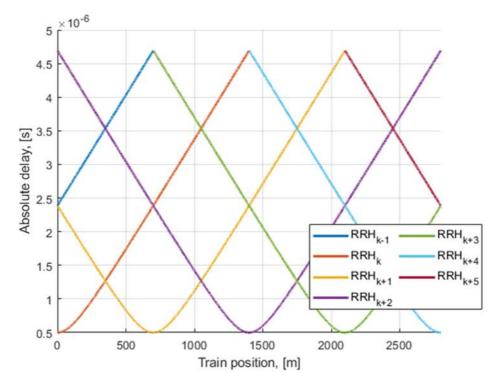


Figure B.3.2-5 Absolute delay trajectories

Static channel matrix will be used as defined in Annex B.1.

B.3.3 HST-DPS Channel Profile

There is an infinite number of RRHs distributed equidistantly along the railway track with the same Cell ID as illustrated in Figure B.3.3-1.

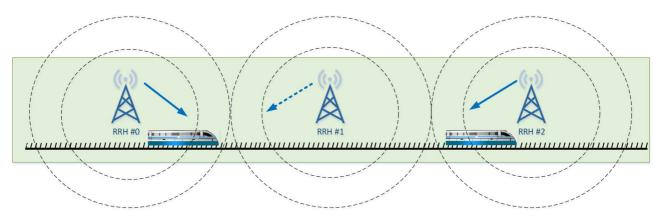


Figure B.3.3-1: Deployment of HST-DPS

The location of RRH *k* is given as:

$$x_k = k * D_s + j * D_{\min}$$
 (B.3.3.1)

where: $k \in [-\infty, \infty]$, j = sqrt(-1) and D_{\min} is the distance between the RRHs and railway track, while D_s is the distance of two RRHs, both in meters.

The train location is denoted as:

$$y = a + j * 0$$
 (B.3.3.2)

where: $a \in [0, \infty]$ and a means distance in meters, which means the train is right on the track.

The HST DPS multi-RRH scenario for the test of the baseband performance is a single tap propagation channel at each time with switching of transmission point in the middle point between two RRHs. Thus, RRH k is visible for the train only in the range:

$$k * D_s - \frac{D_s}{2} \le a < k * D_s + \frac{D_s}{2}$$
 (B.3.3.3)

Power level P_k (dB) for the signal from k^{th} RRH equals to 0. Doppler shift $F_{D,k}$ (Hz) from k^{th} RRH is given by:

$$F_{D,k} = f_C \times real \left[-v \times \frac{y - x_k}{\left| y - x_k \right| \times C} \right] \text{ for } k * D_s - \frac{D_s}{2} \le a < k * D_s + \frac{D_s}{2}$$
 (B.3.3.4)

In the above v (m/s) is the moving speed of the train, f_C (Hz) is the centre frequency, and C (m/s) is the velocity of light.

Doppler shift is given by equation B.3.3.4, where the required input parameters listed in table B.3.3-1 and the resulting Doppler shift shown in Figures B.3.3-2 and B.3.3-3 are applied for all requency bands.

Table B.3.2-1: HST-DPS scenario

Parameter	Value
D_s	700 m
D min	150 m
ν	500 km/h
f_d	870 Hz for 15 kHz SCS test; 1667 Hz for 30 kHz SCS test

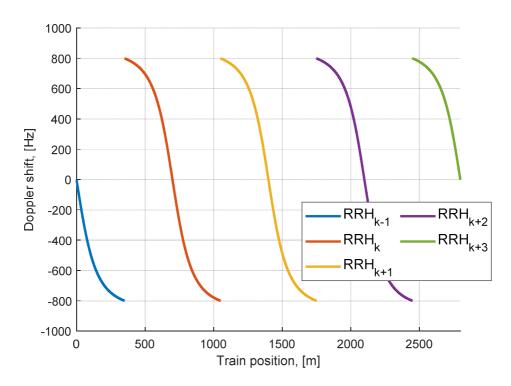


Figure B.3.3-2 Doppler shift trajectory (f_d = 870 Hz)

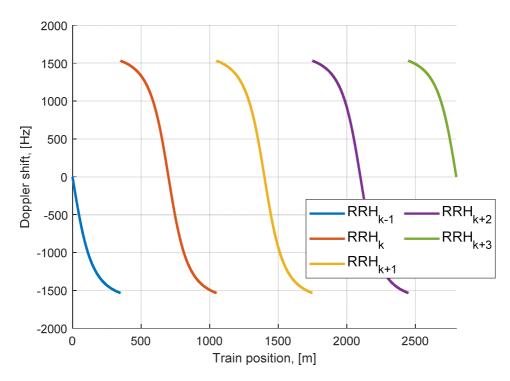


Figure B.3.3-3 Doppler shift trajectory (f_d = 1667 Hz)

Static channel matrix will be used as defined in Annex B.1.

B.4 Physical signals, channels mapping and precoding

B.4.1 General

Unless otherwise stated, the transmission on antenna port(s) $p = p_0, p_0 + 1, ..., p_0 + N_p - 1$ is defined by using a precoder matrix W(i) of size $N_{ANT} \times N_p$, where N_{ANT} is the number of physical transmit antenna elements configured per test, N_p is the number of ports for a reference signal or physical channel configured per test, and p_0 is the first port for that reference signal or physical channel as defined in clauses 7.3 and 7.4 in TS 38.211 [9]. This precoder takes as an input a block of signals for antenna port(s) $p = p_0, p_0 + 1, ..., p_0 + N_p - 1, y^{(p)}(i) = \sum_{i=1}^{n} (i, i) \sum_{j=1}^{n} (i, j)

 $\begin{bmatrix} y^{(p_0)}(i) \ y^{(p_0+1)}(i) \ \dots \ y^{(p_0+N_p-1)}(i) \end{bmatrix}^T$, $i=0,1,\dots,M_{\text{symb}}^{\text{ap}}-1$, with $M_{\text{symb}}^{\text{ap}}$ being the number of modulation symbols per antenna port including the reference signal symbols, and generates a block of signals $y_{bf}^{(q)}(i)=\begin{bmatrix} y_{bf}^{(0)}(i) \ y_{bf}^{(1)}(i) \ \dots \ y_{bf}^{(N_{ANT}-1)}(i) \end{bmatrix}^T$ the elements of which are to be mapped onto the frequency-time index pair (k,l) as per the test configuration but transmitted on different physical antenna elements:

$$y_{bf}^{(q)}(i) = W(i)y^{(p)}(i)$$

For Clause 6 and 8, the transmission of PDCCH and PDCCH DMRS on antenna port $p = p_0$ is defined by using a precoder matrix W(i) of size 2x1. This precoder takes as an input a block of signals for antenna port(s) $p = p_0$,

$$y^{(p)}(i) = y^{(p_0)}(i)$$
 and generates a block of signals $y_{bf}^{(q)}(i) = \left[y_{bf}^{(0)}(i) \ y_{bf}^{\left(\frac{N_{ANT}}{2}\right)}(i)\right]^T$ the elements of which are to be

mapped onto the frequency-time index pair (k, l) as per the test configuration but transmitted on different physical antenna elements:

$$y_{bf}^{(q)}(i) = W(i)y^{(p)}(i)$$

The precoder matrix W(i) is specific to the test case configuration. W(i) is defined in Clause 5.2.2.2 of TS 38.214 [12].

The transimison on PT-RS antenna port is associated (using same precoder) with the lowest indexed DM-RS antenna port among the DM-RS antenna ports assigned for the PDSCH.

The physical antenna elements are identified by indices $j=0,1,...,N_{ANT}-1$, where N_{ANT} is the number of physical antenna elements configured per test.

Modulation symbols $y^{(p)}(i)$ with $p \in \{4000\}$ (i.e. PSS, SSS, PBCH and DM-RS for PBCH) are directly mapped to first physical antenna element.

Modulation symbols $a_{k,l}$ for CSI-RS resources which configured for tracking with one port are directly mapped to first physical antenna element.

Modulation symbols $a_{k,l}$ for CSI-RS resources which configured for beam refinement with one port are directly mapped to first physical antenna element.

Modulation symbols $a_{k,l}^{(p)}$ for NZP CSI-RS which configured for CSI acquisition with

 $p \in \{p_0, p_0 + 1, ..., p_0 + N_{CSI} - 1\}$ are mapped to the physical antenna index $j = p - p_0$ where N_{CSI} is the number of NZP CSI-RS ports configured per test.

Annex C (normative): Downlink physical channels

C.1 General

This annex specifies the downlink physical channels that are needed for setting a connection and channels that are needed during a connection.

C.2 Setup (Conducted)

Table C.2-1 describes the downlink Physical Channels that are required for connection set up.

Table C.2-1: Downlink Physical Channels required for connection set-up

Physical Channel
PBCH
SSS
PSS
PDCCH
PDSCH
PBCH DMRS
PDCCH DMRS
PDSCH DMRS
CSI-RS

C.3 Connection (Conducted)

The following clauses, describes the downlink Physical Channels that are transmitted during a connection i.e., when measurements are done.

C.3.1 Measurement of Performance requirements

Table C.3.1-1 is applicable for measurements in which uniform RS-to-EPRE boosting for all downlink physical channels, unless otherwise stated.

Table C.3.1-1: Downlink Physical Channels transmitted during a connection (FDD and TDD)

Parameter	Unit	Value (Note 2)					
SSS transmit power	W	Test specific					
EPRE ratio of PSS to SSS	dB	0					
EPRE ratio of PBCH to SSS	dB	0					
EPRE ratio of PBCH to PBCH DMRS	dB	0					
EPRE ratio of PDCCH to SSS	dB	0					
EPRE ratio of PDCCH to PDCCH DMRS	dB	0					
EPRE ratio of PDSCH to SSS	dB	0					
EPRE ratio of PDSCH to PDSCH DMRS	dB	Test specific (Note 1)					
EPRE ratio of CSI-RS to SSS	dB	-10*log10(L) (Note 3)					
EPRE ratio of OCNG to SSS	dB	0					
EPRE ratio of PDCCH OCNG to SSS	dB	0					
EPRE ratio of LTE CRS to NR SSS	dB	0 (Note 4)					
Note 1: Value is derived from Table 4.1-1 in TS 38.214 [12] based on "Number of DM-RS CDM							

groups without data" and "DMRS Type" parameters specified for each test.

Note 2: The value is the energy of per RE for a single antenna port before pre-coding.

Note 3: $L \in \{1,2,4,8\}$ is the CDM group size of NZP CSI-RS specified for each test.

Note 4: It is only applicable to LTE-NR coexistence tests.

C.4 Setup (Radiated)

Table C.4-1 describes the downlink Physical Channels that are required for connection set up.

Table C.4-1: Downlink Physical Channels required for connection set-up

Physical Channel
PBCH
SSS
PSS
PDCCH
PDSCH
PBCH DMRS
PDCCH DMRS
PDSCH DMRS
CSI-RS
PTRS

C.5 Connection (Radiated)

The following clauses, describes the downlink Physical Channels that are transmitted during a connection i.e., when measurements are done.

C.5.1 Measurement of Receiver Characteristics

Table C.5.1-1 is applicable for measurements in which uniform RS-to-EPRE boosting for all downlink physical channels, unless otherwise stated.

Table C.5.1-1: Downlink Physical Channels transmitted during a connection (TDD)

Parameter	Unit	Value (Note 2)
SSS transmit power	W	Test specific
EPRE ratio of PSS to SSS	dB	0
EPRE ratio of PBCH to SSS	dB	0
EPRE ratio of PBCH to PBCH DMRS	dB	0
EPRE ratio of PDCCH to SSS	dB	0
EPRE ratio of PDCCH to PDCCH DMRS	dB	0
EPRE ratio of PDSCH to SSS	dB	0
EPRE ratio of PDSCH to PDSCH DMRS	dB	Test specific (Note 1)
EPRE ratio of CSI-RS to SSS	dB	-10*log10(L) (Note 3)
EPRE ratio of PTRS to PDSCH	dB	Test specific
EPRE ratio of OCNG to SSS	dB	0
EPRE ratio of PDCCH OCNG to SSS	dB	0

- Note 1: Value is derived from Table 4.1-1 in TS 38.214 [12] based on "Number of DM-RS CDM groups without data" and "DMRS Type" parameters specified for each test.
- Note 2: The value is the energy of per RE for a single antenna port before pre-coding.
- Note 3: $L \in \{1,2,4,8\}$ is the CDM group size of NZP CSI-RS specified for each test.
- Note 4: Value is derived from Table 4.1-2 in TS 38.214 [12] based on "The number of PDSCH layers" and "epre-Ratio" parameters specified for each test.

Annex D (informative): Void

Annex E (normative): Environmental conditions

E.1 General

This annex specifies the environmental requirements of the UE. Within these limits the requirements of the present documents shall be fulfilled.

E.2 Environmental (Conducted)

The requirements in this clause apply to all types of UE(s).

E.2.1 Temperature

The UE shall fulfil all the requirements in the temperature range defined in Table E.2.1-1.

Table E.2.1-1: Temperature conditions

+15°C to +35°C	For normal conditions (with relative humidity of 25 % to 75 %)
----------------	--

Outside this temperature range the UE, if powered on, shall not make ineffective use of the radio frequency spectrum. In no case shall the UE exceed the transmitted levels as defined in clause 6.2 of TS 38.101-1 [6] for extreme operation.

E.2.2 Voltage

The UE shall fulfil all the requirements in the voltage range defined in Table E.2.2-1.

Table E.2.2-1: Voltage conditions

Power source	Normal conditions voltage
AC mains	nominal
Regulated lead acid battery	1,1 * nominal
Non regulated batteries:	
Leclanché	Nominal
Lithium	1,1 * Nominal
Mercury/nickel & cadmium	Nominal

Outside this voltage range the UE if powered on, shall not make ineffective use of the radio frequency spectrum. In no case shall the UE exceed the transmitted levels as defined in TS 38.101-1[6, Clause 6.2] for extreme operation. In particular, the UE shall inhibit all RF transmissions when the power supply voltage is below the manufacturer declared shutdown voltage.

E.2.3 Vibration

The UE shall fulfil all the requirements when vibrated at the following frequency/amplitudes.

Table E.2.3-1: Vibration conditions

Frequency	ASD (Acceleration Spectral Density) random vibration
5 Hz to 20 Hz	$0.96 \text{ m}^2/\text{s}^3$
20 Hz to 500 Hz	0,96 m ² /s ³ at 20 Hz, thereafter –3 dB/Octave

Outside the specified frequency range the UE, if powered on, shall not make ineffective use of the radio frequency spectrum. In no case shall the UE exceed the transmitted levels as defined in TS 38.101-1[6] for extreme operation.

E.3 Environmental (Radiated)

The requirements in this clause apply to all types of UE(s).

E.3.1 Temperature

All requirements for UEs operating in FR2 are defined over the air and can only be tested in an OTA chamber.

The UE shall fulfil all the requirements in the temperature range defined in Table E.3.1-1.

Table E.3.1-1: Temperature conditions

+ 25 °C ± 10 °C	For normal (room temperature) conditions with relative
	humidity of 25% to 75%

Outside this temperature range the UE, if powered on, shall not make ineffective use of the radio frequency spectrum. In no case shall the UE exceed the transmitted levels as defined in clause 6.2 of TS 38.101-2 [7] for extreme operation.

E.3.2 Voltage

< Editor's note: This requirement is incomplete. The following aspects are either missing or not yet determined:

Methodology to control the voltage in a case which a power cable is not connected to DUT is FFS since it is not agreed whether we can connect the power cable to DUT at the OTA measurement situation yet.

>

The UE shall fulfil all the requirements in the voltage range defined in Table E.3.2-1.

Table E.3.2-1: Voltage conditions

Power source	Normal conditions voltage
AC mains	nominal
Regulated lead acid battery	1,1 * nominal
Non regulated batteries:	
Leclanché	Nominal
Lithium	1,1 * Nominal
Mercury/nickel & cadmium	Nominal

Outside this voltage range the UE if powered on, shall not make ineffective use of the radio frequency spectrum. In no case shall the UE exceed the transmitted levels as defined in clause 6.2 of TS 38.101-2 [7] for extreme operation. In particular, the UE shall inhibit all RF transmissions when the power supply voltage is below the manufacturer declared shutdown voltage.

E.3.3 Void

Annex G (informative): Void	
Annex H (informative): Void	
Annex I (informative): Void	
Annex J (informative): Void	
Annex K (informative): Void	

Annex L (informative): Change history

Data	Maatina	4D	CD	Davi	0-4	Change history	Nous
Date	Meeting	tDoc	CR	Rev	Cat	Subject/Comment	New version
2018-07	RAN4	R4-				Draft skeleton	0.0.1
0010.00	AH18-07	1809554					0.00
2018-08	RAN4#88	R4- 1811357				Skeleton update	0.0.2
2018-10	RAN4#88	R4-				Approved Text Proposal in RAN4#88bis:	0.1.0
	bis	1814237				R4-1814053, "TP on performance specification 38.101-4 Chapter 4 general part"	
						R4-1814054, "TP to TS 38.101-4: FR1 PDSCH demodulation	
						requirements (5.2)"	
						R4-1813924, "TP for introducing FR1 PDCCH requirements in TS 38.101-4 clause 5.3"	
						R4-1814058, "TP for 38.101-4 section 6.3 FR1 PMI test cases"	
						R4-1814060, "Draft TP on FR1 Rank Indication Reporting	
						Performance Requirements" R4-1814055, "Draft TP on FR2 PDSCH Demodulation Performance	
						Requirements"	
						R4-1814022, "TP to TS38.101-4 Section 7.3: PDCCH demodulation requirements"	
						R4-1814059, "TP for 38.101-4 section 8.3 FR2 PMI test cases"	
						R4-1814061, "Draft TP on FR2 Rank Indication Reporting	
						Performance Requirements" R4-1813925, "TP for introducing demodulation performance	
						requirements for interworking TS 38.101-4 section 9"	
						R4-1814052, "TP for 38.101-4 section 10 CSI test cases of	
						interworking" R4-1814066, "TP on channel models for TS38.101-4"	
						R4-1814023, "TP to TS38.101-4 Annex C: Downlink physical	
						channels" R4-1814024, "TP to TS38.101-4 Annex E: Environmental	
						conditions"	
2018-11	RAN4#89	R4-				Approved Text Proposal in RAN4#89:	0.2.0
		1816559				R4-1814053, "TP on performance specification 38.101-4 Chapter 4 general part"	
						R4-1814487, "TP for TS38.101-4 section 2 (Reference)"	
						R4-1814488, "TP for TS38.101-4 section 3 (Definitions, symbols and	
						abbreviations)" R4-1814579, "TP to TS 38.101-4: Annex A Measurement channels –	
						PDSCH"	
						R4-1814580, "TP to TS 38.101-4: Annex A Measurement channels - DL Control"	
						R4-1814581, "TP to TS 38.101-4: Annex A Measurement channels –	
						CSI"	
						R4-1816395, "FR2 demod: Noc, Band groups and Ref point - TP for TS 38.101-4"	
						R4-1816692, "TP to TS 38.101-4: Requirements applicability"	
						R4-1816693, "TP for performance requirements for interworking (9)" R4-1816694, "TP to TS 38.101-4: FR1 PDSCH demodulation	
						requirements (5.2)"	
						R4-1816695, "Draft TP on FR2 PDSCH Demodulation Performance	
						Requirements" R4-1816697, "TP for updating FR1 PDCCH requirements in TS	
						38.101-4 section 5.3"	
						R4-1816699, "TP to TS 38.101-4: 5.4 FR1 PBCH demodulation requirements"	
				1		R4-1816700, "TP to TS 38.101-4: 7.4 FR2 PBCH demodulation	
						requirements"	
						R4-1816701, "TP of introduction of FR1 CQI requirement (6.2)" R4-1816702, "TP to TS 38.101-4: FR2 CQI requirements (8.2)"	
				1		R4-1816703, "Draft TP on FR1 Rank Indication Reporting"	
						Performance Requirements" R4-1816704, "Draft TP on FR2 Rank Indication Reporting	
						Performance Requirements"	
				1		R4-1816705, "TP for TS 38.101-4 FR1 PMI test requirement"	
						R4-1816706, "TP to TS 38.101-4 FR2 PMI requirements" R4-1816712, "TP to TS 38.101-4: FR1 SDR requirements (5.5) "	
				1		R4-1816713, "TP to TS38.101-4 Section 7.3: PDCCH demodulation	
						requirements" P4-1816714 "TP for propagation conditions in TS 38 104-4(Appex	
						R4-1816714, "TP for propagation conditions in TS 38.104-4(Annex B)"	
2018-12	RAN#82	RP-182408				V1.0.0 is submitted to RAN for 1-step approval	1.0.0
2018-12	RAN#82	RP-182704				V1.0.1 with editorial changes	1.0.1
2018-12	RAN#82					Approved by plenary – Rel-15 spec under change control	15.0.0

2019-03	RAN#83	RP-190403	0001	В	CR on UE demodulation and CSI requirements for 38.101-4	15.1.0
					This CR comboines all the endorsed draft CRs as list below: General sections	
					R4-1902427, Draft CR on NR UE demodulation requirements	
					applicability (Intel Corporation)	
					R4-1902576, Draft CR on General Applicability of Requirements (Qualcomm Incorporated)	
					R4-1902412, Editorial cleanup of FR2 Radiated Requirements	
					General section (ANRITSU)	
					PDSCH	
					R4-1902414, Draft CR on FR1 normal PDSCH demodulation requirements (Intel Corporation)	
					R4-1902415, Draft CR on FR2 PDSCH Requirements (Qualcomm	
					Incorporated)	
					R4-1902411, Draft CR on FR1 SDR requirements (Intel Corporation)	
					PDCCH R4-1902416 Draft CR for updating FR1 PDCCH performance	
					R4-1902416 Draft CR for updating FR1 PDCCH performance requirements in TS38.101-4Huawei, HiSilicon	
					R4-1902423 Draft CR for updating FR2 PDCCH performance	
					requirements in TS38.101-4 section 7.3 CATT	
					PBCH R4-1902420, Draft CR on 2Rx PBCH demodulation requirement for	
					FR1 (CMCC)	
					R4-1902421, Draft CR on 4Rx PBCH demodulation requirements for	
					FR1 (CMCC)	
					R4-1902422, Draft CR on 2Rx PBCH demodulation requirement for	
					FR2 (CMCC) CSI	
					R4-1902418, Draft CR on FR2 CSI Reporting Tests (Qualcomm	
					Incorporated)	
					R4-1902419, Draft CR on FR1 CSI Reporting Tests (Qualcomm	
					Incorporated) R4-1900105, Draft CR on NR CSI reporting (Intel Corporation)	
					R4-1902058, Draft CR for update of FR1 CQI reporting test (Huawei,	
					HiSilicon)	
					R4-1902059, Draft CR for update of FR2 CQI reporting test (Intel)	
					R4-1902426, Draft CR for PMI test cases: 6.2, 8.2, A.3.2.2.2, A.3.2.2.5 (Samsung)	
					R4-1902425, Draft CR for FR1 and FR2 RI test cases (Qualcomm)	
					Annex	
					R4-1900369, Draft CR on PDSCH FRC (Intel Corporation)	
					R4-1900370, Draft CR on PDCCH FRC (Intel Corporation) R4-1902424, Corrections to 38.101-4 clause B.2.1 Delay profile	
					calculation (Huawei, HiSilicon)	
					R4-1902575, Draft CR on Beamforming Model (Qualcomm)	
					Additional modifications:	
					- Compared to endorsed CR R4-1902414, requirements for several	
					FR1 PDSCH test cases were modified to correct stat error	
					- Correct the format for Annex A.x	
					- Correct table number under PDSCH section 5.2.3.1.3 - Some minor editorial changes	
					2	
					Editorial changes after RAN#83	
					To align the annex numbering with other specifications (TS 38.101-x	
					series), annexes J and K were added and Change history was numbered as annex L.	

2019-06	RAN#84	RP-191240	0002	В	CR to TS 38.101-4: Implementation of endorsed draft CRs from RAN4#90bis and RAN4#91	15.2.0
					endorsed draft CRs from RAN4#90bis R4-1902885, Draft CR on DL power allocation for TS 38.101-4	
					R4-1903387, Draft CR for adding applicable rules on CSI test cases:	
					6, 8, 10	
					R4-1903471, Draft CR on PBCH requirements	
					R4-1904750, draftCR on RMC for demod requirement for 38.101-4	
					R4-1904751, Clarification on step 5 and step 6 for delay profiles	
					calculation in B.2.1	
					R4-1904756, Draft CR on FR1 normal PDSCH demodulation	
					requirements	
					R4-1904757, Draft CR on FR2 PDSCH Demodulation Performance	
					Tests	
					R4-1904758, Draft CR on EN-DC SDR requirements R4-1904759, Addition of alternative TDD configuration for UE	
					demodulation requirements	
					R4-1904765, Draft CR on FR2 PDCCH demodulation requirements	
					R4-1904766, draftCR: Updates to FR1 PDCCH demodulation	
					requirements	
					R4-1904767, Draft CR for Beamforming model: Annex B.4.1	
					R4-1904768, Draft CR for modification on CSI test cases: 6, 8, 10	
					R4-1904776, Draft CR on FR1 SDR requirements	
					R4-1904777, Draft CR on FR2 SDR Requirements	
					R4-1904778, Draft CR on PDSCH DL RMC R4-1904779, Draft CR to TS38.101-4: Correction to FR1 CSI test	
					cases	
					R4-1904780, Draft CR to TS38.101-4: Correction to FR2 CSI test	
					Cases	
					R4-1904796, Draft CR to 38.101-4 on applicable SNR level for FR2 R4-1904833, Draft CR to TS 38.101-4 on SNR, Es and Noc setup	
					endorsed draft CRs from RAN4#91	
					R4-1906069, Draft CR on PBCH requirements R4-1906706, Editorial corrections for 38.101-4 PBCH tables	
					R4-1907194, Draft CR on Noc and Es setup	
					R4-1907293, Draft CR to TS38.101-4 for FR2 SDR test cases	
					R4-1907294, draftCR: Introduce single-tap HST channel model in	
					TS 38.101-4	
					R4-1907295, draftCR: updates to FR2 PDSCH test parameters	
					R4-1907296, draftCR: updates to FRC for demodulation	
					performance	
					R4-1907297, draftCR: updates to FR1 CQI reporting test cases in	
					section 6.2 R4-1907298, Draft CR to 38.101-4 on Applicability of requirements	
					R4-1907299, Draft CR to 38.101-4 on Demodulation requirements	
					for interworking	
					R4-1907300, Draft CR to 38.101-4 on CSI requirements for	
					interworking	
					R4-1907301, Draft CR on FR1 normal PDSCH demodulation	
					requirements	
					R4-1907302, Draft CR on PDSCH FRC	
					R4-1907303, Draft CR on FR2 CSI Reporting tests	
					R4-1907304, Editorial corrections for 38.101-4 PDCCH tables R4-1907307, draftCR: updates to FR1 PDSCH test parameters	
					R4-1907307, draffick: updates to FRT PDSCH test parameters R4-1907308, Draft CR on EN-DC SDR requirements	
					R4-1907309, Draft CR to TS38.101-4 on adding FRC for sub-band	
					CQI test cases	
					R4-1907310, Draft CR to TS38.101-4: Environmental conditions	
					(Annex E)	
					R4-1907315, Draft CR on SDR requirements for NR CA between	
					FR1 and FR2	

0040.00	DANIJOS	DD 400000	0000		_	OD to TO 00 404 At least one of the description of the first ODs from	45.0.0
2019-09	RAN#85	RP-192022	8000		F	CR to TS 38.101-4: Implementation of endorsed draft CRs from RAN4#92 (Rel-15)	15.3.0
						R4-1907978, Update of Noc values for Power class 2 demodulation test	
						R4-1908202, Draft CR to TS 38.101-4: Environmental conditions R4-1908215, Draft CR to TS 38.101-4: Clarification of PTRS	
						configuration for FR2 tests R4-1908217, Draft CR to TS 38.101-4: DL power configuration in	
						radiated tests R4-1908517, Draft CR to TS 38.101-4: Corrections of FRC for FR2	
						PMI tests R4-1909250, Editorial change to correct TDD measurement	
						channels R4-1909252, Editorial correction to PBCH requirements	
						R4-1909253, Editorial correction to PDSCH reference channels R4-1909862, draft CR: updates to FR2 PDSCH test parameters	
						R4-1909864, draftCR: Introduce single-tap HST channel model in TS 38.101-4	
						R4-1910020, Antenna configuration for LTE cell in EN-DC R4-1910021, DraftCR to 38.101-4: Corrections to Interworking requirements	
						R4-1910023, Draft CR to TS 38.101-4: Enhanced SU-MIMO receiver definition	
						R4-1910024, draftCR: addition of test applicability for features with UE capability	
						R4-1910053, Draft CR on corrections and missing parameters for PDSCH demodulation performance tests	
						R4-1910054, Draft CR to TS 38.101-4: NR FR1 PDSCH requirements finalization	
						R4-1910055, Draft CR to TS 38.101-4: Corrections for SDR requirements	
						R4-1910056, Editorial correction to formatting on SDR table R4-1910057, draft CR: updates to FR1 PDSCH test parameters	
						R4-1910058, Draft CR on corrections for PDCCH demodulation performance tests	
						R4-1910060, Draft CR on corrections for CSI Reporting performance tests	
						R4-1910061, Draft CR on updates to FR1 CSI reporting test R4-1910062, Draft CR on updates to FR2 CSI reporting test	
						R4-1910129, Draft CR to TS 38.101-4: Applicability of minimum requirements	
						R4-1910563, Updates to NR PDCCH test parameters	
2019-12	RAN#86 RAN#86	RP-192998	0009	2	F	CR to TS 38.101-4: Corrections for applicability rules (R15) CR to TS 38.101-4: Editorial corrections for PDSCH RMC (R15)	15.4.0
2019-12	RAN#86	RP-192998 RP-192998	0010		В	CR to TS 38.101-4: Introduction of NE-DC and NR-DC SDR requirements (R15)	15.4.0 15.4.0
2019-12	RAN#86	RP-192998	0014	1	F	CR on corrections for MIMO Correlation Matrices	15.4.0
2019-12	RAN#86	RP-192998	0015	1	F	CR on corrections for FR1 PDSCH demodulation performance tests	15.4.0
2019-12	RAN#86	RP-192998	0016	1	F	CR on corrections for FR2 PDSCH demodulation performance tests	15.4.0
2019-12	RAN#86	RP-192998	0017	1	F	CR on corrections for FR1 CSI Reporting performance tests	15.4.0
2019-12 2019-12	RAN#86 RAN#86	RP-192998 RP-192998	0018	1	F	CR on corrections for FR2 CSI Reporting performance tests Editorial change on reference PDCCH payload size	15.4.0 15.4.0
2019-12	RAN#86	RP-192998	0019	1	F	Editorial CR to correct PMI test cases	15.4.0
2019-12	RAN#86	RP-192998	0023	1	F	CR for TS38.101-4: Angle of arrival for radiated UE demodulation testing	15.4.0
2019-12	RAN#86	RP-192998	0024		F	CR on demodulation performance requirements for EN-DC including FR1 and FR2 CCs	15.4.0
2019-12	RAN#86	RP-192998	0025		F	CR: Correction on NR PDCCH demodulation performance requirements	15.4.0
2019-12	RAN#86	RP-192998	0026		F	CR on CSI reporting requirements for EN-DC including FR1 and FR2 CCs	15.4.0
2019-12	RAN#86	RP-192998	0027	1	В	CR on NE-DC and NGEN-DC performance requirements	15.4.0
2019-12	RAN#86 RAN#86	RP-192998 RP-192998	0028 0029	1	B F	CR on NR-DC performance requirements CR: Updates to NR RMC for UE performance requirements	15.4.0 15.4.0
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2019-12	RAN#86	RP-192998	0030	1	F	CR: Updates to NR EN-DC SDR tests	15.4.0
2020-03	RAN#87	RP-200397	0031	1	F F	Clarification of Random PMI when testing	15.5.0
2020-03 2020-03		RP-200397 RP-200397	0032 0033	1	F	Correction to 5.3.3 4Rx PDCCH Demod Requirements CR on corrections for FR1 PDSCH demodulation performance tests	15.5.0 15.5.0
2020-03	RAN#87	RP-200397	0033	1	F	CR to TS 38.101-4: Editorial corrections (R15)	15.5.0
2020-03		RP-200397	0037		F	CR on number of NZP CSI-RS ports for RI reporting test in a TDD	15.5.0
2020-03		RP-200397	0038		F	4Rx test case CR: Updates to NR PDSCH test parameters (Rel-15)	15.5.0
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2020-03	RAN#87	RP-200379	0035		В	CR to TS 38.101-4: LTE-NR coexistence requirements for TDD mode (R16)	16.0.0
2020-06	RAN#88	RP-200985	0040		Α	CR to Aperiodic Report Slot Offset for CQI report	16.1.0
2020-06	RAN#88	RP-200985	0044		Α	CR to TS 38.101-4: Beamforming clarification (R16)	16.1.0
2020-06	RAN#88	RP-201043	0045		F	CR to TS 38.101-4: CR on TDD LTE-NR coexistence requirements finalization	16.1.0
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2020-06	RAN#88	RP-201048	0042	1	F	CR on max MIMO layer assumption in TS38.101-4	16.1.0
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2020-09	RAN#89	RP-201512	0059		Α	CR to ZP-CSI-RS configuration	16.2.0
2020-09	RAN#89	RP-201512	0061		Α	CR to 2Rx PDSCH mapping type B	16.2.0
2020-09	RAN#89	RP-201499	0074		В	CR for TS 38.101-4: Applicability for NR PMI requirements with Tx ports larger than 8 and up to 32	16.2.0
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2020-09	RAN#89	RP-201512	0078		Α	CR on Corrections in 38.101-4	16.2.0
2020-12	RAN#90	RP-202489	0800		Α	Update of Noc for NR operating bands in FR2	16.3.0
2020-12	RAN#90	RP-202489	0082		Α	Correction to FR1 Aperiodic CSI Reporting	16.3.0
2020-12	RAN#90	RP-202489	0084		Α	Correction to FR2 PMI Aperiodic CSI Reporting	16.3.0
2020-12	RAN#90	RP-202416	0085	1	В	CR on requirements with slot aggregation in FR2	16.3.0
2020-12	RAN#90	RP-202423	0088		В	Draft CR on FRC for Normal NR CA demodulation requirements	16.3.0
2020-12	RAN#90	RP-202422	0090	1	В	CR to TS 38.101-4: HST-SFN FDD performance requirements	16.3.0
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2020-12	RAN#90	RP-202422	0092	1	В	CR on HST-SFN requirements for TDD	16.3.0
2020-12	RAN#90	RP-202423	0093	1	В	Introduction of NR PDSCH FR1 CA 2Rx performance requirements	16.3.0
2020-12	RAN#90	RP-202423	0094	1	В	CR: FR1 EN-DC power imbalance requirements	16.3.0
2020-12	RAN#90	RP-202422	0097	1	В	CR on HST DPS requirements	16.3.0
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2020-12	RAN#90	RP-202422	0099	1	В	CR on applicability rules for HST scenarios	16.3.0
2020-12	RAN#90	RP-202416	0100	1	В	CR to TS 38.101-4: Addition of UE performance requirements for FR1 URLLC PDSCH repetitions over multiple slots	16.3.0
2020-12	RAN#90	RP-202416	0102	1	В	CR to TS 38.101-4: Applicability rules for URLLC UE demodulation requirements	16.3.0
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2020-12	RAN#90	RP-202416	0112	1	В	CR to TS 38.101-4: Performance requirements for URLLC PDSCH 0.001% BLER	16.3.0
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2020-12	RAN#90	RP-202489	0119	1	Α	CR: Correction on OCNG pattern	16.3.0
2020-12	RAN#90	RP-202422	0120	2	В	CR on FDD HST Single-Tap and Multipath Fading Requirements	16.3.0
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2021-03	RAN#91	RP-210078	0124	1	F	CR on FDD HST Single-Tap and Multipath Fading Requirements	16.4.0
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2021-03	RAN#91	RP-210068	0127	1	F	CR to 38.101-4 on requirements with slot aggreagation in FR2	16.4.0
2021-03	RAN#91	RP-210064	0128	1	В	CR to 38.101-4 for eMIMO demod requirements - General and Applicability rule	16.4.0
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2021-03	RAN#91	RP-210066	0131	1	В	CR for TS38.101-4, test for FR1 TDD PDCCH DCI format 2_6	16.4.0
		<u> </u>		<u> </u>		demodulation	<u></u>
2021-03	RAN#91	RP-210067	0133	1	В	CR on adding applicability, requirements and measurement channel for FR2 DL 256QAM CQI reporting test under fading condition	16.4.0
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2021-03	RAN#91	RP-210067	0141	1	В	CR on applicability rules and FRC for FR2 DL 256QAM CQI requirements	16.4.0
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2021-03	RAN#91	RP-210067	0144		В	CR on applicability and FRC for PDSCH normal demodulation for DL 256QAM for FR2	16.4.0
2021-03	RAN#91	RP-210067	0145	1	В	CR on SDR requirements for DL 256QAM for FR2	16.4.0
2021-03	RAN#91	RP-210078	0146		F	CR on update TRS and CSI-RS transmission for HST DPS requirements	16.4.0
2021-03	RAN#91	RP-210064	0147	1	В	CR for 38.101-4 Introduction of PDSCH requirement with Single-DCI based SDM scheme	16.4.0
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2021-03	RAN#91	RP-210068	0151	1	F	CR to TS 38.101-4 Correction of UE performance requirements for FR1 URLLC PDSCH repetitions over multiple slots.	16.4.0
2021-03	RAN#91	RP-210068	0152	1	В	CR to TS38.101-4 Applicability rules for URLLC CSI requirements	16.4.0
2021-03	RAN#91	RP-210065	0153		F	CR: Updates to power imbalance for CA	16.4.0
2021-03	RAN#91	RP-210066		1	F	CR on Fixed reference channel for power saving performance	16.4.0
2021-03	RAN#91	RP-210065	0156		F	Correction of title on 16Tx port subband PMI reporting	16.4.0
2021-03	RAN#91	RP-210116	0158		Α	Correction of CQI test parameters and FRC for UE demodulation test	16.4.0
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2021-03	RAN#91	RP-210065	0172		F	CR: Update on test applicability rule for EN-DC power imbalance	16.4.0
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History

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