# 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 [2] except for test cases listed in Clause 6.2.2.2.1.3, Clause 6.2.3.2.1.3, which are only applicable for FR1 bands restricted to operation with shared spectrum..

The minimum performance requirements in Clause 6 are mandatory for UE supporting NR operation, except test cases listed in Clause 6.1.1.3, 6.1.1.4, 6.1.1.5, 6.1.1.6.

If same test is listed for different UE features/capabilities in Clauses 6.1.1.3 and 6.1.1.4, then this test shall apply for UEs which support all corresponding UE features/capabilities.

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

Table 6.1.1.2-1: Requirements applicability

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

#### 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 10^-5New CQI table (cqi-TableAlt) | FR1 FDD | CQI | Clause 6.2.2.1.1.2  Clause 6.2.3.1.1.2 |  |
| 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 table for PDSCH (*dl-64QAM-MCS-TableAlt*) | FR1 FDD | CQI | Clause 6.2.2.1.1.2  Clause 6.2.3.1.1.2 |  |
| FR1 TDD | CQI | Clause 6.2.2.2.1.2  Clause 6.2.3.2.1.2 |  |
| Validating P/SP-CSI-RS reception (*periodicAndSemi-PersistentCSI-RS-r16*) | FR1 TDD | CQI | Clause 6.2.2.2.1.3  Clause 6.2.3.2.1.3 | The requirements apply only in case tested UE supporting operations in shared spectrum access and validation of P/SP-CSI-RS reception based on DCI |
| Supported UL channels for dynamic channel access mode (*ul-DynamicChAccess-r16*) or UL channel access for semi-static channel access mode (*ul-Semi-StaticChAccess-r16*) or both | FR1 TDD | CQI | Clause 6.2.2.2.1.3  Clause 6.2.3.2.1.3 | The requirements apply only in case tested UE supports one of UL channels for dynamic channel access mode and UL channel access for semi-static channel access mode |

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  (*CodebookParameters* contains *type2, supportedCSI-RS-ResourceList, parameterLx, amplitudeScalingType, amplitudeSubsetRestriction*) | FR1 FDD | PMI | Clause 6.3.2.1.5  Clause 6.3.3.1.5 |  |
| FR1 TDD | PMI | Clause 6.3.2.2.5  Clause 6.3.3.2.5 |  |
| Support of Enhanced Type II codebook with at least 16 ports per CSI-RS resource(*codebookParametersAddition-r16* contains *etype2R1-r16,* *supportedCSI-RS-ResourceListAdd-r16, maxNumberTxPortsPerResource*) | FR1 FDD | PMI | Clause 6.3.2.1.6  Clause 6.3.3.1.6 |  |
| FR1 TDD | PMI | Clause 6.3.2.2.6  Clause 6.3.3.2.6 |

#### 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 |
| PDSCH MIMO layers (*maxNumberMIMO-LayersPDSCH*) | FR1 FDD | CQI | Clause 6.2.3.1.1.1 | The requirements apply only in case the PDSCH MIMO rank in the test case does not exceed UE PDSCH MIMO layers capability |
| PMI | Clause 6.3.3.1.2 |
| RI | Clause 6.4.2.1  Clause 6.4.3.1 |
| FR1 TDD | CQI | Clause 6.2.3.2.1.1 |
| PMI | Clause 6.3.3.2.2 |
| RI | Clause 6.4.2.2  Clause 6.4.3.2 |
| Supported maximum number of ports across all configured NZP-CSI-RS resources per CC  (*maxConfigNumberPortsAcrossNZP-CSI-RS-PerCC*) | FR1 FDD | PMI | Clause 6.3.2.1.1  Clause 6.3.2.1.2  Clause 6.3.3.1.1  Clause 6.3.3.1.2 | 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 |
| RI | Clause 6.4.3.1 (Test 4) |
| FR1 TDD | PMI | Clause 6.3.2.2.1  Clause 6.3.2.2.2  Clause 6.3.3.2.1  Clause 6.3.3.2.2 |
| RI | Clause 6.4.3.2 (Test 4) |

#### 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 |
| NOTE 1: The test coverage can be considered fulfilled if UE passes one of the CC as PCell in Test 1.  NOTE 2: These scenarios are only tested for UEs which are not verified with Test 1 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 clause 5.5A in TS 38.101-1 [2].

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 clause 5.1.1.5.1.

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.

##### 6.1.1.5.3 Test coverage for different number of component 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.

#### 6.1.1.6 Applicability of requirements for RedCap

The performance requirements in Table 6.1.1.6-1 shall apply for UEs which support optional feature *supportOfRedCap*.

Other performance requirements mandatory for UE supporting NR operation defined in Section 6 but not included in table 6.1.1.6-1 should not be considered applicable to RedCap UEs.

Table 6.1.1.6-1: Requirements applicability for RedCap

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE capability | Test type | | Test list | Applicability notes |
| RedCap with 1RX | FR1 FDD and HD-FDD (Note 1) | CQI | All tests in Clause 6.2.1.1.1.1  All tests in Clause 6.2.1.1.2.1 |  |
|  |  | PMI | All tests in Clause 6.3.1.1.1 |  |
|  | FR1 TDD | CQI | All tests in Clause 6.2.1.2.1.1  All tests in Clause 6.2.1.2.2.1 |  |
|  |  | PMI | All tests in Clause 6.3.1.2.1 |  |
| RedCap with 2RX | FR1 FDD and HD-FDD (Note 1) | CQI | All tests in Clause 6.2.2.1.1.4  All tests in Clause 6.2.2.1.2.4 |  |
|  |  | PMI | Clause 6.3.2.1.1 (Test 1) |  |
|  |  | RI | Clause 6.4.2.1.1 (Test 1) |  |
|  | FR1 TDD | CQI | All tests in Clause 6.2.2.2.1.5  All tests in Clause 6.2.2.2.2.4 |  |
|  |  | PMI | Clause 6.3.2.2.7 (Test 1) |  |
|  |  | RI | Clause 6.4.2.2.1 (Test 1) |  |
| Note 1: If UE support only HD-FDD in a FDD band, this UE is tested with HD-FDD mode otherwise UE is tested with full-duplex FDD mode | | | | |

### 6.1.2 Common test parameters

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

Table 6.1.2-1: Test parameters for CSI test cases

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Value** |
| PDSCH transmission scheme | | |  | Transmission 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 |
| DL BWP configuration #1 | Cyclic prefix | |  | Normal |
| RB offset | | RBs | 0 |
| Number of contiguous PRB | | PRBs | Maximum transmission bandwidth configuration as specified in clause 5.3.2 of TS 38.101-1 [2] for tested channel bandwidth and subcarrier spacing |
| Additional PDCCH Configuration for Aperiodic Reporting (Note 4) | Slots for PDCCH monitoring | |  | Each slot |
| Symbols with PDCCH | |  | 0,1 |
| Number of PDCCH candidates and aggregation levels | |  | 1/AL8 |
| DCI format | |  | 0\_1 |
| 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  Static propagation conditions:  Single Panel Type I, Random precoder chosen from precoder index 0 and 2, selection updated per slot |
| 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 index | | |  | 1 |
| Common serving cell parameters | Physical Cell ID | |  | 0 |
| SSB position in burst | |  | First SSB in Slot #0 |
| SSB periodicity | | ms | 20 |
| PDCCH configuration | Slots for PDCCH monitoring | |  | Each slot |
| Symbols with PDCCH | |  | 0,1 |
| Number of PDCCH candidates and aggregation levels | |  | 1/AL8 |
| DCI format | |  | 1\_1 |
| TCI state | |  | TCI state #1 |
| Cross carrier scheduling | | |  | Not configured |
| 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 |
| 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 |
| DMRS ports indexes | |  | {1000} for Rank1  {1000,1001} for Rank2  {1000,1001,1002} for Rank3  {1000,1001,1002,1003} for Rank4 |
| Number of PDSCH DMRS CDM group(s) without data | |  | 2 |
| PTRS configuration | Frequency density (*KPT-RS*) | |  | N/A |
| Time density (*LPT-RS*) | |  | N/A |
| CSI-RS for tracking | First subcarrier index in the PRB used for CSI-RS (*k0*) | |  | 0 for CSI-RS resource 1,2,3,4 |
| First OFDM symbol in the PRB used for CSI-RS (*l0*) | |  | 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 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 | |  | TCI state #0 |
| NZP CSI-RS for CSI acquisition | Frequency Occupation | |  | Start PRB 0  Number of PRB = BWP size |
| QCL info | |  | TCI state #1 |
| ZP CSI-RS for CSI acquisition | Frequency Occupation | |  | Start PRB 0  Number of PRB = BWP size |
| TCI state #0 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| Number of HARQ Processes | | |  | 4 For FDD  8 for TDD |
| HARQ ACK/NACK bundling | | |  | Multiplexed |
| Redundancy version coding sequence | | |  | {0,2,3,1} |
| K1 value (PDSCH-to-HARQ-timing-indicator) | | |  | 2 for FDD  For FR1.30-1:  8 if mod(i,10) = 0 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  Where i is slot index per radio frame with 0~19  For FR1.30-7:  8 if mod(i,10) = 0 7 if mod(i,10) = 1 6 if mod(i,10) = 2 5 if mod(i,10) = 3 4 if mod(i,10) = 4 3 if mod(i,10) = 5 2 if mod(i,10) = 6  Where i is the slot index of all slots in every 5ms i = {0,…,9} |
| Symbols for unused REs | | |  | OP.1 FDD as defined in Annex A.5.1.1  OP.1 TDD as defined in Annex A.5.2.1 |
| Physical signals, channels mapping and precoding | | |  | As specified in Annex B.4.1 |
| Note 1: PDSCH is not scheduled on slots containing CSI-RS or 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.  Note 3: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-1 [2] for tested channel bandwidth and subcarrier spacing.  Note 4: Additional PDCCH configuration for aperiodic reporting is only for test cases with aperiodic CSI reporting configured. | | | | |

## 6.2 Reporting of Channel Quality Indicator (CQI)

### 6.2.1 1RX requirements

#### 6.2.1.1 FDD

##### 6.2.1.1.1 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.

###### 6.2.1.1.1.1 1Rx FDD FR1 periodic CQI reporting under AWGN conditions for RedCap

6.2.1.1.1.1.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of 10% falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

6.2.1.1.1.1.2 Test Applicability

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

6.2.1.1.1.1.3 Minimum requirement for periodic CQI reporting

For the parameters specified in Table 6.2.1.1.1.1.3-1, 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 6.2.1.1.1.1.3-1: CQI reporting definition test

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | | MHz | 10 | | | |
| Subcarrier spacing | | | kHz | 15 | | | |
| Duplex Mode | | |  | FDD | | | |
| SNR | | | dB | 5 | 6 | 11 | 12 |
| Propagation channel | | |  | AWGN | | | |
| Antenna configuration | | |  | 2×1 with static channel specified in Annex B.1 | | | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | | | |
| CSI-RS  periodicity and offset | | slot | 10/5 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 3,(6) | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | | | |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 10/5 | | | |
| 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 | 10/5 | | | |
| ReportConfigType | | |  | Periodic | | | |
| CQI-table | | |  | Table 1 | | | |
| reportQuantity | | |  | cri-RI-PMI-CQI | | | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | | | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | | | |
| cqi-FormatIndicator | | |  | Wideband | | | |
| pmi-FormatIndicator | | |  | Wideband | | | |
| Sub-band Size | | | RB | 8 | | | |
| Csi-ReportingBand | | |  | 1111111 | | | |
| CSI-Report periodicity and offset | | | slot | 10/9 | | | |
| aperiodicTriggeringOffset | | |  | Not configured | | | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | | | |
| Codebook Mode |  | 1 | | | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | | | |
| CodebookSubsetRestriction |  | 000001 | | | |
| RI Restriction |  | N/A | | | |
| Physical channel for CSI report | | |  | PUCCH | | | |
| CQI/RI/PMI delay | | | ms | 10 | | | |
| Maximum number of HARQ transmission | | |  | 1 | | | |
| Measurement channel | | |  | As specified in Table A.4-1, TBS.1-3 | | | |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.1.1.1.1.

6.2.1.1.1.1.4 Test Description

6.2.1.1.1.1.4.1 Initial Conditions

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

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

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

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

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

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

2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.1.1.1.1.3-1 as appropriate.

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

4. Propagation conditions for the NR cell are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, *Connected without release On, Test Mode On*. Message contents are defined in clause 6.2.1.1.1.1.4.3.

6.2.1.1.1.1.4.2 Test Procedure

1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.2.1.1.3-1.

2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 2000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.

3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.

4. If Median CQI is not equal to 1 or 15 and [1800] or more of the wideband CQI values are in the range (Median CQI - 1) ≤ Median CQI ≤ (Median CQI + 1) then continue with step 5, otherwise go to step 8.

5. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data until the number of filtered ACK+NACK responses reaches 1000.

For the filtered ACK and NACK responses if the ratio (NACK / ACK + NACK) ≤ 0.1 then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) > 0.1

then pass the UE for this test and go to step 9, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) ≤ 0.1

then pass the UE for this test and go to step 9, otherwise go to step 8.

8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

9. Repeat step 1 to 8 for Test2.

6.2.1.1.1.1.4.3 Message contents

Message contents are according to TS 38.508 [6] clause 5.4.2 with the following exceptions:

Table 6.2.1.1.1.1.4.3-1: *CSI-ResourcePeriodicityAndOffset*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table 5.4.2.0-16 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset CHOICE { |  |  |  |
| slots10 | 5 |  |  |
| } |  |  |  |

Table 6.2.1.1.1.1.4.3-2: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table 5.4.2.4-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| Two SEQUENCE { |  |  |  |
| twoTX-CodebookSubsetRestriction | 000001 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.1.1.1.1.4.3-3: Void

Table 6.2.1.1.1.1.4.3-4: ZP CSI-ResourcePeriodicityAndOffset

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table 5.4.2.0-22 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots10 | 5 |  |  |
| } |  |  |  |

Table 6.2.1.1.1.1.4.3-5: NZP CSI-ResourcePeriodicityAndOffset

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table 5.4.2.4-2a | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots10 | 5 |  |  |
| } |  |  |  |

6.2.1.1.1.1.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.1.1.1.1.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

##### 6.2.1.1.2 CQI reporting under fading conditions

###### 6.2.1.1.2.1 1Rx FDD FR1 periodic wideband CQI reporting under fading conditions for RedCap

6.2.1.1.2.1.1 Test Purpose

To verify the variance of the wideband CQI reports is within the limits defined, that the ratio of the throughput is within the limits defined and that the average PDSCH BLER is greater than or equal to 2% for the indicated transport format.

6.2.1.1.2.1.2 Test Applicability

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

6.2.1.1.2.1.3 Minimum conformance requirements

The purpose of the requirements is to verify that the RedCap 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 6.2.1.1.2.1.3-1 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 6.2.1.1.2.1.3-2;

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 6.2.1.1.2.1.3-2;

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 6.2.1.1.2.1.3-1: 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 | 9 | 10 | 15 | 16 |
| Propagation channel | | |  | TDLA30-5 | | | |
| Antenna configuration | | |  | 2×1 | | | |
| Correlation configuration | | |  | ULA high | | | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | | | |
| CSI-RS  periodicity and offset | | slot | 10/5 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 3,(6) | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | | | |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 10/5 | | | |
| 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 | 10/5 | | | |
| ReportConfigType | | |  | Periodic | | | |
| CQI-table | | |  | Table 1 | | | |
| reportQuantity | | |  | cri-RI-PMI-CQI | | | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | | | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | | | |
| cqi-FormatIndicator | | |  | Wideband | | | |
| pmi-FormatIndicator | | |  | Wideband | | | |
| Sub-band Size | | | RB | 8 | | | |
| Csi-ReportingBand | | |  | 1111111 | | | |
| CSI-Report periodicity and offset | | | slot | 10/9 | | | |
| aperiodicTriggeringOffset | | |  | Not configured | | | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | | | |
| Codebook Mode |  | 1 | | | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | | | |
| CodebookSubsetRestriction |  | 000001 | | | |
| RI Restriction |  | N/A | | | |
| Physical channel for CSI report | | |  | PUCCH | | | |
| CQI/RI/PMI delay | | | ms | 10 | | | |
| Maximum number of HARQ transmission | | |  | 1 | | | |
| Measurement channel | | |  | As specified in Table A.4-1, TBS.1-3 | | | |

Table 6.2.1.1.2.1.3-2: Minimum requirements

|  |  |  |
| --- | --- | --- |
| Parameters | Test 1 | Test 2 |
| ** [%] | 20 | 20 |
| ** | 1.05 | 1.05 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.1.1.2.1.

6.2.1.1.2.1.4 Test Description

6.2.1.1.2.1.4.1 Initial Conditions

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

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

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

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

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

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

2. The parameter settings for the NR cell are set up according to Table 6.2.1.1.2.1.3-1 as appropriate.

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

4. Propagation conditions for the NR cell are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, *Connected without release On, Test Mode On*. Message contents are defined in clause 6.2.1.1.2.1.4.3.

6.2.1.1.2.1.4.2 Test Procedure

1. Set the parameters of bandwidth, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.1.1.2.1.3-1.

2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 6000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.

3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as Median CQI value.

4. If Median CQI value is not equal to 1 or 15 and 1200 (**%) or more of the wideband CQI values are outside the range (Median CQI - 1) ≤ Median CQI ≤ (Median CQI + 1) then continue with step 5, otherwise go to step 7.

5. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the Median CQI value from step 3 and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. Measure the average throughput according to Annex G.3.3 and G.3.4. Declare the throughput as .

6. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE’s reported wideband CQI value. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data, record the BLER (NACK / ACK + NACK) and measure the average throughput according to Annex G.3.3 and G.3.4. Declare the throughput as t.

If the recorded BLER ≥ 0.02 and t /  ≥ then pass the UE for this test and go to step 8.

7. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 6) for the other SNR point as appropriate. Otherwise fail the UE.

8. Repeat step 1 to 7, with test conditions according to the table 6.2.1.1.2.1.3-1, for Test2 as appropriate.

6.2.1.1.2.1.4.3 Message contents

Message contents are according to TS 38.508 [6] clause 5.4.2 with the following exceptions:

6.2.1.1.2.1.4.3\_1 Message exceptions for SA

Table 6.2.1.1.2.1.4.3\_1-1: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 001000 |  |  |
| } |  |  |  |
| nrofPorts | p2 |  |  |
| firstOFDMSymbolInTimeDomain | 13 |  |  |
| } |  |  |  |

Table 6.2.1.1.2.1.4.3\_1-2: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.2.1.1.2.1.4.3\_1-3: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
| periodicityAndOffset | CSI-ResourcePeriodicityAndOffset |  |  |

Table 6.2.1.1.2.1.4.3\_1-4: *CSI-ResourcePeriodicityAndOffset*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-43 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset CHOICE { |  |  |  |
| Slots10 | 5 |  |  |
| } |  |  |  |

Table 6.2.1.1.2.1.4.3\_1-5: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| Two SEQUENCE { |  |  |  |
| twoTX-CodebookSubsetRestriction | 000001 |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 11111111 |  |  |

Table 6.2.1.1.2.1.4.3\_1-6: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| periodic SEQUENCE { |  |  |  |
| reportSlotConfig | CSI-ReportPeriodicityAndOffset |  |  |
| pucch-CSI-ResourceList | PUCCH-CSI-Resource |  |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |
| subbandSize | value2 |  |  |
| } |  |  |  |

6.2.1.1.2.1.4.3\_2 Message exceptions for NSA

Same as in 6.2.1.1.2.1.4.3\_1.

6.2.1.1.2.1.5 Test requirement

The pass/fail decision is as specified in the test procedure in clause 6.2.1.1.2.1.4.2.

Table 6.2.1.1.2.1.5-1: Test requirements

|  |  |  |
| --- | --- | --- |
| Parameters | Test 1 | Test 2 |
| ** [%] | 20 | 20 |
| ** | 1.05 -TT | 1.05 -TT |
| Note1 : TT = 0.01 | | |

#### 6.2.1.2 TDD

##### 6.2.1.2.1 CQI reporting definition under AWGN conditions

###### 6.2.1.2.1.1 1Rx TDD FR1 periodic CQI reporting under AWGN conditions for RedCap

6.2.1.2.1.1.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of 10% falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

6.2.1.2.1.1.2 Test Applicability

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

6.2.1.2.1.1.3 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 6.2.1.2.1.1.3-1, 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 6.2.1.2.1.1.3-1: CQI reporting definition test

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | | MHz | 20 | | | |
| Subcarrier spacing | | | kHz | 30 | | | |
| Duplex Mode | | |  | TDD | | | |
| TDD UL-DL pattern | | |  | FR1.30-1 | | | |
| SNR | | | dB | 5 | 6 | 11 | 12 |
| Propagation channel | | |  | AWGN | | | |
| Antenna configuration | | |  | 2×1 with static channel specified in Annex B.1 | | | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | | | |
| CSI-RS  periodicity and offset | | slot | 10/1 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 3,(6) | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | | | |
| 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 | | | |
| ReportConfigType | | |  | Periodic | | | |
| CQI-table | | |  | Table 1 | | | |
| reportQuantity | | |  | cri-RI-PMI-CQI | | | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | | | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | | | |
| cqi-FormatIndicator | | |  | Wideband | | | |
| pmi-FormatIndicator | | |  | Wideband | | | |
| Sub-band Size | | | RB | 8 | | | |
| Csi-ReportingBand | | |  | 1111111 | | | |
| CSI-Report periodicity and offset | | | slot | 10/9 | | | |
| aperiodicTriggeringOffset | | |  | Not configured | | | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | | | |
| Codebook Mode |  | 1 | | | |
| (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.4-1, TBS.1-5 | | | |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.1.2.1.1.

6.2.1.2.1.1.4 Test Description

6.2.1.2.1.1.4.1 Initial Conditions

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

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

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

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

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

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

2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.1.2.1.1.3-1 as appropriate.

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

4. Propagation conditions for the NR cell are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, *Connected without release On, Test Mode On*. Message contents are defined in clause 6.2.1.2.1.1.4.3.

6.2.1.2.1.1.4.2 Test Procedure

1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.2.1.1.3-1.

2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 2000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.

3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.

4. If Median CQI is not equal to 1 or 15 and [1800] or more of the wideband CQI values are in the range (Median CQI - 1) ≤ Median CQI ≤ (Median CQI + 1) then continue with step 5, otherwise go to step 8.

5. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data until the number of filtered ACK+NACK responses reaches 1000.

For the filtered ACK and NACK responses if the ratio (NACK / ACK + NACK) ≤ 0.1 then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) > 0.1

then pass the UE for this test and go to step 9, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) ≤ 0.1

then pass the UE for this test and go to step 9, otherwise go to step 8.

8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

9. Repeat step 1 to 8 for Test2.

6.2.1.2.1.1.4.3 Message contents

Message contents are according to TS 38.508 [6] clause 5.4.2 with the following exceptions:

Table 6.2.1.2.1.1.4.3-1: *CSI-ResourcePeriodicityAndOffset*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table 5.4.2.0-16 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset CHOICE { |  |  |  |
| slots10 | 1 |  |  |
| } |  |  |  |

Table 6.2.1.2.1.1.4.3-2: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table 5.4.2.4-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| Two SEQUENCE { |  |  |  |
| twoTX-CodebookSubsetRestriction | 000001 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.1.2.1.1.4.3-3: VOID

6.2.1.2.1.1.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.1.2.1.1.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

##### 6.2.1.2.2 CQI reporting definition under fading conditions

###### 6.2.1.2.2.1 1Rx TDD FR1 periodic wideband CQI reporting under fading conditions for RedCap

6.2.1.2.2.1.1 Test purpose

To verify the variance of the wideband CQI reports is within the limits defined, that the ratio of the throughput is within the limits defined and that the average PDSCH BLER is greater than or equal to 2% for the indicated transport format.

6.2.1.2.2.1.2 Test applicability

This test applies to all types of NR UE release 17 and forward supporting RedCap.

6.2.1.2.2.1.3 Minimum conformance requirements

The purpose of the requirements is to verify that the RedCap 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 6.2.1.2.2.1.3-1 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 6.2.1.2.2.1.3-2;

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 6.2.1.2.2.1.3-2;

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 6.2.1.2.2.1.3-1: Wideband CQI reporting test under frequency non-selective fading conditions

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | | MHz | 20 | | | |
| Subcarrier spacing | | | kHz | 30 | | | |
| Duplex Mode | | |  | TDD | | | |
| TDD UL-DL pattern | | |  | FR1.30-1 | | | |
| SNR | | | dB | 9 | 10 | 15 | 16 |
| Propagation channel | | |  | TDLA30-5 | | | |
| Antenna configuration | | |  | 2×1 | | | |
| Correlation configuration | | |  | ULA high | | | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | | | |
| CSI-RS  periodicity and offset | | slot | 10/1 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 3,(6) | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | | | |
| 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 | | | |
| ReportConfigType | | |  | Periodic | | | |
| CQI-table | | |  | Table 1 | | | |
| reportQuantity | | |  | cri-RI-PMI-CQI | | | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | | | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | | | |
| cqi-FormatIndicator | | |  | Wideband | | | |
| pmi-FormatIndicator | | |  | Wideband | | | |
| Sub-band Size | | | RB | 8 | | | |
| Csi-ReportingBand | | |  | 1111111 | | | |
| CSI-Report periodicity and offset | | | slot | 10/9 | | | |
| aperiodicTriggeringOffset | | |  | Not configured | | | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | | | |
| Codebook Mode |  | 1 | | | |
| (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.4-1, TBS.1-5 | | | |

Table 6.2.1.2.2.1.3-2: Minimum requirements

|  |  |  |
| --- | --- | --- |
| Parameters | Test 1 | Test 2 |
| ** [%] | 20 | 20 |
| ** | 1.05 | 1.05 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.1.2.2.1.

6.2.1.2.2.1.4 Test description

6.2.1.2.2.1.4.1 Initial conditions

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

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

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

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

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

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

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

2. The parameter settings for the cell are set up according to Table 6.2.1.2.2.1.3-1 as appropriate.

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

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

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

6.2.1.2.2.1.4.2 Test procedure

1. Set the parameters of bandwidth, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.1.2.2.1.5-1.

2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 6000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.

3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as Median CQI value.

4. If Median CQI value is not equal to 1 or 15 and 1200 (**%) or more of the wideband CQI values are outside the range (Median CQI - 1) ≤ Median CQI ≤ (Median CQI + 1) then continue with step 5, otherwise go to step 7.

5. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the Median CQI value from step 3 and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. Measure the average throughput according to Annex G.3.3 and G.3.4. Declare the throughput as .

6. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE’s reported wideband CQI value. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data, record the BLER (NACK / ACK + NACK) and measure the average throughput according to Annex G.3.3 and G.3.4. Declare the throughput as t.

If the recorded BLER ≥ 0.02 and t /  ≥ then pass the UE for this test and go to step 8.

7. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 6) for the other SNR point as appropriate. Otherwise fail the UE.

8. Repeat step 1 to 7, with test conditions according to the table 6.2.1.2.2.1.5 -1, for Test2 as appropriate.

6.2.1.2.2.1.4.3 Message contents

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

Table 6.2.1.2.2.1.4.3-1: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 001000 |  |  |
| } |  |  |  |
| nrofPorts | p2 |  |  |
| firstOFDMSymbolInTimeDomain | 13 |  |  |
| } |  |  |  |

Table 6.2.1.2.2.1.4.3-2: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.2.1.2.2.1.4.3-3: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
| periodicityAndOffset | CSI-ResourcePeriodicityAndOffset |  |  |

Table 6.2.1.2.2.1.4.3-4: *CSI-ResourcePeriodicityAndOffset*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-43 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset CHOICE { |  |  |  |
| Slots10 | 1 |  |  |
| } |  |  |  |

Table 6.2.1.2.2.1.4.3-5: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-12 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ReportConfig ::= SEQUENCE { |  |  |  |
| cqi-Table | table1 |  |  |
| } |  |  |  |

Table 6.2.1.2.2.1.4.3-6: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| Two SEQUENCE { |  |  |  |
| twoTX-CodebookSubsetRestriction | 000001 |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 11111111 |  |  |

Table 6.2.1.2.2.1.4.3-7: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| periodic SEQUENCE { |  |  |  |
| reportSlotConfig | CSI-ReportPeriodicityAndOffset |  |  |
| pucch-CSI-ResourceList | PUCCH-CSI-Resource |  |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |
| subbandSize | value2 |  |  |
| } |  |  |  |

6.2.1.2.2.1.5 Test requirement

The pass/fail decision is as specified in the test procedure in clause 6.2.1.2.2.1.4.2.

Table 6.2.1.2.2.1.5-1: Wideband CQI reporting test under frequency non-selective fading conditions

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | | MHz | 20 | | | |
| Subcarrier spacing | | | kHz | 30 | | | |
| Duplex Mode | | |  | TDD | | | |
| TDD UL-DL pattern | | |  | FR1.30-1 | | | |
| SNR | | | dB | 9 | 10 | 15 | 16 |
| Propagation channel | | |  | TDLA30-5 | | | |
| Antenna configuration | | |  | 2×1 | | | |
| Correlation configuration | | |  | ULA high | | | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | | | |
| CSI-RS  periodicity and offset | | slot | 10/1 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 3,(6) | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | | | |
| 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 | | | |
| ReportConfigType | | |  | Periodic | | | |
| CQI-table | | |  | Table 1 | | | |
| reportQuantity | | |  | cri-RI-PMI-CQI | | | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | | | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | | | |
| cqi-FormatIndicator | | |  | Wideband | | | |
| pmi-FormatIndicator | | |  | Wideband | | | |
| Sub-band Size | | | RB | 8 | | | |
| Csi-ReportingBand | | |  | 1111111 | | | |
| CSI-Report periodicity and offset | | | slot | 10/9 | | | |
| aperiodicTriggeringOffset | | |  | Not configured | | | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | | | |
| Codebook Mode |  | 1 | | | |
| (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.4-1, TBS.1-5 | | | |

Table 6.2.1.2.2.1.5-2: Minimum requirements

|  |  |  |
| --- | --- | --- |
| Parameters | Test 1 | Test 2 |
| ** [%] | 20 | 20 |
| ** | 1.05 -TT | 1.05 -TT |
| Note1 : TT = 0.01 | | |

### 6.2.2 2RX requirements

#### 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 2Rx FDD FR1 periodic CQI reporting under AWGN conditions for both SA and NSA

6.2.2.1.1.1.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of 10% falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

6.2.2.1.1.1.2 Test Applicability

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

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

6.2.2.1.1.1.3 Minimum requirement for periodic CQI reporting

For the parameters specified in Table 6.2.2.1.1.1.3-1, 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 6.2.2.1.1.1.3-1: CQI reporting definition test

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Test 1** | | **Test 2** | |
| Bandwidth | | | MHz | 10 | | | |
| Duplex Mode | | |  | FDD | | | |
| Subcarrier spacing | | | kHz | 15 | | | |
| SNR | | | dB | 8 | 9 | 14 | 15 |
| Propagation channel | | |  | AWGN | | | |
| Antenna configuration | | |  | 2×2 with static channel specified in Annex B.1 | | | |
| Beamforming Model | | |  | As specified in Section Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | | | |
| CSI-RS  periodicity and offset | | slot | 5/1 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 3,(6,-) | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | | | |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 5/1 | | | |
| 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 | 5/1 | | | |
| ReportConfigType | | |  | Periodic | | | |
| CQI-table | | |  | Table 2 | | | |
| reportQuantity | | |  | cri-RI-PMI-CQI | | | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | | | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | | | |
| cqi-FormatIndicator | | |  | Wideband | | | |
| pmi-FormatIndicator | | |  | Wideband | | | |
| Sub-band Size | | | RB | 8 | | | |
| CSI-reportingBand | | |  | 1111111 | | | |
| CSI-Report periodicity and offset | | | slot | 5/0 | | | |
| aperiodicTriggeringOffset | | |  | Not configured | | | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | | | |
| Codebook Mode |  | 1 | | | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | | | |
| CodebookSubsetRestriction |  | 010000 | | | |
| RI Restriction |  | N/A | | | |
| Physical channel for CSI report | | |  | PUCCH | | | |
| CQI/RI/PMI delay | | | ms | 8 | | | |
| Maximum number of HARQ transmission | | |  | 1 | | | |
| Measurement channel | | |  | As specified in Table A.4-2, TBS.2-2 | | | |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.1.1.1.

6.2.2.1.1.1.4 Test Description

6.2.2.1.1.1.4.1 Initial Conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7 for TE diagram and section A.3.2.3 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.2.1.1.1.3-1 as appropriate.

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

4. Propagation conditions for the NR cell are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* Onfor NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.2.2.1.1.1.4.3.

6.2.2.1.1.1.4.2 Test Procedure

1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.2.1.1.3-1.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 2000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.

3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.

4. If Median CQI is not equal to 1 or 15 and [1800] or more of the wideband CQI values are in the range (Median CQI - 1) ≤ Median CQI ≤ ( Median CQI + 1) then continue with step 5, otherwise go to step 8.

5. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data until the number of filtered ACK+NACK responses reaches 1000.

For the filtered ACK and NACK responses if the ratio (NACK / ACK + NACK) ≤ 0.1 then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) > 0.1

then pass the UE for this test and go to step 9, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) ≤ 0.1

then pass the UE for this test and go to step 9, otherwise go to step 8.

8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

9. Repeat step 1 to 8 for Test2.

6.2.2.1.1.1.4.3 Message contents

Message contents are according to TS 38.508 [6] clause 5.4.2 with the following exceptions:

6.2.2.1.1.1.4.3\_1 Message exceptions for SA

Table 6.2.2.1.1.1.4.3\_1-1: Void

Table 6.2.2.1.1.1.4.3\_1-2: *Void*

6.2.2.1.1.1.4.3\_2 Message exceptions for NSA

Same as specified in 6.2.2.1.1.1.4.3\_1.

6.2.2.1.1.1.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.2.1.1.1.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

###### 6.2.2.1.1.2 2Rx FDD FR1 periodic CQI reporting with Table 3 under AWGN conditions for both SA and NSA

6.2.2.1.1.2.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of 10-5 falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

6.2.2.1.1.2.2 Test Applicability

This test applies to all types of NR UE release 16 and forward supporting *cqi-TableAlt*.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and *cqi-TableAlt*.

6.2.2.1.1.2.3 Minimum requirement for periodic CQI reporting with Table 3

For the parameters specified in Table 6.2.2.1.1.2.3-1, 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 6.2.2.1.1.2.3-1: CQI reporting test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** | |
| Bandwidth | | MHz | 10 | |
| Duplex Mode | |  | FDD | |
| Subcarrier spacing | | kHz | 15 | |
| SNR | | dB | 1 | 2 |
| Propagation channel | |  | AWGN | |
| Antenna configuration | |  | 1×2 with static channel specified in Annex B.1 | |
| Beamforming Model | |  | As specified in Annex B.4.1 | |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic | |
| Number of CSI-RS ports (*X*) |  | 4 | |
| CDM Type |  | FD-CDM2 | |
| Density (ρ) |  | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 5,4 | |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 9 | |
| CSI-RS  periodicity and offset | slot | 5/1 | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Periodic | |
| Number of CSI-RS ports (*X*) |  | 1 | |
| CDM Type |  | No CDM | |
| Density (ρ) |  | 3 | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 1,(0,-) | |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 13 | |
| NZP CSI-RS-timeConfig  periodicity and offset | slot | 5/1 | |
| 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 | 5/1 | |
| ReportConfigType | |  | Periodic | |
| CQI-table | |  | Table 3 | |
| reportQuantity | |  | cri-RI-PMI-CQI (Note 1) | |
| Codebook configuration | |  | Not configured | |
| timeRestrictionForChannelMeasurements | |  | Not configured | |
| timeRestrictionForInterferenceMeasurements | |  | Not configured | |
| cqi-FormatIndicator | |  | Wideband | |
| pmi-FormatIndicator | |  | Wideband | |
| Sub-band Size | | RB | 8 | |
| Csi-ReportingBand | |  | 1111111 | |
| CSI-Report periodicity and offset | | slot | 5/0 | |
| aperiodicTriggeringOffset | |  | Not configured | |
| Physical channel for CSI report | |  | PUCCH | |
| CQI/RI/PMI delay | | ms | 8 | |
| Maximum number of HARQ transmission | |  | 1 | |
| Measurement channel | |  | As specified in Table A.4-4, TBS.4-1 | |
| Note 1: The bit width of PMI for UCI on PUCCH in a case 1-port CSI-RS is configured as channel measurement resource is given in TS 38.212 [10], section 6.3.1.1.2. | | | | |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.1.1.2.

6.2.2.1.1.2.4 Test Description

6.2.2.1.1.2.4.1 Initial Conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.2 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.2.1.1.2.3-1 as appropriate.

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

4. Propagation conditions for the NR cell are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* Onfor NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.2.2.1.1.2.4.3.

6.2.2.1.1.2.4.2 Test Procedure

1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.1.1.2.3-1.

2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 5000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.

3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.

4. If Median CQI is not equal to 1 or 15 and 4500 or more of the wideband CQI values are in the range (Median CQI - 1) ≤ Median CQI ≤ ( Median CQI + 1) then continue with step 5, otherwise go to step 8.

5. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Measure the BLER for a duration sufficient to achieve statistical significance according to Annex G.4 and early pass fail decision rules as per Annex G.4.3a.

For the filtered ACK and NACK responses if the ratio (NACK / (ACK + NACK)) ≤ 10-5 then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5, and measure the BLER for a duration sufficient to achieve statistical significance according to Annex G.4 and early pass fail decision rules as per Annex G.4.3a.

If the ratio (NACK /(ACK + NACK)) > 10-5

then pass the UE for this test, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5, and measure the BLER for a duration sufficient to achieve statistical significance according to Annex G.4 and early pass fail decision rules as per Annex G.4.3a.

If the ratio (NACK /ACK + NACK) ≤10-5

then pass the UE for this test, otherwise go to step 8.

8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

6.2.2.1.1.2.4.3 Message contents

Message contents are according to TS 38.508 [6] clause 5.4.2 with the following exceptions:

6.2.2.1.1.2.4.3\_1 Message exceptions for SA

Table 6.2.2.1.1.2.4.3\_1-1: NZP CSI-RS-ResourceMapping

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| row1 | 0000 | K0=0, row 1, | 1Tx test cases |
| } |  |  |  |
| nrofPorts | p1 |  |  |
| firstOFDMSymbolInTimeDomain | 13 |  |  |
| CDM Type | noCDM |  |  |
| density CHOICE { |  |  |  |
| three | NULL |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.2.1.1.2.4.4\_1-3: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-IM-Resource ::= SEQUENCE { |  |  |  |
| periodicityAndOffset SEQUENCE { |  |  |  |
| slot5 | 0 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.2.1.1.2.4.3\_1-2: *NZP-CSI-RS-Resource*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-14 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| periodicityAndOffset CHOICE { |  |  |  |
| slot5 | 1 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.2.1.1.2.4.4\_1-3: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-12 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ReportConfig ::= SEQUENCE { |  |  |  |
| cqi-Table | table3 |  |  |
| } |  |  |  |

Table 6.2.2.1.1.2.4.4\_1-4: *VOID*

Table 6.2.2.1.1.2.4.4\_1-5: PDSCH-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-100 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| mcs-Table | **qam64LowSE** |  |  |
| } |  |  |  |

6.2.2.1.1.2.4.3\_2 Message exceptions for NSA

Same as specified in 6.2.2.1.1.2.4.3\_1.

6.2.2.1.1.2.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.2.1.1.2.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

###### 6.2.2.1.1.3 2Rx FDD FR1 periodic CQI reporting with Table 4 under AWGN conditions for both SA and NSA

6.2.2.1.1.3.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of 10% falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

6.2.2.1.1.3.2 Test Applicability

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

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

6.2.2.1.1.3.3 Minimum requirement for periodic CQI reporting

For the parameters specified in Table 6.2.2.1.1.3.3-1, and using the downlink physical channels specified in Annex C.2.1, 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 6.2.2.1.1.3.3-1: CQI reporting definition test

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | |
| Bandwidth | | | MHz | 10 | |
| Duplex Mode | | |  | FDD | |
| Subcarrier spacing | | | kHz | 15 | |
| SNR | | | dB | 28 | 29 |
| Propagation channel | | |  | AWGN | |
| Antenna configuration | | |  | 2×2 with static channel specified in Annex B.1 | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | |
| Number of CSI-RS ports (*X*) | |  | 4 | |
| CDM Type | |  | FD-CDM2 | |
| Density (ρ) | |  | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | |
| CSI-RS  periodicity and offset | | slot | 5/1 | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | |
| Number of CSI-RS ports (*X*) | |  | 2 | |
| CDM Type | |  | FD-CDM2 | |
| Density (ρ) | |  | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 3,(6) | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 5/1 | |
| 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 | 5/1 | |
| ReportConfigType | | |  | Periodic | |
| CQI-table | | |  | Table 4 | |
| reportQuantity | | |  | cri-RI-PMI-CQI | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | |
| cqi-FormatIndicator | | |  | Wideband | |
| pmi-FormatIndicator | | |  | Wideband | |
| Sub-band Size | | | RB | 8 | |
| Csi-ReportingBand | | |  | 1111111 | |
| CSI-Report periodicity and offset | | | slot | 5/0 | |
| aperiodicTriggeringOffset | | |  | Not configured | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | |
| Codebook Mode |  | 1 | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | |
| 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 channel | | |  | As specified in Table A.4-5, TBS.5-1 | |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.1.1.3.

6.2.2.1.1.3.4 Test Description

6.2.2.1.1.3.4.1 Initial Conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7 for TE diagram and section A.3.2.3 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.2.1.1.3.3-1 as appropriate.

3. Downlink signals for the NR cell are initially set up according to Annexes C.0, C.1, C.2, C.2.1, and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions for the NR cell are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* Onfor NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 6.2.2.1.1.3.4.3.

6.2.2.1.1.3.4.2 Test Procedure

1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.1.1.3.3-1.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 2000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.

3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.

4. If Median CQI is not equal to 1 or 15 and [1800] or more of the wideband CQI values are in the range (Median CQI - 1) ≤ Median CQI ≤ (Median CQI + 1) then continue with step 5, otherwise go to step 8.

5. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data until the number of filtered ACK+NACK responses reaches 1000.

For the filtered ACK and NACK responses if the ratio (NACK / ACK + NACK) ≤ 0.1 then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) > 0.1

then pass the UE for this test, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) ≤ 0.1

then pass the UE for this test, otherwise go to step 8.

8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

6.2.2.1.1.3.4.3 Message contents

Message contents are according to TS 38.508 [6] clause 5.4.2 with the following exceptions:

6.2.2.1.1.3.4.3\_1 Message exceptions for SA

Table 6.2.2.1.1.3.4.3\_1-1: PDSCH-Config

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

6.2.2.1.1.3.4.3\_2 Message exceptions for NSA

Same as specified in 6.2.2.1.1.3.4.3\_1.

6.2.2.1.1.3.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.2.1.1.3.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

###### 6.2.2.1.1.4 2Rx FDD FR1 periodic CQI reporting under AWGN conditions for RedCap

6.2.2.1.1.4.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of 10% falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

6.2.2.1.1.4.2 Test Applicability

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

6.2.2.1.1.4.3 Minimum requirement for periodic CQI reporting for RedCap

For the parameters specified in Table 6.2.2.1.1.4.3-1, 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 6.2.2.1.1.4.3-1: CQI reporting definition test

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | | MHz | 10 | | | |
| Subcarrier spacing | | | kHz | 15 | | | |
| Duplex Mode | | |  | FDD | | | |
| SNR | | | dB | 8 | 9 | 14 | 15 |
| Propagation channel | | |  | AWGN | | | |
| Antenna configuration | | |  | 2×2 with static channel specified in Annex B.1 | | | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | | | |
| CSI-RS  periodicity and offset | | slot | 10/5 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 3,(6) | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | | | |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 10/5 | | | |
| 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 | 10/5 | | | |
| ReportConfigType | | |  | Periodic | | | |
| CQI-table | | |  | Table 1 | | | |
| reportQuantity | | |  | cri-RI-PMI-CQI | | | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | | | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | | | |
| cqi-FormatIndicator | | |  | Wideband | | | |
| pmi-FormatIndicator | | |  | Wideband | | | |
| Sub-band Size | | | RB | 8 | | | |
| Csi-ReportingBand | | |  | 1111111 | | | |
| CSI-Report periodicity and offset | | | slot | 10/9 | | | |
| aperiodicTriggeringOffset | | |  | Not configured | | | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | | | |
| Codebook Mode |  | 1 | | | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | | | |
| CodebookSubsetRestriction |  | 010000 | | | |
| RI Restriction |  | N/A | | | |
| Physical channel for CSI report | | |  | PUCCH | | | |
| CQI/RI/PMI delay | | | ms | 10 | | | |
| Maximum number of HARQ transmission | | |  | 1 | | | |
| Measurement channel | | |  | As specified in Table A.4-1, TBS.1-4 | | | |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.1.1.4.

6.2.2.1.1.4.4 Test Description

6.2.2.1.1.4.4.1 Initial Conditions

Same as specified in clause 6.2.2.1.1.1.4.1

6.2.2.1.1.4.4.2 Test Procedure

1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.1.1.4.3-1.

2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 2000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 10 ms and also cases where UE transmits nothing in its CQI occasion are also counted as wideband CQI reports.

3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.

4. If Median CQI is not equal to 1 or 15 and 1800 or more of the wideband CQI values are in the range (Median CQI - 1) ≤ Median CQI ≤ ( Median CQI + 1) then continue with step 5, otherwise go to step 8.

5. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data until the number of filtered ACK+NACK responses reaches 1000.

For the filtered ACK and NACK responses if the ratio (NACK / ACK + NACK) ≤ 0.1 then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) > 0.1

then pass the UE for this test and go to step 9, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) ≤ 0.1

then pass the UE for this test and go to step 9, otherwise go to step 8.

8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

9. Repeat step 1 to 8 for Test2.

6.2.2.1.1.4.4.3 Message contents

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

6.2.2.1.1.4.4.3\_1 Message exceptions for NR/5GC

Same as specified in clause 6.2.2.1.1.1.4.3\_1

6.2.2.1.1.4.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.2.1.1.4.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

##### 6.2.2.1.2 CQI reporting under fading conditions

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 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.

###### 6.2.2.1.2.1 2Rx FDD FR1 periodic wideband CQI reporting under fading conditions for both SA and NSA

6.2.2.1.2.1.1 Test purpose

To verify the variance of the wideband CQI reports is within the limits defined, that the ratio of the throughput is within the limits defined and that the average PDSCH BLER is greater than or equal to 2% for the indicated transport format.

6.2.2.1.2.1.2 Test applicability

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

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

6.2.2.1.2.1.3 Minimum conformance requirements

For the parameters specified in Table 6.2.2.1.2.1.3-1 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 ≥ *γ*, where *γ* is specified in Table 6.2.2.1.2.1.3-2;

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 6.2.2.1.2.1.3-1: 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 channel | | |  | TDLA30-5 | | | |
| Antenna configuration | | |  | 2×2 | | | |
| Correlation configuration | | |  | ULA high | | | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | | | |
| CSI-RS  periodicity and offset | | slot | 5/1 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 3,(6) | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | | | |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 5/1 | | | |
| 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 | 5/1 | | | |
| ReportConfigType | | |  | Periodic | | | |
| CQI-table | | |  | Table 2 | | | |
| reportQuantity | | |  | cri-RI-PMI-CQI | | | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | | | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | | | |
| cqi-FormatIndicator | | |  | Wideband | | | |
| pmi-FormatIndicator | | |  | Wideband | | | |
| Sub-band Size | | | RB | 8 | | | |
| Csi-ReportingBand | | |  | 1111111 | | | |
| CSI-Report periodicity and offset | | | slot | 5/0 | | | |
| aperiodicTriggeringOffset | | |  | Not configured | | | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | | | |
| Codebook Mode |  | 1 | | | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | | | |
| 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 channel | | |  | As specified in Table A.4-2, TBS.2-1 | | | |

Table 6.2.2.1.2.1.3-2: Minimum requirements

|  |  |  |
| --- | --- | --- |
| Parameters | Test 1 | Test 2 |
| ** [%] | 20 | 20 |
| ** | 1.05 | 1.05 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.1.2.1.

6.2.2.1.2.1.4 Test description

6.2.2.1.2.1.4.1 Initial conditions

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

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

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

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

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

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

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

2. The parameter settings for the cell are set up according to Table 6.2.2.1.2.1.3-1 as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with Connected without release On, Test Mode On or EN-DC, DC bearer MCG and SCG, Connected without release On, Test Mode On for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 6.2.2.1.2.1.4.3.

6.2.2.1.2.1.4.2 Test procedure

1. Set the parameters of bandwidth, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.1.2.1.5-1.

2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 6000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.

3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as Median CQI value.

4. If Median CQI value is not equal to 1 or 15 and 1200 (**%)or more of the wideband CQI values are outside the range (Median CQI - 1) ≤ Median CQI ≤ (Median CQI + 1) then continue with step 5, otherwise go to step 7.

5. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the Median CQI value from step 3 and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. Measure the average throughput according to Annex G.3.3 and G.3.4. Declare the throughput as .

6. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE’s reported wideband CQI value. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data, record the BLER (NACK / ACK + NACK) and measure the average throughput according to Annex G.3.3 and G.3.4. Declare the throughput as t.

If the recorded BLER ≥ 0.02 and t /  ≥ then pass the UE for this test and go to step 8.

7. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 6) for the other SNR point as appropriate. Otherwise fail the UE.

8. Repeat step 1 to 7, with test conditions according to the table 6.2.2.1.2.1.5 -1, for Test2 as appropriate.

6.2.2.1.2.1.4.3 Message contents

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

6.2.2.1.2.1.4.3\_1 Message exceptions for SA

Table 6.2.2.1.2.1.4.3\_1-1: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 001000 |  |  |
| } |  |  |  |
| nrofPorts | p2 |  |  |
| firstOFDMSymbolInTimeDomain | 13 |  |  |
| } |  |  |  |

Table 6.2.2.1.2.1.4.3\_1-2: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.2.2.1.2.1.4.3\_1-3: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
| periodicityAndOffset | CSI-ResourcePeriodicityAndOffset |  |  |

Table 6.2.2.1.2.1.4.3\_1-4: *CSI-ResourcePeriodicityAndOffset*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-43 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset CHOICE { |  |  |  |
| slots5 | 1 |  |  |
| } |  |  |  |

Table 6.2.2.1.2.1.4.3\_1-5: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| Two SEQUENCE { |  |  |  |
| twoTX-CodebookSubsetRestriction | 000001 |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 11111111 |  |  |

Table 6.2.2.1.2.1.4.3\_1-6: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| periodic SEQUENCE { |  |  |  |
| reportSlotConfig | CSI-ReportPeriodicityAndOffset |  |  |
| pucch-CSI-ResourceList | PUCCH-CSI-Resource |  |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |
| subbandSize | value2 |  |  |
| } |  |  |  |

6.2.2.1.2.1.4.3\_2 Message exceptions for NSA

Same as in 6.2.2.1.2.1.4.3\_1.

6.2.2.1.2.1.5 Test requirement

The pass/fail decision is as specified in the test procedure in clause 6.2.2.1.2.1.4.2.

Table 6.2.2.1.2.1.5-1: 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 channel | | |  | TDLA30-5 | | | |
| Antenna configuration | | |  | 2×2 | | | |
| Correlation configuration | | |  | ULA high | | | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | | | |
| CSI-RS  periodicity and offset | | slot | 5/1 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 3,(6) | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | | | |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 5/1 | | | |
| 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 | 5/1 | | | |
| ReportConfigType | | |  | Periodic | | | |
| CQI-table | | |  | Table 2 | | | |
| reportQuantity | | |  | cri-RI-PMI-CQI | | | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | | | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | | | |
| cqi-FormatIndicator | | |  | Wideband | | | |
| pmi-FormatIndicator | | |  | Wideband | | | |
| Sub-band Size | | | RB | 8 | | | |
| Csi-ReportingBand | | |  | 1111111 | | | |
| CSI-Report periodicity and offset | | | slot | 5/0 | | | |
| aperiodicTriggeringOffset | | |  | Not configured | | | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | | | |
| Codebook Mode |  | 1 | | | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | | | |
| 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 channel | | |  | As specified in Table A.4-2, TBS.2-1 | | | |

Table 6.2.2.1.2.1.5-2: Test requirements

|  |  |  |
| --- | --- | --- |
| Parameters | Test 1 | Test 2 |
| ** [%] | 20 | 20 |
| ** | 1.05 -TT | 1.05 -TT |
| Note1 : TT = 0.01 | | |

###### 6.2.2.1.2.2 2Rx FDD FR1 aperiodic subband CQI reporting under fading conditions for both SA and NSA

6.2.2.1.2.2.1 Test purpose

To verify the variance of the wideband CQI reports is within the limits defined, that the ratio of the throughput is within the limits defined and that the average PDSCH BLER is greater than or equal to 2% for the indicated transport format.

6.2.2.1.2.2.2 Test applicability

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

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

6.2.2.1.2.2.3 Minimum conformance requirements

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.

For the parameters specified in Table 6.2.2.1.2.2.3-1 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 6.2.2.1.2.2.3-2.

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 ≥ *γ*, where *γ* is specified in Table 6.2.2.1.2.2.3-2.

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 6.2.2.1.2.2.3-1: 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 | | |  | FDD | | | |
| SNR | | | dB | 8 | 9 | 14 | 15 |
| Propagation channel | | |  | Two tap model specified in Annex B.2.4 with *a*=1, *f*D = 5Hz, and τd=0.45μs | | | |
| Antenna configuration | | |  | 2×2 | | | |
| Correlation configuration | | |  | As per Annex B.1 | | | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | | | |
| CSI-RS  periodicity and offset | | slot | 5/1 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 3,(6,-) | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | | | |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 5/1 | | | |
| 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 | 5/1 | | | |
| ReportConfigType | | |  | Aperiodic | | | |
| CQI-table | | |  | Table 2 | | | |
| reportQuantity | | |  | cri-RI-PMI-CQI | | | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | | | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | | | |
| cqi-FormatIndicator | | |  | Subband | | | |
| 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 | | | |
| reportTriggerSize | | |  | 1 | | | |
| CSI-AperiodicTriggerStateList | | |  | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM | | | |
| aperiodicTriggeringOffset | | |  | Not configured | | | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | | | |
| Codebook Mode |  | 1 | | | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | | | |
| CodebookSubsetRestriction |  | 000001 | | | |
| RI Restriction |  | N/A | | | |
| Physical channel for CSI report | | |  | PUSCH | | | |
| CQI/RI/PMI delay | | | ms | 8 | | | |
| Maximum number of HARQ transmission | | |  | 1 | | | |
| Measurement channel | | |  | As specified in Table A.4-2, TBS.2-5 | | | |

Table 6.2.2.1.2.2.3-2: Minimum requirements

|  |  |  |
| --- | --- | --- |
| **Parameters** | **Test 1** | **Test 2** |
| *α* [%] | 2 | 2 |
| *β* [%] | 55 | 55 |
| ** | 1.05 | 1.05 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.1.2.2.

6.2.2.1.2.2.4 Test description

6.2.2.1.2.2.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.6.1 for TE diagram and Figure A.3.2.3.1 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.2.2.1.2.2.3-1 as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with Connected without release On, Test Mode On or EN-DC, DC bearer MCG and SCG, Connected without release On, Test Mode On for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.2.2.1.2.2.4.3.

6.2.2.1.2.2.4.2 Test procedure

1. Set the parameters of bandwidth, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.1.2.2.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband and subband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs at RBStart=0 allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format 0\_1 with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Continue transmission of the PDSCH until 2000 wideband CQI reports and full-size subband CQI reports for each full-size subband have been gathered. In this process the SS collects sub-band CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as subband CQI reports.

3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.

4. For each subband, if subband differential CQI offset level of 0 is reported, at least ** % but less than **% of 6000 full-size subband CQI report, then continue to step 5, otherwise, go to step 7.

5. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC in an each available downlink transmission instance randomly selected full-size subband using the transport format according to the wideband median CQI value regardless of UE wideband or subband CQI report. Note that each full-size subband shall be selected in the equal probability. The SS sends downlink MAC padding bits on the DL RMC. Measure the average throughput according to Annex G.3.3 and G.3.4. Declare the throughput as .

6. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the highest UE reported full-size subband CQI value in one full-size subband selected among the sub-bands in which UE report the highest full-size subband CQI. Subband differential CQI offset level is selected from {0, 1, 2, -1}. Note that the SS shall send PDSCH in the same full-size subband until next UE report is available. In case when same full-size subbands are reported subsequently as subbands with highest full-size subband CQI, the SS shall select for transmission a different subband with respect to the last selection. The SS sends downlink MAC padding bits on the DL RMC Measure the average throughput and (NACK /(ACK + NACK)) according to Annex G.3.3 and G.3.4. Declare the throughput as . If the ratio ( / ) ≥  and (NACK /(ACK + NACK)) ≥ 0.02pass the UE and go to step 8. Otherwise, go to step 7.

7. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 6) for the other SNR point as appropriate. Otherwise fail the UE.

8. If both tests have not been done, then repeat the same procedure (steps 1 to 7) with test conditions according to the table 6.2.2.1.2.2.3-1 for the other test as appropriate.

6.2.2.1.2.2.4.3 Message contents

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

6.2.2.1.2.2.4.3\_1 Message exceptions for SA

Table 6.2.2.1.2.2.4.3\_1-1: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 001000 |  |  |
| } |  |  |  |
| nrofPorts | p2 |  |  |
| firstOFDMSymbolInTimeDomain | 13 |  |  |
| } |  |  |  |

Table 6.2.2.1.2.2.4.3\_1-2: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.2.2.1.2.2.4.3\_1-3: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
| periodicityAndOffset | CSI-ResourcePeriodicityAndOffset |  |  |

Table 6.2.2.1.2.2.4.3\_1-4: *CSI-ResourcePeriodicityAndOffset*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.2-43 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset CHOICE { |  |  |  |
| slots5 | 1 |  |  |
| } |  |  |  |

Table 6.2.2.1.2.2.4.3\_1-5: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| Two SEQUENCE { |  |  |  |
| twoTX-CodebookSubsetRestriction | 000001 |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 11111111 |  |  |

Table 6.2.2.1.2.2.4.3\_1-6: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| cqi-FormatIndicator | subbandCQI |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |

6.2.2.1.2.2.4.3\_2 Message exceptions for NSA

Same as in 6.2.2.1.2.2.4.3\_1.

6.2.2.1.2.2.5 Test requirement

The pass/fail decision is as specified in the test procedure in clause 6.2.2.1.2.2.4.2.

Table: 6.2.2.1.2.2.5-1: Test requirements

|  |  |  |
| --- | --- | --- |
| **Parameters** | **Test 1** | **Test 2** |
| *α* [%] | 2 | 2 |
| *β* [%] | 55 | 55 |
| ** | 1.04 | 1.04 |

###### 6.2.2.1.2.3 2Rx FDD FR1 Wideband CQI reporting with inter-cell intereference

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

- TE connection diagram is TBD.- MU/TT analysis pending.

6.2.2.1.2.3.1 Test purpose

Verify that the UE is tracking the channel variations and selecting the largest transport format possible based on inter-cell interference mitigation receiver.

6.2.2.1.2.3.2 Test applicability

This test applies to all types of NR UEs and E-UTRAN UEs supporting EN-DC for release 15 and release 16 supporting MMSE-IRC processing for scenarios with inter-cell and intra-cell inter-user interference.

This test applies to all types of release 17 and forward NR UEs and E-UTRAN UEs supporting EN-DC.

6.2.2.1.2.3.3 Minimum conformance requirements

For the parameters specified in Table 6.2.2.1.2.3.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following,

a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified INR and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be ≥ **where **is specified in Table 6.2.2.1.2.3.3-2;

b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified INR, the average BLER for the indicated transport formats shall be greater than or equal to 0.02.

Table 6.2.2.1.2.3.3-1: Wideband CQI reporting test with inter-cell interference

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test1 | |
| Cell 1 | Cell 2 |
| Bandwidth | | | MHz | 10 | 10 |
| Duplex Mode | | |  | FDD | FDD |
| Subcarrier spacing | | | kHz | 15 | 15 |
| SINR | | | dB | -2 | - |
| Beamforming Model | | |  | As specified in Annex B.4.1 | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | Periodic |
| Number of CSI-RS ports (*X*) | |  | 4 | 4 |
| CDM Type | |  | FD-CDM2 | FD-CDM2 |
| Density (ρ) | |  | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | Row 5,4 |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | 9 |
| CSI-RS  periodicity and offset | | slot | 5/1 | Same as serving cell |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | Periodic |
| Number of CSI-RS ports (*X*) | |  | 2 | 1 |
| CDM Type | |  | FD-CDM2 | noCDM |
| Density (ρ) | |  | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 3(6, -) | Row 2(6, -) |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | 13 |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 5/1 | Same as serving cell |
| CSI-IM configuration | CSI-IM resource Type | |  | Periodic | Periodic |
| CSI-IM RE pattern | |  | 0 | 0 |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) | |  | (4, 9) | (6, 9) |
| CSI-IM timeConfig  periodicity and offset | | slot | 5/1 | Same as serving cell |
| ReportConfigType | | |  | Periodic | Not configured |
| CQI-table | | |  | Table 2 | Table 2 |
| reportQuantity | | |  | cri-RI-PMI-CQI | Not configured |
| timeRestrictionForChannelMeasurements | | |  | Not configured | Not configured |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | Not configured |
| cqi-FormatIndicator | | |  | Wideband | Wideband |
| pmi-FormatIndicator | | |  | Wideband | Wideband |
| Sub-band Size | | | RB | 8 | - |
| Csi-ReportingBand | | |  | 1111111 | Not configured |
| CSI-Report periodicity and offset | | | slot | 5/0 | Not configured |
| aperiodicTriggeringOffset | | |  | Not configured | Not configured |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | typeI-SinglePanel |
| Codebook Mode |  | 1 | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | Not configured |
| CodebookSubsetRestriction |  | 000001 | Not configured |
| RI Restriction |  | N/A | Not configured |
| Physical channel for CSI report | | |  | PUCCH | Not configured |
| CQI/RI/PMI delay | | | ms | 8 | Not configured |
| Maximum number of HARQ transmission | | |  | 1 | Not configured |
| Measurement channel | | |  | As specified in Table A.4-2, TBS.2-1 | - |
| INR (Note 6) | | | dB | N/A | 10.04 |
| Propagation condition | | |  | TDLA30-5 | AWGN |
| Antenna configuration | | |  | 2×2 | 1×2 |
| Correlation configuration | | |  | ULA Low | N/A |
| Note 1: The respective received power spectral density of each interfering cell relative to  is defined by its associated INR value as specified in clause B.6.1.  Note 2: Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. Interfering cell is fully loaded.  Note 3: Both cells are time-synchronous.  Note 4: Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present.  Note 5: SINR corresponds to  of Cell 1 as defined in clause 4.4.5.  Note 6: INR is defined in clause B.6.1. | | | | | |

Table 6.2.2.1.2.3.3-2: Minimum requirements

|  |  |
| --- | --- |
| Parameters | Test 1 |
| ** | 1.9 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.1.2.3.

6.2.2.1.2.3.4 Test description

6.2.2.1.2.3.4.1 Initial conditions

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

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

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

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

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

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

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

2. The parameter settings for the serving cell (Cell 1) and interfering cell (Cell 2) are set up according to Table 6.1.2-1 and Table 6.2.2.1.2.3.3-1 as appropriate.

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

4. Propagation conditions are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.15\_1.3.3.

6.2.2.1.2.3.4.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband CQI value reported from UE. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data, record the BLER (NACK / ACK + NACK) and measure the average throughput according to Annex G.3.3 and G.3.4. Declare the throughput as .

2. Deactivate i.e., stop transmitting anything from Cell 2 and set the Cell 1 parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.2.2.1.2.3.3-1 as appropriate.

3. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband CQI value reported from UE. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data, measure the average throughput according to Annex G.3.3 and G.3.4. Declare the throughput as .

4. If the ratio ( /) ≥  specified in Table 6.2.2.1.2.3.3-2 and the BLER (NACK / ACK + NACK) calculated in step 2 is greater or equal to 0.02, then pass the UE for this test. Otherwise fail the UE.

6.2.2.1.2.3.4.3 Message contents

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

6.2.2.1.2.3.5 Test requirement

The pass fail decision is as specified in the test procedure in clause 6.2.2.1.2.3.4.2.

The test tolerance for this test is FFS.

###### 6.2.2.1.2.4 2Rx FDD FR1 periodic wideband CQI reporting under fading conditions for RedCap

6.2.2.1.2.4.1 Test purpose

To verify the variance of the wideband CQI reports is within the limits defined, that the ratio of the throughput is within the limits defined and that the average PDSCH BLER is greater than or equal to 2% for the indicated transport format.

6.2.2.1.2.4.2 Test applicability

This test applies to all types of NR UE release 17 and forward supporting RedCap.

6.2.2.1.2.4.3 Minimum requirement for wideband CQI reporting for RedCap

The purpose of the requirements is to verify that the RedCap 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 6.2.2.1.2.4.3-1 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 6.2.2.1.2.4.3-2;

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 6.2.2.1.2.4.3-2;

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 6.2.2.1.2.4.3-1: Wideband CQI reporting test under frequency non-selective fading conditions

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | |
| Bandwidth | | | MHz | 10 | |
| Subcarrier spacing | | | kHz | 15 | |
| Duplex Mode | | |  | FDD | |
| SNR | | | dB | 6 | 7 |
| Propagation channel | | |  | TDLA30-5 | |
| Antenna configuration | | |  | 2×2 | |
| Correlation configuration | | |  | ULA high | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | |
| Number of CSI-RS ports (*X*) | |  | 4 | |
| CDM Type | |  | FD-CDM2 | |
| Density (ρ) | |  | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | |
| CSI-RS  periodicity and offset | | slot | 10/5 | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | |
| Number of CSI-RS ports (*X*) | |  | 2 | |
| CDM Type | |  | FD-CDM2 | |
| Density (ρ) | |  | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 3,(6) | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 10/5 | |
| 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 | 10/5 | |
| ReportConfigType | | |  | Periodic | |
| CQI-table | | |  | Table 1 | |
| reportQuantity | | |  | cri-RI-PMI-CQI | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | |
| cqi-FormatIndicator | | |  | Wideband | |
| pmi-FormatIndicator | | |  | Wideband | |
| Sub-band Size | | | RB | 8 | |
| Csi-ReportingBand | | |  | 1111111 | |
| CSI-Report periodicity and offset | | | slot | 10/9 | |
| aperiodicTriggeringOffset | | |  | Not configured | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | |
|  | | Codebook Mode |  | 1 | |
|  | | (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | |
|  | | CodebookSubsetRestriction |  | 000001 | |
|  | | RI Restriction |  | N/A | |
| Physical channel for CSI report | | |  | PUCCH | |
| CQI/RI/PMI delay | | | ms | 10 | |
| Maximum number of HARQ transmission | | |  | 1 | |
| Measurement channel | | |  | As specified in Table A.4-1, TBS.1-3 | |

Table 6.2.2.1.2.4.3-2: Minimum requirements

|  |  |
| --- | --- |
| Parameters | Test 1 |
| ** [%] | 20 |
| ** | 1.05 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.1.2.4.

6.2.2.1.2.4.4 Test description

6.2.2.1.2.4.4.1 Initial conditions

Same as specified in clause 6.2.2.1.1.1.4.1

6.2.2.1.2.4.4.2 Test procedure

1. Set the parameters of bandwidth, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.1.2.4.3-1.

2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 6000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 10 ms and also cases where UE transmits nothing in its CQI reporting occasion are also counted as wideband CQI reports.

3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as Median CQI value.

4. If Median CQI value is not equal to 1 or 15 and 1200 (**%)or more of the wideband CQI values are outside the range (Median CQI - 1) ≤ Median CQI ≤ (Median CQI + 1) then continue with step 5, otherwise go to step 7.

5. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the Median CQI value from step 3 and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. Measure the average throughput according to Annex G.3.3 and G.3.4. Declare the throughput as .

6. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE’s reported wideband CQI value. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data, record the BLER (NACK / ACK + NACK) and measure the average throughput according to Annex G.3.3 and G.3.4. Declare the throughput as t.

If the recorded BLER ≥ 0.02 and t /  ≥ then pass the UE for this test and go to step 8.

7. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 6) for the other SNR point as appropriate. Otherwise fail the UE.

6.2.2.1.2.4.4.3 Message contents

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

6.2.2.1.2.4.4.3\_1 Message exceptions for NR/5GC

Same as specified in clause 6.2.2.1.1.1.4.3\_1

6.2.2.1.2.4.5 Test requirement

The pass/fail decision is as specified in the test procedure in clause 6.2.2.1.2.4.4.2.

Table 6.2.2.1.2.4.5-1: Test requirements

|  |  |
| --- | --- |
| Parameters | Test 1 |
| ** [%] | 20 |
| ** | 1.05 - TT |
| Note: TT = 0.01 | |

#### 6.2.2.2 TDD

##### 6.2.2.2.1 CQI Reporting definition under AWGN conditions

###### 6.2.2.2.1.1 2Rx TDD FR1 periodic CQI reporting under AWGN conditions for both SA and NSA

6.2.2.2.1.1.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of 10% falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

6.2.2.2.1.1.2 Test Applicability

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

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

6.2.2.2.1.1.3 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.

For the parameters specified in Table 6.2.2.2.1.1.3-1, 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 6.2.2.2.1.1.3-1: CQI reporting definition test

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Test 1** | | **Test 2** | |
| Bandwidth | | | MHz | 40 | | | |
| Subcarrier spacing | | | kHz | 30 | | | |
| Duplex Mode | | |  | TDD | | | |
| TDD UL-DL pattern | | |  | FR1.30-1 | | | |
| SNR | | | dB | 8 | 9 | 14 | 15 |
| Propagation channel | | |  | AWGN | | | |
| Antenna configuration | | |  | 2×2 with static channel specified in Annex B.1 | | | |
| Beamforming Model | | |  | As specified in Section Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | | | |
| CSI-RS  periodicity and offset | | slot | 10/1 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 3,(6,-) | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | | | |
| 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 | | | |
| ReportConfigType | | |  | Periodic | | | |
| CQI-table | | |  | Table 2 | | | |
| reportQuantity | | |  | cri-RI-PMI-CQI | | | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | | | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | | | |
| cqi-FormatIndicator | | |  | Wideband | | | |
| pmi-FormatIndicator | | |  | Wideband | | | |
| Sub-band Size | | | RB | 16 | | | |
| CSI-reportingBand | | |  | 1111111 | | | |
| CSI-Report periodicity and offset | | | slot | 10/9 | | | |
| aperiodicTriggeringOffset | | |  | Not configured | | | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | | | |
| Codebook Mode |  | 1 | | | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | | | |
| CodebookSubsetRestriction |  | 010000 | | | |
| 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.4-2, TBS.2-4 | | | |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.2.1.1.

6.2.2.2.1.1.4 Test Description

6.2.2.2.1.1.4.1 Initial Conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7 for TE diagram and section A.3.2.3 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.2.2.1.1.3-1 as appropriate.

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

4. Propagation conditions for the NR cell are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG**, Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.2.2.2.1.1.4.3.

6.2.2.2.1.1.4.2 Test Procedure

1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.2.1.1.3-1.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 2000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.

3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.

4. If Median CQI is not equal to 1 or 15 and [1800] or more of the wideband CQI values are in the range (Median CQI - 1) ≤ Median CQI ≤ ( Median CQI + 1) then continue with step 5, otherwise go to step 8.

5. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data until the number of filtered ACK+NACK responses reaches 1000.

For the filtered ACK and NACK responses if the ratio (NACK / ACK + NACK) ≤ 0.1 then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) > 0.1

then pass the UE for this test and go to step 9, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) ≤ 0.1

then pass the UE for this test and go to step 9, otherwise go to step 8.

8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

9. Repeat step 1 to 8 for Test2.

6.2.2.2.1.1.4.4 Message contents

Message contents are according to TS 38.508 [6] clause 5.4.2 with the following exceptions:

6.2.2.2.1.1.4.4\_1 Message exceptions for SA

Table 6.2.2.2.1.1.4.4\_1-1: Void

Table 6.2.2.2.1.1.4.4\_1-2: Void

6.2.2.2.1.1.4.4\_2 Message exceptions for NSA

Same as specified in 6.2.2.2.1.1.4.4\_1.

6.2.2.2.1.1.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.2.2.1.1.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

###### 6.2.2.2.1.2 2Rx TDD FR1 periodic CQI reporting with Table 3 under AWGN conditions for both SA and NSA

6.2.2.2.1.2.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of 10-5 falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

6.2.2.2.1.2.2 Test Applicability

This test applies to all types of NR UE release 16 and forward supporting *cqi-TableAlt*.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and *cqi-TableAlt*.

6.2.2.2.1.2.3 Minimum requirement for periodic CQI reporting with Table 3

For the parameters specified in Table 6.2.2.2.1.2.3-1, 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 6.2.2.2.1.2.3-1: CQI reporting test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** | |
| Bandwidth | | MHz | 40 | |
| Subcarrier spacing | | kHz | 30 | |
| Duplex Mode | |  | TDD | |
| TDD UL-DL pattern | |  | FR1.30-1 | |
| SNR | | dB | 1 | 2 |
| Propagation channel | |  | AWGN | |
| Antenna configuration | |  | 1×2 with static channel specified in Annex B.1 | |
| Beamforming Model | |  | As specified in Annex B.4.1 | |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic | |
| Number of CSI-RS ports (*X*) |  | 4 | |
| CDM Type |  | FD-CDM2 | |
| Density (ρ) |  | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 5,4 | |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 9 | |
| CSI-RS  periodicity and offset | slot | 10/1 | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Periodic | |
| Number of CSI-RS ports (*X*) |  | 1 | |
| CDM Type |  | No CDM | |
| Density (ρ) |  | 3 | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 1,(0,-) | |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 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 | |
| ReportConfigType | |  | Periodic | |
| CQI-table | |  | Table 3 | |
| reportQuantity | |  | cri-RI-PMI-CQI (Note 1) | |
| Codebook configuration | |  | Not configured | |
| timeRestrictionForChannelMeasurements | |  | Not configured | |
| timeRestrictionForInterferenceMeasurements | |  | Not configured | |
| cqi-FormatIndicator | |  | Wideband | |
| pmi-FormatIndicator | |  | Wideband | |
| Sub-band Size | | RB | 16 | |
| Csi-ReportingBand | |  | 1111111 | |
| CSI-Report periodicity and offset | | slot | 10/9 | |
| aperiodicTriggeringOffset | |  | Not configured | |
| 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 | |
| Note 1: The bit width of PMI for UCI on PUCCH in a case 1-port CSI-RS is configured as channel measurement resource is given in TS 38.212 [10], section 6.3.1.1.2. | | | | |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.2.1.2.

6.2.2.2.1.2.4 Test Description

6.2.2.2.1.2.4.1 Initial Conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.2 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.2.2.1.2.3-1 as appropriate.

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

4. Propagation conditions for the NR cell are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* Onfor NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.2.2.2.1.2.4.3.

6.2.2.2.1.2.4.2 Test Procedure

1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.2.1.2.3-1.

2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 5000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 10 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.

3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.

4. If Median CQI is not equal to 1 or 15 and 4500 or more of the wideband CQI values are in the range (Median CQI - 1) ≤ Median CQI ≤ ( Median CQI + 1) then continue with step 5, otherwise go to step 8.

5. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Measure the BLER for a duration sufficient to achieve statistical significance according to Annex G.4 and early pass fail decision rules as per Annex G.4.3a.

For the filtered ACK and NACK responses if the ratio (NACK / (ACK + NACK)) ≤ 10-5 then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5, and measure the BLER for a duration sufficient to achieve statistical significance according to Annex G.4 and early pass fail decision rules as per Annex G.4.3a.

If the ratio (NACK / (ACK + NACK)) > 10-5

then pass the UE for this test, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5, and measure the BLER for a duration sufficient to achieve statistical significance according to Annex G.4 and early pass fail decision rules as per Annex G.4.3a.

If the ratio (NACK / ACK + NACK) ≤10-5

then pass the UE for this test, otherwise go to step 8.

8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

6.2.2.2.1.2.4.3 Message contents

Message contents are according to TS 38.508 [6] clause 5.4.2 with the following exceptions:

6.2.2.2.1.2.4.3\_1 Message exceptions for SA

Table 6.2.2.2.1.2.4.3\_1-1: NZP CSI-RS-ResourceMapping

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| row1 | 0000 | K0=0, row 1, | 1Tx test cases |
| } |  |  |  |
| nrofPorts | p1 |  |  |
| firstOFDMSymbolInTimeDomain | 1 |  |  |
| CDM Type | noCDM |  |  |
| density CHOICE { |  |  |  |
| three | NULL |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.2.2.1.2.4.3\_1-2: *NZP-CSI-RS-Resource*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-14 | | | |
| Information Element | Value/remark | Comment | Condition |
| NZP-CSI-RS-Resource ::= SEQUENCE { |  |  |  |
| periodicityAndOffset CHOICE { |  |  |  |
| slot10 | 1 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.2.2.1.2.4.4\_1-3: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-IM-Resource ::= SEQUENCE { |  |  |  |
| periodicityAndOffset SEQUENCE { |  |  |  |
| slot10 | 1 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.2.2.1.2.4.4\_1-4: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-12 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ReportConfig ::= SEQUENCE { |  |  |  |
| cqi-Table | table3 |  |  |
| } |  |  |  |

Table 6.2.2.2.1.2.4.4\_1-5: Void

Table 6.2.2.2.1.2.4.4\_1-6: PDSCH-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-100 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| mcs-Table | **qam64LowSE** |  |  |
| } |  |  |  |

6.2.2.2.1.2.4.3\_2 Message exceptions for NSA

Same as specified in 6.2.2.2.1.2.4.3\_1.

6.2.2.2.1.2.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.2.2.1.2.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

###### 6.2.2.2.1.3 2Rx TDD FR1 CQI reporting for PCell on band with shared spectrum access under AWGN conditions for both SA and NSA

6.2.2.2.1.3.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports for PCell on band with shared spectrum access is within the limits defined and a PDSCH BLER of 10% falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI+1.

6.2.2.2.1.3.2 Test Applicability

This test applies to all types of NR UE release 16 and forward supporting NR/5GC and NR-U and supporting UL on shared channel access.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and NR-U.

6.2.2.2.1.3.3 Minimum requirement for CQI reporting with shared spectrum access

For each Downlink Transmission Duration, the transmission power offset is randomly chosen between [0, +6] dB and 2 sets of CQI reports are obtained for each transmission power offset. 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 for each power offset. 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 6.2.2.2.1.3.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

a) For each transmission power offset 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) For each transmission power offset, 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. For each transmission power offset, 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.

c) The absolute difference in median CQI value for each of the transmission power offset according to the reference channel shall be ≥ 2.

Table 6.2.2.2.1.3.3-1: CQI reporting test parameters for PCell on band with shared spectrum access

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | |
| Bandwidth | | | MHz | 20 | |
| Subcarrier spacing | | | kHz | 30 | |
| Duplex Mode | | |  | TDD | |
| Downlink Transmission Model | | |  | As specified in Annex B.5 | |
| Downlink Transmission Model Parameters | Downlink period | | ms | 5 | |
| LBT failure probability (*pLBT*) | |  | 0.25 | |
| Downlink transmission duration values set | | slot | {4,6,7} | |
| Occupied OFDM symbols in slot other than the last slot of the downlink duration | | symbol | 14 | |
| Occupied OFDM symbols in the last slot set of the downlink duration | | symbol | 14 | |
| TDD UL-DL pattern | | |  | FR1.30-7 | |
| SNR | | | dB | 8 | 9 |
| for power offset 1 | | | dBm/Hz | -112 | |
| for power offset 2 | | | dBm/Hz | -106 | |
| Propagation channel | | |  | AWGN | |
| Antenna configuration | | |  | 2×2 with static channel specified in Annex B.1 | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | |
| ZP CSI-RS configuration | | CSI-RS resource Type |  | Aperiodic | |
| Number of CSI-RS ports (*X*) |  | 4 | |
| CDM Type |  | FD-CDM2 | |
| Density (ρ) |  | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 5,4 | |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 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*) |  | 2 | |
| CDM Type |  | FD-CDM2 | |
| Density (ρ) |  | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 3, 6 | |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 3 | |
| CSI-RS  interval and offset | slot | Not configured | |
| aperiodicTriggeringOffset | slot | 0 | |
| CSI-IM configuration | | CSI-IM resource Type |  | Aperiodic | |
| CSI-IM RE pattern |  | 0 | |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) |  | (4, 9) | |
| CSI-IM timeConfig  interval and offset | slot | Not configured | |
| ReportConfigType | | |  | Aperiodic | |
| CQI-table | | |  | Table 2 | |
| reportQuantity | | |  | cri-RI-PMI-CQI | |
| timeRestrictionForChannelMeasurements | | |  | configured | |
| timeRestrictionForInterferenceMeasurements | | |  | 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 | | |  | 7 | |
| CSI request | | |  | 1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0 | |
| reportTriggrtSize | | |  | 1 | |
| CSI-AperiodicTriggerStateList | | |  | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | |
| Codebook Mode |  | 1 | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | |
| CodebookSubsetRestriction |  | 010000 | |
| 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.2-8 | |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.2.1.3.

6.2.2.2.1.3.4 Test Description

6.2.2.2.1.3.4.1 Initial Conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.2 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.2.2.1.3.3-1 as appropriate.

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

4. Propagation conditions for the NR cell are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* Onfor NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 6.2.2.2.1.3.4.3.

6.2.2.2.1.3.4.2 Test Procedure

1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.2.1.3.3-1.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 2000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.

3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.

4. If Median CQI is not equal to 1 or 15 and [1800] or more of the wideband CQI values are in the range (Median CQI - 1) ≤ Median CQI ≤ (Median CQI + 1) then continue with step 5, otherwise go to step 8.

5. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data until the number of filtered ACK+NACK responses reaches 1000.

For the filtered ACK and NACK responses if the ratio (NACK / ACK + NACK) ≤ 0.1 then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) > 0.1

then pass the UE for this test and go to step 9, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) ≤ 0.1

then pass the UE for this test and go to step 9, otherwise go to step 8.

8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

9. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

6.2.2.2.1.3.4.3 Message contents

Message contents are according to TS 38.508 [6] clause 5.4.2 with the following exceptions:

6.2.2.2.1.3.4.3\_1 Message exceptions for SA

Table 6.2.2.2.1.3.4.3\_1-1: Void

Table 6.2.2.2.1.3.4.3\_1-2: *Void*

6.2.2.2.1.3.4.3\_2 Message exceptions for NSA

Same as specified in 6.2.2.2.1.3.4.3\_1.

6.2.2.2.1.3.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.2.2.1.3.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

###### 6.2.2.2.1.4 2Rx TDD FR1 periodic CQI reporting with Table 4 under AWGN conditions for both SA and NSA

6.2.2.2.1.4.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of 10% falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

6.2.2.2.1.4.2 Test Applicability

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

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

6.2.2.2.1.4.3 Minimum requirement for periodic CQI reporting

For the parameters specified in Table 6.2.2.2.1.4.3-1, and using the downlink physical channels specified in Annex C.2.1, 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 6.2.2.2.1.4.3-1: CQI reporting definition test

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | |
| Bandwidth | | | MHz | 40 | |
| Subcarrier spacing | | | kHz | 30 | |
| Duplex Mode | | |  | TDD | |
| TDD UL-DL pattern | | |  | FR1.30-1 | |
| SNR | | | dB | 28 | 29 |
| Propagation channel | | |  | AWGN | |
| Antenna configuration | | |  | 2×2 with static channel specified in Annex B.1 | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | |
| Number of CSI-RS ports (*X*) | |  | 4 | |
| CDM Type | |  | FD-CDM2 | |
| Density (ρ) | |  | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | |
| CSI-RS  periodicity and offset | | slot | 10/1 | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | |
| Number of CSI-RS ports (*X*) | |  | 2 | |
| CDM Type | |  | FD-CDM2 | |
| Density (ρ) | |  | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 3,(6) | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | |
| 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 | |
| ReportConfigType | | |  | Periodic | |
| CQI-table | | |  | Table 4 | |
| reportQuantity | | |  | cri-RI-PMI-CQI | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | |
| cqi-FormatIndicator | | |  | Wideband | |
| pmi-FormatIndicator | | |  | Wideband | |
| Sub-band Size | | | RB | 16 | |
| Csi-ReportingBand | | |  | 1111111 | |
| CSI-Report periodicity and offset | | | slot | 10/9 | |
| aperiodicTriggeringOffset | | |  | Not configured | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | |
| Codebook Mode |  | 1 | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | |
| CodebookSubsetRestriction |  | 010000 | |
| 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.4-5, TBS.5-2 | |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.2.1.4.

6.2.2.2.1.4.4 Test Description

6.2.2.2.1.4.4.1 Initial Conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7 for TE diagram and section A.3.2.3 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.2.2.1.4.3-1 as appropriate.

3. Downlink signals for the NR cell are initially set up according to Annexes C.0, C.1, C.2, C.2.1, and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions for the NR cell are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* Onfor NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 6.2.2.2.1.4.4.3.

6.2.2.2.1.4.4.2 Test Procedure

1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.2.1.4.3-1.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 2000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.

3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.

4. If Median CQI is not equal to 1 or 15 and [1800] or more of the wideband CQI values are in the range (Median CQI - 1) ≤ Median CQI ≤ (Median CQI + 1) then continue with step 5, otherwise go to step 8.

5. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data until the number of filtered ACK+NACK responses reaches 1000.

For the filtered ACK and NACK responses if the ratio (NACK / ACK + NACK) ≤ 0.1 then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) > 0.1

then pass the UE for this test, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) ≤ 0.1

then pass the UE for this test, otherwise go to step 8.

8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

6.2.2.2.1.4.4.3 Message contents

Message contents are according to TS 38.508 [6] clause 5.4.2 with the following exceptions:

6.2.2.2.1.4.4.3\_1 Message exceptions for SA

Table 6.2.2.2.1.4.4.3\_1-1: PDSCH-Config

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

6.2.2.2.1.4.4.3\_2 Message exceptions for NSA

Same as specified in 6.2.2.2.1.4.4.3\_1.

6.2.2.2.1.4.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.2.2.1.4.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

###### 6.2.2.2.1.5 2Rx TDD FR1 periodic CQI reporting under AWGN conditions for RedCap

6.2.2.2.1.5.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of 10% falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

6.2.2.2.1.5.2 Test Applicability

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

6.2.2.2.1.5.3 Minimum requirement for periodic CQI reporting for RedCap

For the parameters specified in Table 6.2.2.2.1.5.3-1, 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 6.2.2.2.1.5.3-1: CQI reporting definition test

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | | MHz | 20 | | | |
| Subcarrier spacing | | | kHz | 30 | | | |
| Duplex Mode | | |  | TDD | | | |
| TDD UL-DL pattern | | |  | FR1.30-1 | | | |
| SNR | | | dB | 8 | 9 | 14 | 15 |
| Propagation channel | | |  | AWGN | | | |
| Antenna configuration | | |  | 2×2 with static channel specified in Annex B.1 | | | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | | | |
| CSI-RS  periodicity and offset | | slot | 10/1 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 3,(6) | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | | | |
| 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 | | | |
| ReportConfigType | | |  | Periodic | | | |
| CQI-table | | |  | Table 1 | | | |
| reportQuantity | | |  | cri-RI-PMI-CQI | | | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | | | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | | | |
| cqi-FormatIndicator | | |  | Wideband | | | |
| pmi-FormatIndicator | | |  | Wideband | | | |
| Sub-band Size | | | RB | 8 | | | |
| Csi-ReportingBand | | |  | 1111111 | | | |
| CSI-Report periodicity and offset | | | slot | 10/9 | | | |
| aperiodicTriggeringOffset | | |  | Not configured | | | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | | | |
|  | | Codebook Mode |  | 1 | | | |
|  | | (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | | | |
|  | | CodebookSubsetRestriction |  | 010000 | | | |
|  | | 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.4-1, TBS.1-6 | | | |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.2.1.5.

6.2.2.2.1.5.4 Test Description

6.2.2.2.1.5.4.1 Initial Conditions

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

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

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

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

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

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

2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.2.2.1.5-1 as appropriate.

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

4. Propagation conditions for the NR cell are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, *Connected without release On, Test Mode On*. Message contents are defined in clause 6.2.2.2.1.5.4.3.

6.2.2.2.1.5.4.2 Test Procedure

Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.2.1.5.3-1.

2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 2000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI occasion are also counted as wideband CQI reports.

3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.

4. If Median CQI is not equal to 1 or 15 and 1800 or more of the wideband CQI values are in the range (Median CQI - 1) ≤ Median CQI ≤ ( Median CQI + 1) then continue with step 5, otherwise go to step 8.

5. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data until the number of filtered ACK+NACK responses reaches 1000.

For the filtered ACK and NACK responses if the ratio (NACK / ACK + NACK) ≤ 0.1 then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) > 0.1

then pass the UE for this test and go to step 9, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) ≤ 0.1

then pass the UE for this test and go to step 9, otherwise go to step 8.

8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

9. Repeat step 1 to 8 for Test2.

6.2.2.2.1.5.4.3 Message contents

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

Table 6.2.2.2.1.5.4.3-1: *CSI-ResourcePeriodicityAndOffset*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table 5.4.2.0-16 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset CHOICE { |  |  |  |
| slots10 | 1 |  |  |
| } |  |  |  |

Table 6.2.2.2.1.5.4.3-2: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table 5.4.2.4-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| Two SEQUENCE { |  |  |  |
| twoTX-CodebookSubsetRestriction | 010000 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2.2.2.1.5.4.3-3: Void

6.2.2.2.1.5.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.2.2.1.5.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

##### 6.2.2.2.2 CQI reporting under fading conditions

###### 6.2.2.2.2.1 2Rx TDD FR1 periodic wideband CQI reporting under fading conditions for both SA and NSA

6.2.2.2.2.1.1 Test purpose

To verify the variance of the wideband CQI reports is within the limits defined, that the ratio of the throughput is within the limits defined and that the average PDSCH BLER is greater than or equal to 2% for the indicated transport format.

6.2.2.2.2.1.2 Test applicability

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

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

6.2.2.2.2.1.3 Minimum conformance requirements

For the parameters specified in Table 6.2.2.2.2.1.3-1 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 6.2.2.2.2.1.3-2;

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 6.2.2.2.2.1.3-2;

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 6.2.2.2.2.1.3-1: 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 pattern | | |  | FR1.30-1 | | | |
| SNR | | | dB | 6 | 7 | 12 | 13 |
| Propagation channel | | |  | TDLA30-5 | | | |
| Antenna configuration | | |  | 2×2 | | | |
| Correlation configuration | | |  | ULA high | | | |
| Beamforming Model | | |  | As specified in AnnexB.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | | | |
| CSI-RS  periodicity and offset | | slot | 10/1 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 3,(6,-) | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | | | |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 10/1 | | | |
| CSI-IM configuration | CSI-RS 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 | | | |
| ReportConfigType | | |  | Periodic | | | |
| CQI-table | | |  | Table 2 | | | |
| reportQuantity | | |  | cri-RI-PMI-CQI | | | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | | | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | | | |
| cqi-FormatIndicator | | |  | Wideband | | | |
| pmi-FormatIndicator | | |  | Wideband | | | |
| Sub-band Size | | | RB | 16 | | | |
| Csi-ReportingBand | | |  | 1111111 | | | |
| CSI-Report periodicity and offset | | | slot | 10/9 | | | |
| aperiodicTriggeringOffset | | |  | Not configured | | | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | | | |
| Codebook Mode |  | 1 | | | |
| (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.4-1, TBS.2-3 | | | |

Table 6.2.2.2.2.1.3-2: Minimum requirements

|  |  |  |
| --- | --- | --- |
| **Parameters** | **Test 1** | **Test 2** |
| ** [%] | 20 | 20 |
| ** | 1.05 | 1.05 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.2.2.1.

6.2.2.2.2.1.4 Test description

6.2.2.2.2.1.4.1 Initial conditions

Same initial conditions as specified in clause 6.2.2.1.2.1.4.1 with the following exceptions:

Instead of Table 6.2.2.1.2.1.3-1 🡪 use Table 6.2.2.2.2.1.3-1.

6.2.2.2.2.1.4.2 Test procedure

Same test procedure as specified in clause 6.2.2.1.2.1.4.2 with the following exceptions:

Instead of Table 6.2.2.1.2.1.5-1 🡪 use Table 6.2.2.2.2.1.3-1.

6.2.2.2.2.1.4.3 Message contents

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

6.2.2.2.2.1.4.3\_1 Message exceptions for SA

Same as 6.2.2.1.2.1.4.3\_1 with following exceptions:

Table 6.2.2.2.2.1.4.3\_1-1: *CSI-ResourcePeriodicityAndOffset*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.2-43 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset CHOICE { |  |  |  |
| slots10 | 1 |  |  |
| } |  |  |  |

6.2.2.2.2.1.4.3\_2 Message exceptions for NSA

Same as 6.2.2.2.2.1.4.3\_1.

6.2.2.2.2.1.5 Test requirement

The pass/fail decision is as specified in the test procedure in clause 6.2.2.2.2.1.4.2.

Table 6.2.2.2.2.1.5-1: Test requirements

|  |  |  |
| --- | --- | --- |
| Parameters | Test 1 | Test 2 |
| ** [%] | 20 | 20 |
| ** | 1.04 | 1.04 |
|  | | |

###### 6.2.2.2.2.2 2Rx TDD FR1 aperiodic subband CQI reporting under fading conditions for both SA and NSA

6.2.2.2.2.2.1 Test purpose

To verify the variance of the subband CQI reports is within the limits defined, that the ratio of the throughput is within the limits defined and that the average PDSCH BLER is greater than or equal to 2 % for the indicated transport format.

6.2.2.2.2.2.2 Test applicability

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

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

6.2.2.2.2.2.3 Minimum conformance requirements

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.

For the parameters specified in Table 6.2.2.2.2.2.3-1 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 6.2.2.2.2.2.3-2;

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 ≥ *γ*, where *γ* is specified in Table 6.2.2.2.2.2.3-2;

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 6.2.2.2.2.2.3-1: Sub-band CQI reporting test under frequency-selective fading conditions

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Test 1** | | **Test 2** | |
| Bandwidth | | | MHz | 40 | | | |
| Subcarrier spacing | | | kHz | 30 | | | |
| Duplex Mode | | |  | TDD | | | |
| TDD UL-DL pattern | | |  | FR1.30-1 | | | |
| SNR | | | dB | 8 | 9 | 14 | 15 |
| Propagation channel | | |  | Two tap model specified in Annex B.2.4 with *a*=1, *f*D = 5Hz, and τd=0.1125μs | | | |
| Antenna configuration | | |  | 2×2 | | | |
| Correlation configuration | | |  | As per Annex B.1 | | | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | | | |
| CSI-RS  periodicity and offset | | slot | 10/1 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 3,(6,-) | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | | | |
| 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 | | | |
| ReportConfigType | | |  | Aperiodic | | | |
| CQI-table | | |  | Table 2 | | | |
| reportQuantity | | |  | cri-RI-PMI-CQI | | | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | | | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | | | |
| cqi-FormatIndicator | | |  | Subband | | | |
| pmi-FormatIndicator | | |  | Wideband | | | |
| 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 | | | |
| reportTriggerSize | | |  | 1 | | | |
| CSI-AperiodicTriggerStateList | | |  | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM | | | |
| aperiodicTriggeringOffset | | |  | Not configured | | | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | | | |
| Codebook Mode |  | 1 | | | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | | | |
| 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 6.2.2.2.2.2.3-2: Minimum requirements

|  |  |  |
| --- | --- | --- |
| **Parameters** | **Test 1** | **Test 2** |
| *α* [%] | 2 | 2 |
| *β* [%] | 55 | 55 |
| ** | 1.05 | 1.05 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.2.2.2.

6.2.2.2.2.2.4 Test description

6.2.2.2.2.2.4.1 Initial conditions

Same initial conditions as specified in clause 6.2.2.1.2.2.4.1 with the following exceptions:

Instead of Table 6.2.2.1.2.2.3-1 🡪 use Table 6.2.2.2.2.2.3 -1.

Instead of clause 6.2.2.1.2.2.4.3 🡪 use clause 6.2.2.2.2.2.4.3.

6.2.2.2.2.2.4.2 Test procedure

Same test procedure as specified in clause 6.2.2.1.2.2.4.2 with the following exceptions:

Instead of Table 6.2.2.1.2.2.3-1 🡪 use Table 6.2.2.2.2.2.3-1.

6.2.2.2.2.2.4.3 Message contents

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

6.2.2.2.2.2.4.3\_1 Message exceptions for SA

Table 6.2.2.2.2.2.4.3\_1-1: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 001000 |  |  |
| } |  |  |  |
| nrofPorts | p2 |  |  |
| firstOFDMSymbolInTimeDomain | 13 |  |  |
| } |  |  |  |

Table 6.2.2.2.2.2.4.3\_1-2: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.2.2.2.2.2.4.3\_1-3: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
| periodicityAndOffset | CSI-ResourcePeriodicityAndOffset |  |  |

Table 6.2.2.2.2.2.4.3\_1-4: *CSI-ResourcePeriodicityAndOffset*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.2-43 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset CHOICE { |  |  |  |
| slots10 | 1 |  |  |
| } |  |  |  |

Table 6.2.2.2.2.2.4.3\_1-5: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| Two SEQUENCE { |  |  |  |
| twoTX-CodebookSubsetRestriction | 000001 |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 11111111 |  |  |

Table 6.2.2.2.2.2.4.3\_1-6: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| cqi-FormatIndicator | subbandCQI |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |

6.2.2.2.2.2.4.3\_2 Message exceptions for NSA

Same as in 6.2.2.2.2.2.4.3\_1.

6.2.2.2.2.2.5 Test requirement

The pass/fail decision is as specified in the test procedure in clause 6.2.2.2.2.2.4.2.

Table 6.2.2.2.2.2.5-1: Test requirements

|  |  |  |
| --- | --- | --- |
| **Parameters** | **Test 1** | **Test 2** |
| *α* [%] | 2 | 2 |
| *β* [%] | 55 | 55 |
| ** | 1.04 | 1.04 |

###### 6.2.2.2.2.3 2Rx FDD FR1 Wideband CQI reporting with inter-cell interference

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

- TE connection diagram is TBD.

- MU/TT analysis pending.

6.2.2.2.2.3.1 Test purpose

Verify that the UE is tracking the channel variations and selecting the largest transport format possible based on inter-cell interference mitigation receiver.

6.2.2.2.2.3.2 Test applicability

This test applies to all types of NR UEs and E-UTRAN UEs supporting EN-DC for release 15 and release 16 supporting MMSE-IRC processing for scenarios with inter-cell and intra-cell inter-user interference.

This test applies to all types of release 17 and forward NR UEs and E-UTRAN UEs supporting EN-DC.

6.2.2.2.2.3.3 Minimum conformance requirements

For the parameters specified in Table 6.2.2.2.2.3.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following,

a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified INR and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be ≥ **where **is specified in Table 6.2.2.2.2.3.3-2;

b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified INR, the average BLER for the indicated transport formats shall be greater than or equal to 0.02.

Table 6.2.2.2.2.3.3-1: Wideband CQI reporting test with inter-cell interference (TDD)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | |
| Cell 1 | Cell 2 |
| Bandwidth | | | MHz | 40 | 40 |
| Duplex Mode | | |  | TDD | TDD |
| Subcarrier spacing | | | kHz | 30 | 30 |
| TDD UL-DL pattern | | |  | FR1.30-1 | FR1.30-1 |
| SINR | | | dB | -2 | - |
| Beamforming Model | | |  | As specified in Annex B.4.1 | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | Periodic |
| Number of CSI-RS ports (*X*) | |  | 2 | 1 |
| CDM Type | |  | FD-CDM2 | noCDM |
| Density (ρ) | |  | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 3(8) | Row 2(8) |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | 9 |
| CSI-RS  periodicity and offset | | slot | 10/1 | Same as serving cell |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | Periodic |
| Number of CSI-RS ports (*X*) | |  | 2 | 1 |
| CDM Type | |  | FD-CDM2 | noCDM |
| Density (ρ) | |  | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 3(6, -) | Row 2(6, -) |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | 13 |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 10/1 | Same as serving cell |
| CSI-IM configuration | CSI-IM resource Type | |  | Periodic | Periodic |
| CSI-IM RE pattern | |  | 0 | 0 |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) | |  | (4, 9) | (6,9) |
| CSI-IM timeConfig  periodicity and offset | | slot | 10/1 | Same as serving cell |
| ReportConfigType | | |  | Periodic | Not configured |
| CQI-table | | |  | Table 2 | Table 2 |
| reportQuantity | | |  | cri-RI-PMI-CQI | Not configured |
| timeRestrictionForChannelMeasurements | | |  | Not configured | Not configured |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | Not configured |
| cqi-FormatIndicator | | |  | Wideband | Wideband |
| pmi-FormatIndicator | | |  | Wideband | Wideband |
| Sub-band Size | | | RB | 16 |  |
| Csi-ReportingBand | | |  | 1111111 | Not configured |
| CSI-Report periodicity and offset | | | slot | 10/9 | Not configured |
| aperiodicTriggeringOffset | | |  | Not configured | Not configured |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | typeI-SinglePanel |
| Codebook Mode |  | 1 | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | Not configured |
| CodebookSubsetRestriction |  | 000001 | Not configured |
| RI Restriction |  | N/A | Not configured |
| Physical channel for CSI report | | |  | PUCCH | Not configured |
| CQI/RI/PMI delay | | | ms | 9.5 | Not configured |
| Maximum number of HARQ transmission | | |  | 1 | Not configured |
| Measurement channel | | |  | As specified in Table A.4-2, TBS.2-3 |  |
| INR | | | dB | N/A | 10.04 |
| Propagation condition | | |  | TDLA30-5 | AWGN |
| Antenna configuration | | |  | 2×2 | 1×2 |
| Correlation configuration | | |  | ULA Low | N/A |
| Note 1: The respective received power spectral density of each interfering cell relative to  is defined by its associated INR value as specified in clause B.6.1.  Note 2: Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. Interfering cell is fully loaded.  Note 3: Both cells are time synchronous.  Note 4: Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present. The sum of power of white noise for white Gaussian noise model equals to the power of white noise and interference for inter-cell interference model.  Note 5: SINR corresponds to  of Cell 1 as defined in clause 4.4.5.  Note 6: INR corresponds to Cell 2 is defined in clause B.6.1 | | | | | |

Table 6.2.2.2.2.3.3-2: Minimum requirement (TDD)

|  |  |
| --- | --- |
| **Parameters** | **Test 1** |
| ** | 1.9 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.2.2.3.

6.2.2.2.2.3.4 Test description

6.2.2.2.2.3.4.1 Initial conditions

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

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

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

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

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

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

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

2. The parameter settings for the serving cell (Cell 1) and interfering cell (Cell 2) are set up according to Table 6.1.2-1 and Table 6.2.2.2.2.3.3-1 as appropriate.

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

4. Propagation conditions are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On,* Test Mode *On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* On*,* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 5.2.2.1.15\_1.3.3.

6.2.2.2.2.3.4.2 Test procedure

1. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband CQI value reported from UE. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data, record the BLER (NACK / ACK + NACK) and measure the average throughput according to Annex G.3.3 and G.3.4. Declare the throughput as .

2. Deactivate i.e., stop transmitting anything from Cell 2 and set the Cell 1 parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.2.2.2.2.3.3-1 as appropriate.

3. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband CQI value reported from UE. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data, measure the average throughput according to Annex G.3.3 and G.3.4. Declare the throughput as .

4. If the ratio ( /) ≥  specified in Table 6.2.2.2.2.3.3-2 and the BLER (NACK / ACK + NACK) calculated in step 2 is greater or equal to 0.02, then pass the UE for this test. Otherwise fail the UE.

6.2.2.2.2.3.4.3 Message contents

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

6.2.2.2.2.3.5 Test requirement

The pass fail decision is as specified in the test procedure in clause 6.2.2.2.2.3.4.2.

The test tolerance for this test is FFS.

###### 6.2.2.2.2.4 2Rx TDD FR1 periodic wideband CQI reporting under fading conditions for RedCap

6.2.2.2.2.4.1 Test Purpose

To verify the variance of the wideband CQI reports is within the limits defined, that the ratio of the throughput is within the limits defined and that the average PDSCH BLER is greater than or equal to 2% for the indicated transport format.

6.2.2.2.2.4.2 Test Applicability

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

6.2.2.2.2.4.3 Minimum requirement for wideband CQI reporting for RedCap

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 6.2.2.2.2.4.3-1 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 6.2.2.2.2.4.3-2;

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 6.2.2.2.2.4.3-2;

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 6.2.2.2.2.4.3-1: Wideband CQI reporting test under frequency non-selective fading conditions

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | |
| Bandwidth | | | MHz | 20 | |
| Subcarrier spacing | | | kHz | 30 | |
| Duplex Mode | | |  | TDD | |
| TDD UL-DL pattern | | |  | FR1.30-1 | |
| SNR | | | dB | 6 | 7 |
| Propagation channel | | |  | TDLA30-5 | |
| Antenna configuration | | |  | 2×2 | |
| Correlation configuration | | |  | ULA high | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | |
| Number of CSI-RS ports (*X*) | |  | 4 | |
| CDM Type | |  | FD-CDM2 | |
| Density (ρ) | |  | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | |
| CSI-RS  periodicity and offset | | slot | 10/1 | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | |
| Number of CSI-RS ports (*X*) | |  | 2 | |
| CDM Type | |  | FD-CDM2 | |
| Density (ρ) | |  | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 3,(6) | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | |
| 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 | |
| ReportConfigType | | |  | Periodic | |
| CQI-table | | |  | Table 1 | |
| reportQuantity | | |  | cri-RI-PMI-CQI | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | |
| cqi-FormatIndicator | | |  | Wideband | |
| pmi-FormatIndicator | | |  | Wideband | |
| Sub-band Size | | | RB | 8 | |
| Csi-ReportingBand | | |  | 1111111 | |
| CSI-Report periodicity and offset | | | slot | 10/9 | |
| aperiodicTriggeringOffset | | |  | Not configured | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | |
|  | | Codebook Mode |  | 1 | |
|  | | (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.4-1, TBS.1-5 | |

Table 6.2.2.2.2.4.3-2: Minimum requirements

|  |  |
| --- | --- |
| Parameters | Test 1 |
| ** [%] | 20 |
| ** | 1.05 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.2.2.2.4.

6.2.2.2.2.4.4 Test Description

6.2.2.2.2.4.4.1 Initial Conditions

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

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

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

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

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

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

2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.2.2.2.4.3-1 as appropriate.

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

4. Propagation conditions for the NR cell are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, *Connected without release On, Test Mode On*. Message contents are defined in clause 6.2.2.2.2.4.5.

6.2.2.2.2.4.4.2 Test Procedure

1. Set the parameters of bandwidth, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.2.2.4.3-1.

2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 6000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.

3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as Median CQI value.

4. If Median CQI value is not equal to 1 or 15 and 1200 (**%)or more of the wideband CQI values are outside the range (Median CQI - 1) ≤ Median CQI ≤ (Median CQI + 1) then continue with step 5, otherwise go to step 7.

5. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the Median CQI value from step 3 and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. Measure the average throughput according to Annex G.3.3 and G.3.4. Declare the throughput as .

6. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE’s reported wideband CQI value. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data, record the BLER (NACK / ACK + NACK) and measure the average throughput according to Annex G.3.3 and G.3.4. Declare the throughput as t.

If the recorded BLER ≥ 0.02 and t /  ≥ then pass the UE.

7. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 6) for the other SNR point as appropriate. Otherwise fail the UE.

6.2.2.2.2.4.4.3 Message contents

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

Table 6.2.2.2.2.4.4.3-1: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 001000 |  |  |
| } |  |  |  |
| nrofPorts | p2 |  |  |
| firstOFDMSymbolInTimeDomain | 13 |  |  |
| } |  |  |  |

Table 6.2.2.2.2.4.4.3-2: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.2.2.2.2.4.4.3-3: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
| periodicityAndOffset | CSI-ResourcePeriodicityAndOffset |  |  |

Table 6.2.2.2.2.4.4.3-4: *CSI-ResourcePeriodicityAndOffset*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-43 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset CHOICE { |  |  |  |
| Slots10 | 1 |  |  |
| } |  |  |  |

Table 6.2.2.2.2.4.4.3-5: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| Two SEQUENCE { |  |  |  |
| twoTX-CodebookSubsetRestriction | 000001 |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 11111111 |  |  |

Table 6.2.2.2.2.4.4.3-6: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| periodic SEQUENCE { |  |  |  |
| reportSlotConfig | CSI-ReportPeriodicityAndOffset |  |  |
| pucch-CSI-ResourceList | PUCCH-CSI-Resource |  |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |
| subbandSize | value2 |  |  |
| } |  |  |  |

6.2.2.2.2.4.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.2.2.2.4.4.2.

Table 6.2.2.2.2.4.5-2: Test requirements

|  |  |
| --- | --- |
| Parameters | Test 1 |
| ** [%] | 20 |
| ** | 1.04 |
| Note1 : TT = 0.01 | |

### 6.2.3 4RX requirements

#### 6.2.3.1 FDD

##### 6.2.3.1.1 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

###### 6.2.3.1.1.1 4Rx FDD FR1 periodic CQI reporting under AWGN conditions for both SA and NSA

6.2.3.1.1.1.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of 10% falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

6.2.3.1.1.1.2 Test Applicability

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

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

6.2.3.1.1.1.3 Minimum requirement for periodic CQI reporting

For the parameters specified in Table 6.2.3.1.1.1.3-1, 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 6.2.3.1.1.1.3-1: CQI reporting definition test

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Test 1** | | **Test 2** | |
| Bandwidth | | | MHz | 10 | | | |
| Subcarrier spacing | | | kHz | 15 | | | |
| Duplex Mode | | |  | FDD | | | |
| SNR | | | dB | 5 | 6 | 11 | 12 |
| Propagation channel | | |  | AWGN | | | |
| Antenna configuration | | |  | 2×4 with static channel specified in Annex B.1 | | | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | | | |
| CSI-RS  periodicity and offset | | slot | 5/1 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 3,(6,-) | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | | | |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 5/1 | | | |
| 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 | 5/1 | | | |
| ReportConfigType | | |  | Periodic | | | |
| CQI-table | | |  | Table 2 | | | |
| reportQuantity | | |  | cri-RI-PMI-CQI | | | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | | | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | | | |
| cqi-FormatIndicator | | |  | Wideband | | | |
| pmi-FormatIndicator | | |  | Wideband | | | |
| Sub-band Size | | | RB | 8 | | | |
| csi-ReportingBand | | |  | 1111111 | | | |
| CSI-Report periodicity and offset | | | slot | 5/0 | | | |
| aperiodicTriggeringOffset | | |  | Not configured | | | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | | | |
| Codebook Mode |  | 1 | | | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | | | |
| CodebookSubsetRestriction |  | 010000 | | | |
| RI Restriction |  | N/A | | | |
| Physical channel for CSI report | | |  | PUCCH | | | |
| CQI/RI/PMI delay | | | ms | 8 | | | |
| Maximum number of HARQ transmission | | |  | 1 | | | |
| Measurement channel | | |  | As specified in Table A.4-2, TBS.2-2 | | | |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.3.1.1.1.

6.2.3.1.1.1.4 Test Description

6.2.3.1.1.1.4.1 Initial Conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.5 for TE diagram and section A.3.2.5 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.3.1.1.1.3-1 as appropriate.

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

4. Propagation conditions for the NR cell are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.2.3.1.1.1.4.3.

6.2.3.1.1.1.4.2 Test Procedure

1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.2.1.1.3-1.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 2000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.

3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.

4. If Median CQI is not equal to 1 or 15 and [1800] or more of the wideband CQI values are in the range (Median CQI - 1) ≤ Median CQI ≤ ( Median CQI + 1) then continue with step 5, otherwise go to step 8.

5. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data until the number of filtered ACK+NACK responses reaches 1000.

For the filtered ACK and NACK responses if the ratio (NACK / ACK + NACK) ≤ 0.1 then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) > 0.1

then pass the UE for this test and go to step 9, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) ≤ 0.1

then pass the UE for this test and go to step 9, otherwise go to step 8.

8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

9. Repeat step 1 to 8 for Test2.

6.2.3.1.1.1.4.4 Message contents

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

6.2.3.1.1.1.4.4\_1 Message exceptions for SA

Same as specified in clause 6.2.2.1.1.1.4.4\_1

6.2.3.1.1.1.4.4\_2 Message exceptions for NSA

Same as specified in clause 6.2.3.1.1.1.4.4\_1.

6.2.3.1.1.1.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.3.1.1.1.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

###### 6.2.3.1.1.2 4Rx FDD FR1 periodic CQI reporting with Table 3 under AWGN conditions for both SA and NSA

6.2.3.1.1.2.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of 10-5 falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

6.2.3.1.1.2.2 Test Applicability

This test applies to all types of NR UE release 16 and forward supporting *cqi-TableAlt*.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and *cqi-TableAlt*.

6.2.3.1.1.2.3 Minimum requirement for periodic CQI reporting with Table 3

For the parameters specified in Table 6.2.3.1.1.2.3-1, 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 6.2.3.1.1.2.3-1: CQI reporting test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** | |
| Bandwidth | | MHz | 10 | |
| Subcarrier spacing | | kHz | 15 | |
| Duplex Mode | |  | FDD | |
| SNR | | dB | -2 | -1 |
| Propagation channel | |  | AWGN | |
| Antenna configuration | |  | 1×4 with static channel specified in Annex B.1 | |
| Beamforming Model | |  | As specified in Annex B.4.1 | |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic | |
| Number of CSI-RS ports (*X*) |  | 4 | |
| CDM Type |  | FD-CDM2 | |
| Density (ρ) |  | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 5,4 | |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 9 | |
| CSI-RS  periodicity and offset | slot | 5/1 | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Periodic | |
| Number of CSI-RS ports (*X*) |  | 1 | |
| CDM Type |  | No CDM | |
| Density (ρ) |  | 3 | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 1,(0,-) | |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 1 | |
| NZP CSI-RS-timeConfig  periodicity and offset | slot | 5/1 | |
| 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 | 5/1 | |
| ReportConfigType | |  | Periodic | |
| CQI-table | |  | Table 3 | |
| reportQuantity | |  | cri-RI-PMI-CQI (Note 1) | |
| Codebook configuration | |  | Not configured | |
| timeRestrictionForChannelMeasurements | |  | Not configured | |
| timeRestrictionForInterferenceMeasurements | |  | Not configured | |
| cqi-FormatIndicator | |  | Wideband | |
| pmi-FormatIndicator | |  | Wideband | |
| Sub-band Size | | RB | 8 | |
| Csi-ReportingBand | |  | 1111111 | |
| CSI-Report periodicity and offset | | slot | 5/0 | |
| aperiodicTriggeringOffset | |  | Not configured | |
| Physical channel for CSI report | |  | PUCCH | |
| CQI/RI/PMI delay | | ms | 8 | |
| Maximum number of HARQ transmission | |  | 1 | |
| Measurement channel | |  | As specified in Table A.4-4, TBS.4-1 | |
| Note 1: The bit width of PMI for UCI on PUCCH in a case 1-port CSI-RS is configured as channel measurement resource is given in TS 38.212 [10], section 6.3.1.1.2. | | | | |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.3.1.1.2.

6.2.3.1.1.2.4 Test Description

6.2.3.1.1.2.4.1 Initial Conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.3 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.3.1.1.2.3-1 as appropriate.

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

4. Propagation conditions for the NR cell are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* Onfor NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.2.3.1.1.2.4.3.

6.2.3.1.1.2.4.2 Test Procedure

1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.3.1.1.2.3-1.

2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 5000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.

3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.

4. If Median CQI is not equal to 1 or 15 and 4500 or more of the wideband CQI values are in the range (Median CQI - 1) ≤ Median CQI ≤ ( Median CQI + 1) then continue with step 5, otherwise go to step 8.

5. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Measure the BLER for a duration sufficient to achieve statistical significance according to Annex G.4.

For the filtered ACK and NACK responses if the ratio (NACK / (ACK + NACK)) ≤ 10-5 then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5, and measure the BLER for a duration sufficient to achieve statistical significance according to Annex G.4.

If the ratio (NACK /(ACK + NACK)) > 10-5

then pass the UE for this test, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5, and measure the BLER for a duration sufficient to achieve statistical significance according to Annex G.4.

If the ratio (NACK /ACK + NACK) ≤10-5

then pass the UE for this test, otherwise go to step 8.

8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

6.2.3.1.1.2.4.3 Message contents

Message contents are according to TS 38.508 [6] clause 5.4.2 with the following exceptions:

6.2.3.1.1.2.4.3\_1 Message exceptions for SA

Same as specified in clause 6.2.2.1.1.2.4.3\_1.

6.2.3.1.1.2.4.3\_2 Message exceptions for NSA

Same as specified in 6.2.3.1.1.2.4.3\_1.

6.2.3.1.1.2.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.3.1.1.2.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

###### 6.2.3.1.1.3 4Rx FDD FR1 periodic CQI reporting with Table 4 under AWGN conditions for both SA and NSA

6.2.3.1.1.3.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of 10% falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

6.2.3.1.1.3.2 Test Applicability

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

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

6.2.3.1.1.3.3 Minimum requirement for periodic CQI reporting

For the parameters specified in Table 6.2.3.1.1.3.3-1, and using the downlink physical channels specified in Annex C.2.1, 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 6.2.3.1.1.3.3-1: CQI reporting definition test

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | |
| Bandwidth | | | MHz | 10 | |
| Duplex Mode | | |  | FDD | |
| Subcarrier spacing | | | kHz | 15 | |
| SNR | | | dB | 25 | 26 |
| Propagation channel | | |  | AWGN | |
| Antenna configuration | | |  | 2×4 with static channel specified in Annex B.1 | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | |
| Number of CSI-RS ports (*X*) | |  | 4 | |
| CDM Type | |  | FD-CDM2 | |
| Density (ρ) | |  | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | |
| CSI-RS  periodicity and offset | | slot | 5/1 | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | |
| Number of CSI-RS ports (*X*) | |  | 2 | |
| CDM Type | |  | FD-CDM2 | |
| Density (ρ) | |  | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 3,(6) | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 5/1 | |
| 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 | 5/1 | |
| ReportConfigType | | |  | Periodic | |
| CQI-table | | |  | Table 4 | |
| reportQuantity | | |  | cri-RI-PMI-CQI | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | |
| cqi-FormatIndicator | | |  | Wideband | |
| pmi-FormatIndicator | | |  | Wideband | |
| Sub-band Size | | | RB | 8 | |
| Csi-ReportingBand | | |  | 1111111 | |
| CSI-Report periodicity and offset | | | slot | 5/0 | |
| aperiodicTriggeringOffset | | |  | Not configured | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | |
| Codebook Mode |  | 1 | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | |
| 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 channel | | |  | As specified in Table A.4-5, TBS.5-1 | |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.3.1.1.3.

6.2.3.1.1.3.4 Test Description

6.2.3.1.1.3.4.1 Initial Conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7 for TE diagram and section A.3.2.3 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.3.1.1.3.3-1 as appropriate.

3. Downlink signals for the NR cell are initially set up according to Annexes C.0, C.1, C.2, C.2.1, and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions for the NR cell are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* Onfor NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 6.2.3.1.1.3.4.3.

6.2.3.1.1.3.4.2 Test Procedure

1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.3.1.1.3.3-1.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 2000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.

3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.

4. If Median CQI is not equal to 1 or 15 and [1800] or more of the wideband CQI values are in the range (Median CQI - 1) ≤ Median CQI ≤ (Median CQI + 1) then continue with step 5, otherwise go to step 8.

5. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data until the number of filtered ACK+NACK responses reaches 1000.

For the filtered ACK and NACK responses if the ratio (NACK / ACK + NACK) ≤ 0.1 then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) > 0.1

then pass the UE for this test, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) ≤ 0.1

then pass the UE for this test, otherwise go to step 8.

8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

6.2.3.1.1.3.4.3 Message contents

Message contents are according to TS 38.508 [6] clause 5.4.2 with the following exceptions:

6.2.3.1.1.3.4.3\_1 Message exceptions for SA

Table 6.2.3.1.1.3.4.3\_1-1: PDSCH-Config

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

6.2.3.1.1.3.4.3\_2 Message exceptions for NSA

Same as specified in 6.2.3.1.1.3.4.3\_1.

6.2.3.1.1.3.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.3.1.1.3.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

##### 6.2.3.1.2 CQI reporting definition under fading conditions

###### 6.2.3.1.2.1 4Rx FDD FR1 periodic wideband CQI reporting under fading conditions for both SA and NSA

6.2.3.1.2.1.1 Test purpose

To verify the variance of the wideband CQI reports is within the limits defined, that the ratio of the throughput is within the limits defined and that the average PDSCH BLER is greater than or equal to 2% for the indicated transport format.

6.2.3.1.2.1.2 Test applicability

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

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

6.2.3.1.2.1.3 Minimum conformance requirements

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.

For the parameters specified in Table 6.2.3.1.2.1.3-1 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 6.2.3.1.2.1.3-2;

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 6.2.3.1.2.1.3-2;

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 6.2.3.1.2.1.3-1: 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 | 3 | 4 | 9 | 10 |
| Propagation channel | | |  | TDLA30-5 | | | |
| Antenna configuration | | |  | 2×4 | | | |
| Correlation configuration | | |  | XP High | | | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | | | |
| CSI-RS  periodicity and offset | | slot | 5/1 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 3,(6,-) | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | | | |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 5/1 | | | |
| 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 | 5/1 | | | |
| ReportConfigType | | |  | Periodic | | | |
| CQI-table | | |  | Table 2 | | | |
| reportQuantity | | |  | cri-RI-PMI-CQI | | | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | | | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | | | |
| cqi-FormatIndicator | | |  | Wideband | | | |
| pmi-FormatIndicator | | |  | Wideband | | | |
| Sub-band Size | | | RB | 8 | | | |
| csi-ReportingBand | | |  | 1111111 | | | |
| CSI-Report periodicity and offset | | | slot | 5/0 | | | |
| aperiodicTriggeringOffset | | |  | Not configured | | | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | | | |
| Codebook Mode |  | 1 | | | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | | | |
| 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 channel | | |  | As specified in Table A.4-2, TBS.2-1 | | | |

Table 6.2.3.1.2.1.3-2: Minimum requirements

|  |  |  |
| --- | --- | --- |
| **Parameters** | **Test 1** | **Test 2** |
| ** [%] | 5 | 5 |
| ** | 1.05 | 1.05 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.3.1.2.1.

6.2.3.1.2.1.4 Test description

6.2.3.1.2.1.4.1 Initial conditions

Same initial conditions as specified in clause 6.2.2.1.2.1.4.1 with the following exceptions:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and section A.3.2.5 for UE diagram.

Instead of Table 6.2.2.1.2.1.3-1🡪 use Table 6.2.3.1.2.1.3-1.

6.2.3.1.2.1.4.2 Test procedure

Same test procedure as specified in clause 6.2.2.1.2.1.4.2 with the following exceptions:

4. If Median CQI value is not equal to 1 or 15 and 300 (**%)or more of the wideband CQI values are outside the range (Median CQI - 1) ≤ Median CQI ≤ (Median CQI + 1) then continue with step 5, otherwise go to step 7.

Instead of Table 6.2.2.1.2.1.5-1 🡪 use Table 6.2.3.1.2.1.3-1.

6.2.3.1.2.1.4.3 Message contents

Same message contests as specified in clause 6.2.2.1.2.1.4.3 with the following exceptions:

6.2.3.1.2.1.4.3\_1 Message exceptions for SA

Table 6.2.3.1.2.1.4.3\_1-1: *CSI-ResourcePeriodicityAndOffset*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.2-43 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset CHOICE { |  |  |  |
| slots5 | 1 |  |  |
| } |  |  |  |

6.2.3.1.2.1.4.3\_2 Message exceptions for NSA

Same as in 6.2.3.1.2.1.4.3\_1.

6.2.3.1.2.1.5 Test requirement

The pass/fail decision is as specified in the test procedure in clause 6.2.3.1.2.1.4.2.

Table 6.2.3.1.2.1.3-1: Test requirements

|  |  |  |
| --- | --- | --- |
| **Parameters** | **Test 1** | **Test 2** |
| ** [%] | 5 | 5 |
| ** | 1.04 | 1.04 |

###### 6.2.3.1.2.2 4Rx FDD FR1 aperiodic subband CQI reporting under fading conditions for both SA and NSA

6.2.3.1.2.2.1 Test purpose

To verify the variance of the wideband CQI reports is within the limits defined, that the ratio of the throughput is within the limits defined and that the average PDSCH BLER is greater than or equal to 2% for the indicated transport format.

6.2.3.1.2.2.2 Test applicability

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

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

6.2.3.1.2.2.3 Minimum conformance requirements

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.

For the parameters specified in Table 6.2.3.1.2.2.3-1 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 6.2.3.1.2.2.3-2;

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 ≥ *γ*, where *γ* is specified in Table 6.2.3.1.2.2.3-2;

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 6.2.3.1.2.2.3-1: 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 | | |  | FDD | | | |
| SNR | | | dB | 5 | 6 | 11 | 12 |
| Propagation channel | | |  | Two tap model specified in Annex B.2.4 with *a*=1, *f*D = 5Hz, and τd=0.45μs | | | |
| Antenna configuration | | |  | 2×4 | | | |
| Correlation configuration | | |  | As per Annex B.1 | | | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | | | |
| CSI-RS  periodicity and offset | | slot | 5/1 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 3,(6,-) | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | | | |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 5/1 | | | |
| 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 | 5/1 | | | |
| ReportConfigType | | |  | Aperiodic | | | |
| CQI-table | | |  | Table 2 | | | |
| reportQuantity | | |  | cri-RI-PMI-CQI | | | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | | | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | | | |
| cqi-FormatIndicator | | |  | Subband | | | |
| 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 | | | |
| reportTriggerSize | | |  | 1 | | | |
| CSI-AperiodicTriggerStateList | | |  | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM | | | |
| aperiodicTriggeringOffset | | |  | Not configured | | | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | | | |
| Codebook Mode |  | 1 | | | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | | | |
| CodebookSubsetRestriction |  | 000001 | | | |
| RI Restriction |  | N/A | | | |
| Physical channel for CSI report | | |  | PUSCH | | | |
| CQI/RI/PMI delay | | | ms | 8 | | | |
| Maximum number of HARQ transmission | | |  | 1 | | | |
| Measurement channel | | |  | As specified in Table A.4-2, TBS.2-5 | | | |

Table 6.2.3.1.2.2.3-2: Minimum requirements

|  |  |  |
| --- | --- | --- |
| **Parameters** | **Test 1** | **Test 2** |
| *α* [%] | 2 | 2 |
| *β* [%] | 55 | 55 |
| ** | 1.05 | 1.05 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.3.1.2.2.

6.2.3.1.2.2.4 Test description

6.2.3.1.2.2.4.1 Initial conditions

Same initial conditions as specified in clause 6.2.2.1.2.2.4.1 with the following exceptions:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and section A.3.2.5 for UE diagram.

Instead of Table 6.2.2.1.2.2.3-1🡪 use Table 6.2.3.1.2.2.3-1.

6.2.3.1.2.2.4.2 Test procedure

Same test procedure as specified in clause 6.2.2.1.2.2.4.2 with the following exceptions:

Instead of Table 6.2.2.1.2.2.5-1 🡪 use Table 6.2.3.1.2.2.3-1.

6.2.3.1.2.2.4.3 Message contents

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

6.2.3.1.2.2.4.3\_1 Message exceptions for SA

Same message exceptions as in 6.2.2.1.2.2.4.3\_1.

6.2.3.1.2.2.4.3\_2 Message exceptions for NSA

Same as in 6.2.3.1.2.2.4.3\_1.

6.2.3.1.2.2.5 Test requirement

The pass/fail decision is as specified in the test procedure in clause 6.2.3.1.2.2.4.2.

Table 6.2.3.1.2.2.5-1: Test requirements

|  |  |  |
| --- | --- | --- |
| **Parameters** | **Test 1** | **Test 2** |
| *α* [%] | 2 | 2 |
| *β* [%] | 55 | 55 |
| ** | 1.04 | 1.04 |
|  | | |

###### 6.2.3.1.2.3 4Rx FDD FR1 Wideband CQI reporting with inter-cell interference

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

- TE connection diagram is TBD.

- MU/TT analysis pending.

6.2.3.1.2.3.1 Test purpose

Verify that the UE is tracking the channel variations and selecting the largest transport format possible based on inter-cell interference mitigation receiver.

6.2.3.1.2.3.2 Test applicability

This test applies to all types of NR UEs and E-UTRAN UEs supporting EN-DC for release 15 and release 16 supporting MMSE-IRC processing for scenarios with inter-cell and intra-cell inter-user interference.

This test applies to all types of release 17 and forward NR UEs and E-UTRAN UEs supporting EN-DC.

6.2.3.1.2.3.3 Minimum conformance requirements

For the parameters specified in Table 6.2.3.1.2.3.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following,

a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified INR and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be ≥ **where **is specified in Table 6.2.3.1.2.3.3-2;

b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified INR, the average BLER for the indicated transport formats shall be greater than or equal to 0.02.

Table 6.2.3.1.2.3.3-1 Wideband CQI reporting test with inter-cell interference

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test1 | |
| Cell 1 | Cell 2 |
| Bandwidth | | | MHz | 10 | 10 |
| Duplex Mode | | |  | FDD | FDD |
| Subcarrier spacing | | | kHz | 15 | 15 |
| SINR | | | dB | -2 | - |
| Beamforming Model | | |  | As specified in Annex B.4.1 | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | Periodic |
| Number of CSI-RS ports (*X*) | |  | 4 | 4 |
| CDM Type | |  | FD-CDM2 | FD-CDM2 |
| Density (ρ) | |  | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | Row 5,4 |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | 9 |
| CSI-RS  periodicity and offset | | slot | 5/1 | Same as serving cell |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | Periodic |
| Number of CSI-RS ports (*X*) | |  | 2 | 1 |
| CDM Type | |  | FD-CDM2 | noCDM |
| Density (ρ) | |  | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 3(6, -) | Row 2(6, -) |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | 13 |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 5/1 | Same as serving cell |
| CSI-IM configuration | CSI-IM resource Type | |  | Periodic | Periodic |
| CSI-IM RE pattern | |  | 0 | 0 |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) | |  | (4, 9) | (6, 9) |
| CSI-IM timeConfig  periodicity and offset | | slot | 5/1 | Same as serving cell |
| ReportConfigType | | |  | Periodic | Not configured |
| CQI-table | | |  | Table 2 | Table 2 |
| reportQuantity | | |  | cri-RI-PMI-CQI | Not configured |
| timeRestrictionForChannelMeasurements | | |  | Not configured | Not configured |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | Not configured |
| cqi-FormatIndicator | | |  | Wideband | Wideband |
| pmi-FormatIndicator | | |  | Wideband | Wideband |
| Sub-band Size | | | RB | 8 | - |
| Csi-ReportingBand | | |  | 1111111 | Not configured |
| CSI-Report periodicity and offset | | | slot | 5/0 | Not configured |
| aperiodicTriggeringOffset | | |  | Not configured | Not configured |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | typeI-SinglePanel |
| Codebook Mode |  | 1 | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | Not configured |
| CodebookSubsetRestriction |  | 000001 | Not configured |
| RI Restriction |  | N/A | Not configured |
| Physical channel for CSI report | | |  | PUCCH | Not configured |
| CQI/RI/PMI delay | | | ms | 8 | Not configured |
| Maximum number of HARQ transmission | | |  | 1 | Not configured |
| Measurement channel | | |  | As specified in Table A.4-2, TBS.2-1 | - |
| INR (Note 6) | | | dB | N/A | 10.04 |
| Propagation condition | | |  | TDLA30-5 | AWGN |
| Antenna configuration | | |  | 2×4 | 1×4 |
| Correlation configuration | | |  | ULA Low | N/A |
| Note 1: The respective received power spectral density of each interfering cell relative to  is defined by its associated INR value as specified in clause B.6.1.  Note 2: Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. Interfering cell is fully loaded.  Note 3: Both cells are time synchronous.  Note 4: Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present.  Note 5: SINR corresponds to  of Cell 1 as defined in clause 4.4.5.  Note 6: INR is defined in clause B.6.1. | | | | | |

Table 6.2.3.1.2.3.3-2: Minimum requirements

|  |  |
| --- | --- |
| Parameters | Test 1 |
| ** | 2.0 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.3.1.2.3.

6.2.3.1.2.3.4 Test description

6.2.3.1.2.3.4.1 Initial conditions

Same initial conditions as specified in clause 6.2.2.1.2.3.4.1 with the following exceptions:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure TBD for TE diagram and section A.3.2.5 for UE diagram.

Instead of Table 6.2.2.1.2.3.3-1🡪 use Table 6.2.3.1.2.3.3-1.

6.2.3.1.2.3.4.2 Test procedure

Same test procedure as specified in clause 6.2.2.1.2.3.4.2 with the following exceptions:

Instead of Table 6.2.2.1.2.3.3-1 🡪 use Table 6.2.3.1.2.3.3-1.

Instead of Table 6.2.2.1.2.3.3-2 🡪 use Table 6.2.3.1.2.3.3-2.

6.2.3.1.2.3.4.3 Message contents

Same test procedure as specified in clause 6.2.2.1.2.3.4.3

6.2.3.1.2.3.5 Test requirement

The pass fail decision is as specified in the test procedure in clause 6.2.3.1.2.3.4.2.

The test tolerance for this test is FFS.

#### 6.2.3.2 TDD

##### 6.2.3.2.1 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

###### 6.2.3.2.1.1 4Rx TDD FR1 periodic CQI reporting under AWGN conditions for both SA and NSA

6.2.3.2.1.1.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of 10% falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

6.2.3.2.1.1.2 Test Applicability

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

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

6.2.3.2.1.1.3 Minimum requirement for periodic CQI reporting

For the parameters specified in Table 6.2.3.2.1.1.3-1, 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 6.2.3.2.1.1.3-1: CQI reporting definition test

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Test 1** | | **Test 2** | |
| Bandwidth | | | MHz | 40 | | | |
| Subcarrier spacing | | | kHz | 30 | | | |
| Duplex Mode | | |  | TDD | | | |
| TDD UL-DL pattern | | |  | FR1.30-1 | | | |
| SNR | | | dB | 5 | 6 | 11 | 12 |
| Propagation channel | | |  | AWGN | | | |
| Antenna configuration | | |  | 2×4 with static channel specified in Annex B.1 | | | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | | | |
| CSI-RS  periodicity and offset | | slot | 10/1 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 3,(6,-) | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | | | |
| 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 | | | |
| ReportConfigType | | |  | Periodic | | | |
| CQI-table | | |  | Table 2 | | | |
| reportQuantity | | |  | cri-RI-PMI-CQI | | | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | | | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | | | |
| cqi-FormatIndicator | | |  | Wideband | | | |
| pmi-FormatIndicator | | |  | Wideband | | | |
| Sub-band Size | | | RB | 16 | | | |
| csi-ReportingBand | | |  | 1111111 | | | |
| CSI-Report periodicity and offset | | | slot | 10/9 | | | |
| aperiodicTriggeringOffset | | |  | Not configured | | | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | | | |
| Codebook Mode |  | 1 | | | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | | | |
| CodebookSubsetRestriction |  | 010000 | | | |
| 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.4-2, TBS.2-4 | | | |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.3.2.1.1.

6.2.3.2.1.1.4 Test Description

6.2.3.2.1.1.4.1 Initial Conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.5 for TE diagram and section A.3.2.5 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.3.2.1.1.3-1 as appropriate.

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

4. Propagation conditions for the NR cell are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.2.3.2.1.1.4.3.

6.2.3.2.1.1.4.2 Test Procedure

1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.2.2.1.1.3-1.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 2000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.

3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.

4. If Median CQI is not equal to 1 or 15 and [1800] or more of the wideband CQI values are in the range (Median CQI - 1) ≤ Median CQI ≤ ( Median CQI + 1) then continue with step 5, otherwise go to step 8.

5. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data until the number of filtered ACK+NACK responses reaches 1000.

For the filtered ACK and NACK responses if the ratio (NACK / ACK + NACK) ≤ 0.1 then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) > 0.1

then pass the UE for this test and go to step 9, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) ≤ 0.1

then pass the UE for this test and go to step 9, otherwise go to step 8.

8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

9. Repeat step 1 to 8 for Test2.

6.2.3.2.1.1.4.4 Message contents

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

6.2.3.2.1.1.4.4\_1 Message exceptions for SA

Same as specified in 6.2.2.2.1.1.4.4\_1.

6.2.3.2.1.1.4.4\_2 Message exceptions for NSA

Same as specified in 6.2.3.2.1.1.4.4\_1.

6.2.3.2.1.1.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.3.2.1.1.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

###### 6.2.3.2.1.2 4Rx TDD FR1 periodic CQI reporting with Table 3 under AWGN conditions for both SA and NSA

6.2.3.2.1.2.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of 10-5 falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

6.2.3.2.1.2.2 Test Applicability

This test applies to all types of NR UE release 16 and forward supporting *cqi-TableAlt*.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and *cqi-TableAlt*.

6.2.3.2.1.2.3 Minimum requirement for periodic CQI reporting with Table 3

For the parameters specified in Table 6.2.3.2.1.2.3-1, 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 6.2.3.2.1.2.3-1: CQI reporting test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** | |
| Bandwidth | | MHz | 40 | |
| Subcarrier spacing | | kHz | 30 | |
| Duplex Mode | |  | TDD | |
| TDD UL-DL pattern | |  | FR1.30-1 | |
| SNR | | dB | -2 | -1 |
| Propagation channel | |  | AWGN | |
| Antenna configuration | |  | 1×4 with static channel specified in Annex B.1 | |
| Beamforming Model | |  | As specified in Annex B.4.1 | |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic | |
| Number of CSI-RS ports (*X*) |  | 4 | |
| CDM Type |  | FD-CDM2 | |
| Density (ρ) |  | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 5,4 | |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 9 | |
| CSI-RS  periodicity and offset | slot | 10/1 | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Periodic | |
| Number of CSI-RS ports (*X*) |  | 1 | |
| CDM Type |  | No CDM | |
| Density (ρ) |  | 3 | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 1,(0,-) | |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 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 | |
| ReportConfigType | |  | Periodic | |
| CQI-table | |  | Table 3 | |
| reportQuantity | |  | cri-RI-PMI-CQI (Note 1) | |
| Codebook configuration | |  | Not configured | |
| timeRestrictionForChannelMeasurements | |  | Not configured | |
| timeRestrictionForInterferenceMeasurements | |  | Not configured | |
| cqi-FormatIndicator | |  | Wideband | |
| pmi-FormatIndicator | |  | Wideband | |
| Sub-band Size | | RB | 16 | |
| Csi-ReportingBand | |  | 1111111 | |
| CSI-Report periodicity and offset | | slot | 10/9 | |
| aperiodicTriggeringOffset | |  | Not configured | |
| 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 | |
| Note 1: The bit width of PMI for UCI on PUCCH in a case 1-port CSI-RS is configured as channel measurement resource is given in TS 38.212 [10], section 6.3.1.1.2. | | | | |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.3.2.1.2.

6.2.3.2.1.2.4 Test Description

6.2.3.2.1.2.4.1 Initial Conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.3 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.3.2.1.2.3-1 as appropriate.

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

4. Propagation conditions for the NR cell are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* Onfor NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.2.3.2.1.2.4.3.

6.2.3.2.1.2.4.2 Test Procedure

1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.3.2.1.2.3-1.

2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 5000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 10 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.

3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.

4. If Median CQI is not equal to 1 or 15 and 4500 or more of the wideband CQI values are in the range (Median CQI - 1) ≤ Median CQI ≤ ( Median CQI + 1) then continue with step 5, otherwise go to step 8.

5. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Measure the BLER for a duration sufficient to achieve statistical significance according to Annex G.4 and early pass fail decision rules as per Annex G.4.3a.

For the filtered ACK and NACK responses if the ratio (NACK / (ACK + NACK)) ≤ 10-5 then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5, and measure the BLER for a duration sufficient to achieve statistical significance according to Annex G.4 and early pass fail decision rules as per Annex G.4.3a.

If the ratio (NACK / (ACK + NACK)) > 10-5

then pass the UE for this test, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5, and measure the BLER for a duration sufficient to achieve statistical significance according to Annex G.4 and early pass fail decision rules as per Annex G.4.3a.

If the ratio (NACK / ACK + NACK) ≤10-5

then pass the UE for this test, otherwise go to step 8.

8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

6.2.3.2.1.2.4.3 Message contents

Message contents are according to TS 38.508 [6] clause 5.4.2 with the following exceptions:

6.2.3.2.1.2.4.3\_1 Message exceptions for SA

Same as specified in clause 6.2.2.2.1.2.4.3\_1.

6.2.3.2.1.2.4.3\_2 Message exceptions for NSA

Same as specified in 6.2.3.2.1.2.4.3\_1.

6.2.3.2.1.2.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.3.2.1.2.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

###### 6.2.3.2.1.3 4Rx TDD FR1 CQI reporting for PCell on band with shared spectrum access under AWGN conditions for both SA and NSA

6.2.3.2.1.3.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of 10% falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI+1.

6.2.3.2.1.3.2 Test Applicability

This test applies to all types of NR UE release 16 and forward supporting NR/5GC and NR-U and supporting UL on shared channel access.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and NR-U.

6.2.3.2.1.3.3 Minimum requirement for CQI reporting with shared spectrum access

For each Downlink Transmission Duration, the transmission power offset is randomly chosen between [0, +6] dB and 2 sets of CQI reports are obtained for each transmission power offset. 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 for each power offset. 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 6.2.3.2.1.3.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following:

a) For each transmission power offset 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) For each transmission power offset, 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. For each transmission power offset, 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.

c) The absolute difference in median CQI value for each of the transmission power offset according to the reference channel shall be ≥ 2.

Table 6.2.3.2.1.3-1: CQI reporting test parameters for PCell on band with shared spectrum access

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | |
| Bandwidth | | | MHz | 20 | |
| Subcarrier spacing | | | kHz | 30 | |
| Duplex Mode | | |  | TDD | |
| Downlink Transmission Model | | |  | As specified in Annex B.5 | |
| Downlink Transmission Model Parameters | Downlink period | |  | 5 | |
| LBT failure probability (*pLBT*) | |  | 0.25 | |
| Downlink transmission duration values set | |  | {4,6,7} | |
| Occupied OFDM symbols in slot other than the last slot of the downlink duration | |  | 14 | |
| Occupied OFDM symbols in the last slot set of the downlink duration | |  | 14 | |
| TDD UL-DL pattern | | |  | FR1.30-7 | |
| SNR | | | dB | 5 | 6 |
| for power offset 1 | | | dBm/Hz | -112 | |
| for power offset 2 | | | dBm/Hz | -106 | |
| Propagation channel | | |  | AWGN | |
| Antenna configuration | | |  | 2×4 with static channel specified in Annex B.1 | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | |
| ZP CSI-RS configuration | | CSI-RS resource Type |  | Aperiodic | |
| Number of CSI-RS ports (*X*) |  | 4 | |
| CDM Type |  | FD-CDM2 | |
| Density (ρ) |  | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 5,4 | |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 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 |  | Periodic | |
| Number of CSI-RS ports (*X*) |  | 2 | |
| CDM Type |  | FD-CDM2 | |
| Density (ρ) |  | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 3, 6 | |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 3 | |
| CSI-RS  interval and offset | slot | Not configured | |
| aperiodicTriggeringOffset |  | 0 | |
| CSI-IM configuration | | CSI-IM resource Type |  | Aperiodic | |
| CSI-IM RE pattern |  | 0 | |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) |  | (4, 9) | |
| CSI-IM timeConfig  interval and offset | slot | Not configured | |
| ReportConfigType | | |  | Aperiodic | |
| CQI-table | | |  | Table 2 | |
| reportQuantity | | |  | cri-RI-PMI-CQI | |
| timeRestrictionForChannelMeasurements | | |  | configured | |
| timeRestrictionForInterferenceMeasurements | | |  | 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 | | |  | 7 | |
| CSI request | | |  | 1 in slots i, where mod(i, 10) = 1, otherwise it is equal to 0 | |
| reportTriggrtSize | | |  | 1 | |
| CSI-AperiodicTriggerStateList | | |  | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | |
| Codebook Mode |  | 1 | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | |
| CodebookSubsetRestriction |  | 010000 | |
| 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.2-8 | |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.3.2.1.3.

6.2.3.2.1.3.4 Test Description

6.2.3.2.1.3.4.1 Initial Conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.2 for TE diagram and section A.3.2 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.3.2.1.3.3-1 as appropriate.

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

4. Propagation conditions for the NR cell are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* Onfor NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 6.2.3.2.1.3.4.3.

6.2.3.2.1.3.4.2 Test Procedure

1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.3.2.1.3.3-1.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 2000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.

3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.

4. If Median CQI is not equal to 1 or 15 and [1800] or more of the wideband CQI values are in the range (Median CQI - 1) ≤ Median CQI ≤ (Median CQI + 1) then continue with step 5, otherwise go to step 8.

5. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data until the number of filtered ACK+NACK responses reaches 1000.

For the filtered ACK and NACK responses if the ratio (NACK / ACK + NACK) ≤ 0.1 then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) > 0.1

then pass the UE for this test and go to step 9, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) ≤ 0.1

then pass the UE for this test and go to step 9, otherwise go to step 8.

8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

9. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

6.2.3.2.1.3.4.3 Message contents

Message contents are according to TS 38.508 [6] clause 5.4.2 with the following exceptions:

6.2.3.2.1.3.4.3\_1 Message exceptions for SA

Table 6.2.3.2.1.3.4.3\_1-1: Void

Table 6.2.3.2.1.3.4.3\_1-2: *Void*

6.2.3.2.1.3.4.3\_2 Message exceptions for NSA

Same as specified in 6.2.3.2.1.3.4.3\_1.

6.2.3.2.1.3.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.3.2.1.3.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

###### 6.2.3.2.1.4 4Rx TDD FR1 periodic CQI reporting with Table 4 under AWGN conditions for both SA and NSA

6.2.3.2.1.4.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of 10% falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

6.2.3.2.1.4.2 Test Applicability

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

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

6.2.3.2.1.4.3 Minimum requirement for periodic CQI reporting

For the parameters specified in Table 6.2.3.2.1.4.3-1, and using the downlink physical channels specified in Annex C.2.1, 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 6.2.3.2.1.4.3-1: CQI reporting definition test

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | |
| Bandwidth | | | MHz | 40 | |
| Subcarrier spacing | | | kHz | 30 | |
| Duplex Mode | | |  | TDD | |
| TDD UL-DL pattern | | |  | FR1.30-1 | |
| SNR | | | dB | 25 | 26 |
| Propagation channel | | |  | AWGN | |
| Antenna configuration | | |  | 2×4 with static channel specified in Annex B.1 | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | |
| Number of CSI-RS ports (*X*) | |  | 4 | |
| CDM Type | |  | FD-CDM2 | |
| Density (ρ) | |  | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | |
| CSI-RS  periodicity and offset | | slot | 10/1 | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | |
| Number of CSI-RS ports (*X*) | |  | 2 | |
| CDM Type | |  | FD-CDM2 | |
| Density (ρ) | |  | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 3,(6) | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | |
| 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 | |
| ReportConfigType | | |  | Periodic | |
| CQI-table | | |  | Table 4 | |
| reportQuantity | | |  | cri-RI-PMI-CQI | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | |
| cqi-FormatIndicator | | |  | Wideband | |
| pmi-FormatIndicator | | |  | Wideband | |
| Sub-band Size | | | RB | 16 | |
| csi-ReportingBand | | |  | 1111111 | |
| CSI-Report periodicity and offset | | | slot | 10/9 | |
| aperiodicTriggeringOffset | | |  | Not configured | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | |
| Codebook Mode |  | 1 | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | |
| CodebookSubsetRestriction |  | 010000 | |
| 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.4-5, TBS.5-2 | |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.3.2.1.4.

6.2.3.2.1.4.4 Test Description

6.2.3.2.1.4.4.1 Initial Conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7 for TE diagram and section A.3.2.3 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 6.1.2-1 and 6.2.3.2.1.4.3-1 as appropriate.

3. Downlink signals for the NR cell are initially set up according to Annexes C.0, C.1, C.2, C.2.1, and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-1 [7].

4. Propagation conditions for the NR cell are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode* Onfor NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 6.2.3.2.1.4.4.3.

6.2.3.2.1.4.4.2 Test Procedure

1. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 6.2.3.2.1.4.3-1.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 2000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 5 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.

3. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.

4. If Median CQI is not equal to 1 or 15 and [1800] or more of the wideband CQI values are in the range (Median CQI - 1) ≤ Median CQI ≤ (Median CQI + 1) then continue with step 5, otherwise go to step 8.

5. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data until the number of filtered ACK+NACK responses reaches 1000.

For the filtered ACK and NACK responses if the ratio (NACK / ACK + NACK) ≤ 0.1 then go to step 6, otherwise go to step 7.

6. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) > 0.1

then pass the UE for this test, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 5 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) ≤ 0.1

then pass the UE for this test, otherwise go to step 8.

8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

6.2.3.2.1.4.4.3 Message contents

Message contents are according to TS 38.508 [6] clause 5.4.2 with the following exceptions:

6.2.3.2.1.4.4.3\_1 Message exceptions for SA

Table 6.2.3.2.1.4.4.3\_1-1: PDSCH-Config

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

6.2.3.2.1.4.4.3\_2 Message exceptions for NSA

Same as specified in 6.2.3.2.1.4.4.3\_1.

6.2.3.2.1.4.5 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2.3.2.1.4.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

##### 6.2.3.2.2 CQI reporting under fading conditions

###### 6.2.3.2.2.1 4Rx TDD FR1 periodic wideband CQI reporting under fading conditions for both SA and NSA

6.2.3.2.2.1.1 Test purpose

To verify the variance of the wideband CQI reports is within the limits defined, that the ratio of the throughput is within the limits defined and that the average PDSCH BLER is greater than or equal to 2% for the indicated transport format.

6.2.3.2.2.1.2 Test applicability

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

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

6.2.3.2.2.1.3 Minimum conformance requirements

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.

For the parameters specified in Table 6.2.3.2.2.1.3-1 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 6.2.3.2.2.1.3-2;

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 6.2.3.2.2.1.3-2;

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 6.2.3.2.2.1.3-1: 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 pattern | | |  | FR1.30-1 | | | |
| SNR | | | dB | 3 | 4 | 9 | 10 |
| Propagation channel | | |  | TDLA30-5 | | | |
| Antenna configuration | | |  | 2×4 | | | |
| Correlation configuration | | |  | XP High | | | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | | | |
| CSI-RS  periodicity and offset | | slot | 10/1 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 3,(6,-) | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | | | |
| 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 | | | |
| ReportConfigType | | |  | Periodic | | | |
| CQI-table | | |  | Table 2 | | | |
| reportQuantity | | |  | cri-RI-PMI-CQI | | | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | | | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | | | |
| cqi-FormatIndicator | | |  | Wideband | | | |
| pmi-FormatIndicator | | |  | Wideband | | | |
| Sub-band Size | | | RB | 16 | | | |
| csi-ReportingBand | | |  | 1111111 | | | |
| CSI-Report periodicity and offset | | | slot | 10/9 | | | |
| aperiodicTriggeringOffset | | |  | Not configured | | | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | | | |
| Codebook Mode |  | 1 | | | |
| (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.4-2, TBS.2-3 | | | |

Table 6.2.3.2.2.1.3-2: Minimum requirements

|  |  |  |
| --- | --- | --- |
| Parameters | Test 1 | Test 2 |
| ** [%] | 5 | 5 |
| ** | 1.05 | 1.05 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.3.2.2.1.

6.2.3.2.2.1.4 Test description

6.2.3.2.2.1.4.1 Initial conditions

Same initial conditions as specified in clause 6.2.2.1.2.1.4.1 with the following exceptions:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and section A.3.2.5 for UE diagram.

Instead of Table 6.2.2.1.2.1.3-1 🡪 use Table 6.2.3.2.2.1.3-1.

6.2.3.2.2.1.4.2 Test procedure

Same test procedure as specified in clause 6.2.2.1.2.1.4.2 with the following exceptions:

4. If Median CQI value is not equal to 1 or 15 and 300 (**%)or more of the wideband CQI values are outside the range (Median CQI - 1) ≤ Median CQI ≤ (Median CQI + 1) then continue with step 5, otherwise go to step 7.

Instead of Table 6.2.2.1.2.1.5-1 🡪 use Table 6.2.3.2.2.1.3-1.

6.2.3.2.2.1.4.3 Message contents

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

6.2.3.2.2.1.4.3\_1 Message exceptions for SA

Same as 6.2.2.1.2.1.4.3\_1 with following exceptions:

Table 6.2.3.2.2.1.4.3\_1-1: *CSI-ResourcePeriodicityAndOffset*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-43 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset CHOICE { |  |  |  |
| slots10 | 1 |  |  |
| } |  |  |  |

6.2.3.2.2.1.4.3\_2 Message exceptions for NSA

Same as 6.2.3.2.2.1.4.3\_1.

6.2.3.2.2.1.5 Test requirement

The pass/fail decision is as specified in the test procedure in clause 6.2.3.2.2.1.4.2.

Table 6.2.3.2.2.1.5-1: Test requirements

|  |  |  |
| --- | --- | --- |
| **Parameters** | **Test 1** | **Test 2** |
| ** [%] | 5 | 5 |
| ** | 1.04 | 1.04 |

###### 6.2.3.2.2.2 4Rx TDD FR1 aperiodic subband CQI reporting under fading conditions for both SA and NSA

6.2.3.2.2.2.1 Test purpose

To verify the variance of the wideband CQI reports is within the limits defined, that the ratio of the throughput is within the limits defined and that the average PDSCH BLER is greater than or equal to 2% for the indicated transport format.

6.2.3.2.2.2.2 Test applicability

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

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

6.2.3.2.2.2.3 Minimum conformance requirements

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.

For the parameters specified in Table 6.2.3.2.2.2.3-1 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 6.2.3.2.2.2.3-2;

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 ≥ *γ*, where *γ* is specified in Table 6.2.3.2.2.2.3-2;

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 6.2.3.2.2.2.3-1: Sub-band CQI reporting test under frequency-selective fading conditions

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | | Test 2 | |
| Bandwidth | | | MHz | 40 | | | |
| Subcarrier spacing | | | kHz | 30 | | | |
| Duplex Mode | | |  | TDD | | | |
| TDD UL-DL pattern | | |  | FR1.30-1 | | | |
| SNR | | | dB | 5 | 6 | 11 | 12 |
| Propagation channel | | |  | Two tap model specified in Annex B.2.4 with *a*=1, *f*D = 5Hz, and τd=0.1125μs | | | |
| Antenna configuration | | |  | 2×4 | | | |
| Correlation configuration | | |  | As per Annex B.1 | | | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,4 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | | | |
| CSI-RS  periodicity and offset | | slot | 10/1 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | FD-CDM2 | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 3,(6,-) | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | | | |
| 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 | | | |
| ReportConfigType | | |  | Aperiodic | | | |
| CQI-table | | |  | Table 2 | | | |
| reportQuantity | | |  | cri-RI-PMI-CQI | | | |
| timeRestrictionForChannelMeasurements | | |  | Not configured | | | |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | | | |
| cqi-FormatIndicator | | |  | Subband | | | |
| pmi-FormatIndicator | | |  | Wideband | | | |
| 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 | | | |
| reportTriggerSize | | |  | 1 | | | |
| CSI-AperiodicTriggerStateList | | |  | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM | | | |
| aperiodicTriggeringOffset | | |  | Not Configured | | | |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | | | |
| Codebook Mode |  | 1 | | | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | | | |
| 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 6.2.3.2.2.2.3-2: Minimum requirements

|  |  |  |
| --- | --- | --- |
| **Parameters** | **Test 1** | **Test 2** |
| *α* [%] | 2 | 2 |
| *β* [%] | 55 | 55 |
| ** | 1.05 | 1.05 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.3.2.2.2.

6.2.3.2.2.2.4 Test description

6.2.3.2.2.2.4.1 Initial conditions

Same initial conditions as specified in clause 6.2.2.1.2.2.4.1 with the following exceptions:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 for TE diagram and section A.3.2.5 for UE diagram.

Instead of Table 6.2.2.1.2.2.3-1 🡪 use Table 6.2.3.2.2.2.3-1.

Instead of clause 6.2.2.1.2.2.4.3 🡪 use clause 6.2.3.2.2.2.4.3.

6.2.3.2.2.2.4.2 Test procedure

Same test procedure as specified in clause 6.2.2.1.2.2.4.2 with the following exceptions:

Instead of Table 6.2.2.1.2.2.3-1 🡪 use Table 6.2.3.2.2.2.3-1.

6.2.3.2.2.2.4.3 Message contents

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

6.2.3.2.2.2.4.3\_1 Message exceptions for SA

Same as 6.2.2.1.2.2.4.3\_1 with following exceptions:

Table 6.2.3.2.2.2.4.3\_1-1: *CSI-ResourcePeriodicityAndOffset*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.2-43 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset CHOICE { |  |  |  |
| Slots10 | 1 |  |  |
| } |  |  |  |

6.2.3.2.2.2.4.3\_2 Message exceptions for NSA

Same as 6.2.3.2.2.2.4.3\_1.

6.2.3.2.2.2.5 Test requirement

The pass/fail decision is as specified in the test procedure in clause 6.2.3.2.2.2.4.2.

Table 6.2.3.2.2.2.5-1: Minimum requirements

|  |  |  |
| --- | --- | --- |
| Parameters | Test 1 | Test 2 |
| *α* [%] | 2 | 2 |
| *β* [%] | 55 | 55 |
| ** | 1.04 | 1.04 |
| Note 1: TT = 0.01 | | |

###### 6.2.3.2.2.3 4Rx FDD FR1 Wideband CQI reporting with inter-cell interference

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

- TE connection diagram is TBD.

- MU/TT analysis pending.

6.2.3.2.2.3.1 Test purpose

Verify that the UE is tracking the channel variations and selecting the largest transport format possible based on inter-cell interference mitigation receiver.

6.2.3.2.2.3.2 Test applicability

This test applies to all types of NR UEs and E-UTRAN UEs supporting EN-DC for release 15 and release 16 supporting MMSE-IRC processing for scenarios with inter-cell and intra-cell inter-user interference.

This test applies to all types of release 17 and forward NR UEs and E-UTRAN UEs supporting EN-DC.

6.2.3.2.2.3.3 Minimum conformance requirements

For the parameters specified in Table 6.2.3.2.2.3.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified by the following,

a) the ratio of the throughput obtained when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified INR and that obtained when transmitting the transport format indicated by each reported wideband CQI index subject to a white Gaussian noise source shall be ≥ **where **is specified in Table 6.2.3.2.2.3.3-2;

b) when transmitting the transport format indicated by each reported wideband CQI index subject to an interference source with specified INR, the average BLER for the indicated transport formats shall be greater than or equal to 0.02.

Table 6.2.3.2.2.3.3-1: Wideband CQI reporting test with inter-cell interference (TDD)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | |
| Cell 1 | Cell 2 |
| Bandwidth | | | MHz | 40 | 40 |
| Duplex Mode | | |  | TDD | TDD |
| Subcarrier spacing | | | kHz | 30 | 30 |
| TDD UL-DL pattern | | |  | FR1.30-1 | FR1.30-1 |
| SINR | | | dB | -2 | - |
| Beamforming Model | | |  | As specified in Annex B.4.1 | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | Periodic |
| Number of CSI-RS ports (*X*) | |  | 2 | 1 |
| CDM Type | |  | FD-CDM2 | noCDM |
| Density (ρ) | |  | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 3(8) | Row 2(8) |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 9 | 9 |
| CSI-RS  periodicity and offset | | slot | 10/1 | Same as serving cell |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | Periodic |
| Number of CSI-RS ports (*X*) | |  | 2 | 1 |
| CDM Type | |  | FD-CDM2 | noCDM |
| Density (ρ) | |  | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 3(6, -) | Row 2(6, -) |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | 13 | 13 |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 10/1 | Same as serving cell |
| CSI-IM configuration | CSI-IM resource Type | |  | Periodic | Periodic |
| CSI-IM RE pattern | |  | 0 | 0 |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) | |  | (4, 9) | (6,9) |
| CSI-IM timeConfig  periodicity and offset | | slot | 10/1 | Same as serving cell |
| ReportConfigType | | |  | Periodic | Not configured |
| CQI-table | | |  | Table 2 | Table 2 |
| reportQuantity | | |  | cri-RI-PMI-CQI | Not configured |
| timeRestrictionForChannelMeasurements | | |  | Not configured | Not configured |
| timeRestrictionForInterferenceMeasurements | | |  | Not configured | Not configured |
| cqi-FormatIndicator | | |  | Wideband | Wideband |
| pmi-FormatIndicator | | |  | Wideband | Wideband |
| Sub-band Size | | | RB | 16 |  |
| Csi-ReportingBand | | |  | 1111111 | Not configured |
| CSI-Report periodicity and offset | | | slot | 10/9 | Not configured |
| aperiodicTriggeringOffset | | |  | Not configured | Not configured |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | typeI-SinglePanel |
| Codebook Mode |  | 1 | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | Not configured | Not configured |
| CodebookSubsetRestriction |  | 000001 | Not configured |
| RI Restriction |  | N/A | Not configured |
| Physical channel for CSI report | | |  | PUCCH | Not configured |
| CQI/RI/PMI delay | | | ms | 9.5 | Not configured |
| Maximum number of HARQ transmission | | |  | 1 | Not configured |
| Measurement channel | | |  | As specified in Table A.4-2, TBS.2-3 |  |
| INR | | | dB | N/A | 10.04 |
| Propagation condition | | |  | TDLA30-5 | AWGN |
| Antenna configuration | | |  | 2×4 | 1×4 |
| Correlation configuration | | |  | ULA Low | N/A |
| Note 1: The respective received power spectral density of each interfering cell relative to  is defined by its associated INR value as specified in clause B.6.1.  Note 2: Two cells are considered in which Cell 1 is the serving cell and Cell 2 is the interfering cell. Interfering cell is fully loaded.  Note 3: Both cells are time synchronous.  Note 4: Static channel is used for the interference model. In case for white Gaussian noise model Cell 2 is not present. The sum of power of white noise for white Gaussian noise model equals to the power of white noise and interference for inter-cell interference model.  Note 5: SINR corresponds to  of Cell 1 as defined in clause 4.4.5.  Note 6: NR corresponds to Cell 2 is defined in clause B.6.1. | | | | | |

Table 6.2.3.2.2.3.3-2: Minimum requirement (TDD)

|  |  |
| --- | --- |
| **Parameters** | **Test 1** |
| ** | 2.0 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.2.3.2.2.3.

6.2.3.2.2.3.4 Test description

6.2.3.2.2.3.4.1 Initial conditions

Same initial conditions as specified in clause 6.2.2.2.2.3.4.1 with the following exceptions:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure TBD for TE diagram and section A.3.2.5 for UE diagram.

Instead of Table 6.2.2.2.2.3.3-1🡪 use Table 6.2.3.2.2.3.3-1.

6.2.3.2.2.3.4.2 Test procedure

Same test procedure as specified in clause 6.2.2.2.2.3.4.2 with the following exceptions:

Instead of Table 6.2.2.2.2.3.3-1 🡪 use Table 6.2.3.2.2.3.3-1.

Instead of Table 6.2.2.2.2.3.3-2 🡪 use Table 6.2.3.2.2.3.3-2.

6.2.3.2.2.3.4.3 Message contents

Same test procedure as specified in clause 6.2.2.2.2.3.4.3

6.2.3.2.2.3.5 Test requirement

The pass fail decision is as specified in the test procedure in clause 6.2.3.2.2.3.4.2.

The test tolerance for this test is FFS.

## 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 and 4RX requirements

#### 6.2A.3.1 CQI reporting definition under AWGN conditions

##### 6.2A.3.1.0 Minimum requirement for periodic CQI reporting

For each CA CQI reporting test defined in Table 6.2A.3.1.0-6, the test requirements and the test parameters are defined as below.

For each CC, the test parameters are specified in Table 6.2A.3.1.0-1. The additional parameters specified in Table 6.2A.3.1.0-2 are applicable for tests on FDD CC. The additional parameters specified in Table 6.2A.3.1.0-3 are applicable for tests on TDD CC.

For CA with 2 DL CC, for the SNR configuration specified in Table 6.2A.3.1.0-4, 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 CQIPCell – wideband CQISCell ≥ 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.3.1.0-5, 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 CQIPCell – wideband CQISCell1 ≥ 2

wideband CQISCell1 – wideband CQISCell2, 3… ≥ 2

for more than 90% of the time.

Table 6.2A.3.1.0-1: CA CQI reporting test parameters for FDD and TDD CC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Propagation channel | |  | AWGN |
| Antenna configuration | |  | 1×2 with static channel specified in Annex B.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 5, 4 |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 9 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 1 |
| CDM Type |  | No CDM |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 2, 6 |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | 13 |
| CSI-IM configuration | CSI-IM resource Type |  | Periodic |
| CSI-IM RE pattern |  | 0 |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) |  | (4, 9) |
| ReportConfigType | |  | Periodic |
| CQI-table | |  | Table 2 |
| reportQuantity | |  | cri-RI-PMI-CQI (Note 1) |
| Codebook configuration | |  | Not configured |
| timeRestrictionForChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | Not configured |
| cqi-FormatIndicator | |  | Wideband |
| pmi-FormatIndicator | |  | Wideband |
| Csi-ReportingBand | |  | 1111111 |
| aperiodicTriggeringOffset | |  | Not configured |
| Physical channel for CSI report | |  | PUCCH |
| Maximum number of HARQ transmission | |  | 1 |
| Measurement channel | |  | Derived as per section 5.1.3.2 of TS 38.214 [12] |
| Note 1: The bit width of PMI for UCI on PUCCH in a case 1-port CSI-RS is configured as channel measurement resource is given in TS 38.212 [10], section 6.3.1.1.2. | | | |

Table 6.2A.3.1.0-2: Additional test parameters for FDD CC

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | Unit | | Value | |
| Duplex Mode | | | |  | | FDD | |
| Subcarrier spacing | | | | kHz | | 15 | |
| ZP CSI-RS configuration | | CSI-RS  periodicity and offset | | slot | | 5/1 | |
| NZP CSI-RS for CSI acquisition | | NZP CSI-RS-timeConfig  periodicity and offset | | slot | | 5/1 | |
| 10/1 if configured as SCell with TDD PCell (Test1) | |
| CSI-IM configuration | | CSI-IM timeConfig  periodicity and offset | | slot | | 5/1 | |
| CSI-Report periodicity and offset | | | | slot | | 5/0 if configured as PCell | |
| 5/1 if configured as SCell with FDD PCell (Test2) | |
| 20/18 if configured as SCell with TDD PCell (Test1) | |
| CQI/RI/PMI delay | | | | ms | | 8 if configured as PCell | |
| 12 if configured as SCell | |
| Sub-band Size | | | | RB | | 8 for 5MHz and 10MHz,  16 for 15MHz, 20MHz and 25MHz, 32 for 30MHz, 35MHz, 40MHz, 45MHz and 50MHz | |
| Note 1: NZP CSI-RS periodicity/offset slots are based on the carrier SCS and CSI reporting periodicity/offset slots are based on the PCell SCS. | | | | | | | |

Table 6.2A.3.1.0-3: Additional test parameters for TDD CC

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | | Value | |
| Duplex Mode | | |  | | TDD | |
| Subcarrier spacing | | | kHz | | 30 | |
| TDD UL-DL pattern | | |  | | 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 if configured as SCell with FDD PCell (Test1) | |
| 20/1 | |
| CSI-IM configuration | | CSI-IM timeConfig  periodicity and offset | slot | | 10/1 | |
| CSI-Report periodicity and offset | | | slot | | 20/19 if configured as PCell | |
| 20/18 if configured as SCell with TDD PCell (Test3) | |
| 5/1 if configured as SCell with FDD PCell (Test1) | |
| CQI/RI/PMI delay | | | ms | | 14.5 if configured as PCell | |
| 12.5 if configured as SCell with TDD PCell (Test3) | |
| 9.5 if configured as SCell with FDD PCell (Test1) | |
| Sub-band Size | | | RB | | 8 for 10MHz, 15MHz, 20MHz and 25MHz,  16 for 30MHz, 40MHz and 50MHz, 32 for 60MHz, 80MHz, 90MHz and 100MHz | |
| Note 1: NZP CSI-RS periodicity/offset slots are based on the carrier SCS and CSI reporting periodicity/offset slots are based on the PCell SCS. | | | | | | |

Table 6.2A.3.1.0-4: SNR configurations for 2 DL CA

|  |  |  |
| --- | --- | --- |
| Parameter | PCell | SCell |
| SNR (dB) | 10.0 | 4.0 |

Table 6.2A.3.1.0-5: SNR configurations for 3 or more DL CA

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

Table 6.2A.3.1.0-6: List of CA CQI reporting test

|  |  |
| --- | --- |
| Test number | CA duplex mode and SCS combination |
| 1 | FDD 15 kHz + TDD 30 kHz |
| 2 | FDD 15 kHz + FDD 15 kHz |
| 3 | TDD 30 kHz + TDD 30 kHz |
| Note 1: The applicability of requirements for different CA duplex modes, SCSs, is 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. | |

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.

The normative reference for this requirement is TS 38.101-4 [5], clause 6.2A.3.1.1.

##### 6.2A.3.1.1 CQI reporting accuracy under AWGN conditions for CA (2DL CA)

Editor’s note: EN-DC applicability of this test case is FFS in TS 38.522.

6.2A.3.1.1.1 Test Purpose

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.3.1.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 2DL CA.

6.2A.3.1.1.3 Test description

6.2A.3.1.1.3.1 Initial conditions

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

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

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

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

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

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

CA capability to be tested: test any one of the supported CA capabilities with largest aggregated CA bandwidth combination, as specified in 6.1.1.5.2.

CA configuration to be tested: For the selected CA capability, test any one of the supported CA configurations with largest aggregated CA bandwidth combination, as specified in 6.1.1.5.2.

Table 6.2A.3.1.1.3.1-1: Test point selection table

|  |  |  |  |
| --- | --- | --- | --- |
| Test number | CA duplex mode | Configuration | PCell CC configuration |
| 1 | FDD 15 kHz + TDD 30 kHz | As defined in Table 6.2A.3.1.0-1 to Table 6.2A.3.1.0-3 | TDD CC if supported, otherwise FDD CC |
| 2 (Note 2) | FDD 15 kHz + FDD 15 kHz | As defined in Table 6.2A.3.1.0-1 to Table 6.2A.3.1.0-2 | Any of CCs |
| 3 | TDD 30 kHz + TDD 30 kHz | As defined in Table 6.2A.3.1.0-1 and Table 6.2A.3.1.0-3 | Any of CCs |
| NOTE 1: The test coverage can be considered fulfilled if UE passes one of the CC as PCell in Test 1.  NOTE 2: These scenarios are only tested for UEs which are not verified with Test 1. | | | |

1. Connect the SS and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A Figure A.3.1.7.2A for TE diagram, Figure A.3.2.3 for UE supporting only 2Rx RF bands on all CC. Annex A, Figure A.3.2.5 for UE supporting 4Rx on some or all the CCs.

2. The parameter settings for the cell are set up according to Table 6.1.2-1, and Table 6.2A.3.1.0-1 to Table 6.2A.3.1.0-3 as appropriate.

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

4. Propagation conditions are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 6.2A.3.1.1.3.3.

6.2A.3.1.1.3.2 Test Procedure

1. Configure SCC according to Annex C.0, C.1 and C.2 for all downlink physical channels.

2. The SS shall configure SCC as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 6.2A.3.1.1.3.3.

3. SS activates SCC by sending the activation MAC-CE (Refer TS 38.321 [24], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[25], clause9.3).

4. Set the parameters of bandwidth, reference channel, propagation condition and antenna configuration according to Table 6.2A.3.1.0-1 to Table 6.2A.3.1.0-3 as appropriate. Set the SNR according to Table 6.2A.3.1.0-4 as appropriate for PCC and SCC (For UE supporting 4Rx antenna ports on a given CC, the SNR is reduced by 3dB for that CC).

5. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.

6. The SS shall start gathering CQI reports, and will continue gathering CQI reports until 2000 wideband CQI reports have been gathered for each PCC and SCC. For each CSI report calculate the respective difference CQIP-S = wideband CQIPCell – wideband CQISCell.

7. If more than 1800 values of CQIP-S are ≥ 2 pass the UE. Otherwise fail the UE.

8. Repeat steps from 1 to 7 for each test point in Table 6.2A.3.1.1.3.1-1 as appropriate.

6.2A.3.1.1.3.3 Message contents

Message contents are according to TS 38.508 [6] clause 5.4.2 with the following exceptions:

6.2A.3.1.1.3.3\_1 Message exceptions for SA

Table 6.2A.3.1.1.3.3\_1-1: CSI-RS-ResourceMapping

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| row2 | 0000 0010 0000 | k0=6, row2 |  |
| } |  |  |  |
| density CHOICE { |  |  |  |
| one | NULL |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2A.3.1.1.3.3\_1-2: NZP CSI-ResourcePeriodicityAndOffset

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-2a | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots5 | 1 |  | For FDD CC |
| slot10 | 1 |  | (For TDD CC if configured as SCell with FDD PCell (Test1))  OR  (For FDD CC if configured as SCell with TDD PCell (Test1)) |
| Slot20 | 1 |  | For TDD CC |
| } |  |  |  |

Table 6.2A.3.1.1.3.3\_1-3: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-IM-Resource ::= SEQUENCE { |  |  |  |
| periodicityAndOffset SEQUENCE { |  |  |  |
| slots5 | 1 |  | For FDD CC |
| slots10 | 1 |  | For TDD CC |
| } |  |  |  |
| } |  |  |  |

Table 6.2A.3.1.1.3.3\_1-4: CSI-ReportConfig

|  |  |  |
| --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-12 | | |
| Information Element | Value/remark | Condition |
| CSI-ReportConfig ::= SEQUENCE { |  |  |
| subbandSize | 8 | For the CC with FDD 15kHz SCS 5MHz and 10MHz CHBW;  For the CC with TDD 30kHz SCS 10MHz, 15MHz, 20MHz and 25MHz CHBW. |
|  | 16 | For the CC with FDD 15kHz SCS 15MHz, 20MHz and 25MHz CHBW;  For the CC with TDD 30kHz SCS 30MHz, 40MHz and 50MHz CHBW. |
|  | 32 | For the CC with FDD 15kHz SCS 30MHz, 35MHz, 40MHz, 45MHz and 50MHz CHBW;  For the CC with TDD 30kHz SCS 60MHz, 80MHz, 90MHz and 100MHz CHBW. |
| } |  |  |

Table 6.2A.3.1.1.3.3\_1-5: Physical layer parameters for DCI format 1\_1

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-1 | | | |
| Parameter | Value | Value in binary | Condition |
| PDSCH-to-HARQ\_feedback timing indicator | corresponding to K1 slots as per Table 9.2.3-1 in TS 38.213 [22] and dl-DataToUL-ACK in Table 4.6.3-112  For FDD 15kHz SCell:  K1 = 7 if mod(i,5) = 0  K1 = 5 if mod(i,5) = 1  K1 = 4 if mod(i,5) = 2  K1 = 11 if mod(i,5) = 3  K1 = 9 if mod(i,5) = 4  where i is slot index per frame; i = {0,…,19} | - | (For FDD CC if configured as SCell with TDD PCell (Test1)) |
| corresponding to K1 slots as per Table 9.2.3-1 in TS 38.213 [22] and dl-DataToUL-ACK in Table 4.6.3-112  For TDD30kHz SCell:  K1 = 2 |  | (For TDD CC if configured as SCell with FDD PCell (Test1)) |

Table 6.2A.3.1.1.3.3\_1-6: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | Not present | n8 | (For FDD CC if configured as SCell with TDD PCell (Test1)) |
| } |  |  |  |

Table 6.2A.3.1.1.3.3\_1-7: CellGroupConfig-SCell

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.5.1.2.3-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| CellGroupConfig ::= SEQUENCE { |  |  |  |
| spCellConfig SEQUENCE { |  |  |  |
| servCellIndex | Not present | PCell always uses servCellIndex=0 |  |
| reconfigurationWithSync | Not present |  |  |
| rlf-TimersAndConstants | Not present |  |  |
| rlmInSyncOutOfSyncThreshold | Not present |  |  |
| spCellConfigDedicated | ServingCellConfig-SpCell | Table 6.2A.3.1.1.3.3\_1-8 |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2A.3.1.1.3.3\_1-8: ServingCellConfig-SpCell (Table 6.2A.3.1.1.3.3\_1-7)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-167 | | | |
| Information Element | Value/remark | Comment | Condition |
| ServingCellConfig ::= SEQUENCE { |  | Current ‘Not present’ for PCC are already present in RRCSetup during Call Connection |  |
| initialDownlinkBWP | Not present |  |  |
| firstActiveDownlinkBWP-Id | Not present |  |  |
| defaultDownlinkBWP-Id | Not present |  |  |
| uplinkConfig | Not present |  |  |
| pdcch-ServingCellConfig | Not present |  |  |
| pdsch-ServingCellConfig | Not present |  |  |
| csi-MeasConfig | CSI-MeasConfig-SpCell | Table 6.2A.3.1.1.3.3\_1-9 |  |
| } |  |  |  |

Table 6.2A.3.1.1.3.3\_1-9: CSI-MeasConfig-SpCell (Table 6.2A.3.1.1.3.3\_1-8)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-11 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-MeasConfig::= SEQUENCE { |  | Current ‘Not present’ for PCC are already present in RRCSetup during Call Connection |  |
| nzp-CSI-RS-ResourceToAddModList | Not present |  |  |
| nzp-CSI-RS-ResourceSetToAddModList | Not present |  |  |
| csi-IM-ResourceToAddModList | Not present |  |  |
| csi-IM-ResourceSetToAddModList | Not present |  |  |
| csi-SSB-ResourceSetToAddModList | Not present |  |  |
| csi-ResourceConfigToAddModList | Not present |  |  |
| csi-ReportConfigToAddModList | CSI-ReportConfig specified in TS 38.508-1 [6] Table 5.4.2.4-12 | Do not set in RRCSetup during Call Connection |  |
| } |  |  |  |

6.2A.3.1.1.3.3\_2 Message exceptions for NSA

Same as specified in 6.2A.3.1.1.3.3\_2.

6.2A.3.1.1.4 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2A.3.1.1.3.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

##### 6.2A.3.1.2 CQI reporting accuracy under AWGN conditions for CA (3DL CA)

Editor’s note: EN-DC applicability of this test case is FFS in TS 38.522.

6.2A.3.1.2.1 Test Purpose

Same with 6.2A.3.1.1.1.

6.2A.3.1.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 3DL CA.

6.2A.3.1.2.3 Test description

6.2A.3.1.2.3.1 Initial conditions

Same with 6.2A.3.1.1.3.1.

6.2A.3.1.2.3.2 Test Procedure

1. Configure SCCs according to Annex C.0, C.1 and C.2 for all downlink physical channels.

2. The SS shall configure SCCs as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 6.2A.3.1.2.3.3.

3. SS activates SCCs by sending the activation MAC-CE (Refer TS 38.321 [24], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[25], clause9.3).

4. Set the parameters of bandwidth, reference channel, propagation condition and antenna configuration according to Table 6.2A.3.1.0-1 to Table 6.2A.3.1.0-3 as appropriate. Set the SNR according to Table 6.2A.3.1.0-5 as appropriate for PCC and SCCs (For a UE supporting 4Rx antenna ports on a given CC, the SNR is reduced by 3dB for that CC).

5. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.

6. The SS shall start gathering CQI reports, and will continue gathering CQI reports until 2000 wideband CQI reports have been gathered for each PCC and SCCs. For each CSI report calculate the respective difference CQIP-S1 = wideband CQIPCell – wideband CQISCell1 and the respective difference CQIS1-S2 = wideband CQISCell1 – wideband CQISCell2.

7. If more than 1800 values of CQIP-S1 are ≥ 2 and more than 1800 values of CQI S1-S2 are ≥ 2, pass the UE. Otherwise fail the UE.

8. Repeat steps from 1 to 7 for each test point in Table 6.2A.3.1.0-6 as appropriate.

6.2A.3.1.2.3.3 Message contents

Same with 6.2A.3.1.1.3.3.

6.2A.3.1.2.4 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2A.3.1.2.3.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

##### 6.2A.3.1.3 CQI reporting accuracy under AWGN conditions for CA (4DL CA)

Editor’s note: EN-DC applicability of this test case is FFS in TS 38.522.

6.2A.3.1.3.1 Test Purpose

Same with 6.2A.3.1.1.1.

6.2A.3.1.3.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 4DL CA.

6.2A.3.1.3.3 Test description

6.2A.3.1.3.3.1 Initial conditions

Same with 6.2A.3.1.1.3.1.

6.2A.3.1.3.3.2 Test Procedure

1. Configure SCCs according to Annex C.0, C.1 and C.2 for all downlink physical channels.

2. The SS shall configure SCCs as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 6.2A.3.1.3.3.3.

3. SS activates SCCs by sending the activation MAC-CE (Refer TS 38.321 [24], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[25], clause9.3).

4. Set the parameters of bandwidth, reference channel, propagation condition and antenna configuration according to Table 6.2A.3.1.0-1 to Table 6.2A.3.1.0-3 as appropriate. Set the SNR according to Table 6.2A.3.1.0-5 as appropriate for PCC and SCCs (For a UE supporting 4Rx antenna ports on a given CC, the SNR is reduced by 3dB for that CC).

5. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC on both PCC and SCCs. The SS sends downlink MAC padding bits on the DL RMC.

6. The SS shall start gathering CQI reports, and will continue gathering CQI reports until 2000 wideband CQI reports have been gathered for each PCC and SCCs. For each CSI report calculate the respective difference CQIP-S1 = wideband CQIPCell – wideband CQISCell1, the respective difference CQIS1-S2 = wideband CQISCell1 – wideband CQISCell2 and the respective difference CQIS1-S3 = wideband CQISCell1 – wideband CQISCell3.

7. If more than 1800 values of CQIP-S1 are ≥ 2, more than 1800 values of CQI S1-S2 are ≥ 2 and more than 1800 values of CQI S1-S3 are ≥ 2, pass the UE. Otherwise fail the UE.

8. Repeat steps from 1 to 7 for each test point defined in Table 6.2A.3.1.0-6 as appropriate.

6.2A.3.1.3.3.3 Message contents

Same with 6.2A.3.1.1.3.3.

6.2A.3.1.3.4 Test Requirements

The pass fail decision is as specified in the test procedure in clause 6.2A.3.1.3.3.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

## 6.3 Reporting of Precoding Matrix Indicator (PMI)

### 6.3.0 General

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 probability of each applicable i1 and i2 combination and applied to the PDSCH. A fixed transport format (FRC) is configured for all requirements.

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



In the definition of *γ*, for 4TX, 8TX, 16TX, and 32TX PMI requirements, is 90 % of the maximum throughput obtained at  using the precoders configured according to the UE reports, and is the throughput measured at with random precoding.

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



In the definition of *γ*, for 16TX PMI requirements, is 90 % of the maximum throughput obtained at  using the precoders configured according to the UE reports, and is the throughput measured at with random precoding.

### 6.3.1 1RX requirements

#### 6.3.1.1 FDD

##### 6.3.1.1.1 1Rx FDD Single PMI with 4TX TypeI-SinglePanel Codebook for RedCap

Editor’s note: This test case is incomplete in following aspects:

- Connection diagram for TE is TBD

6.3.1.1.1.1 Test purpose

The purpose of this test is to test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.1.1.1.2 Test applicability

This test applies to all types of NR RedCap UE with 1Rx from Release 17 onwards.

6.3.1.1.1.3 Minimum conformance requirements

For the parameters specified in Table 6.3.1.1.1-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.1.1.1-2.

Table 6.3.1.1.1.3-1: Test parameters (single layer)

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Bandwidth | | MHz | 10 |
| Subcarrier spacing | | kHz | 15 |
| Duplex Mode | |  | FDD |
| Propagation channel | |  | TDLA30-5 |
| Antenna configuration | |  | High ULA 4 x 1 |
| Beamforming Model | |  | As specified in 38.521-4 [7] Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 5,(4) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (9) |
| CSI-RS  periodicity and offset | slot | 5/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 4, (0) |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | (13) |
| CSI-RS  periodicity and offset |  | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) |  | (4,9) |
| CSI-IM timeConfig  periodicity and offset | slot | Not configured |
| ReportConfigType | |  | Aperiodic |
| CQI-table | |  | Table 1 |
| reportQuantity | |  | cri-RI-PMI-CQI |
| timeRestrictionForChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | Not configured |
| cqi-FormatIndicator | |  | Wideband |
| pmi-FormatIndicator | |  | Wideband |
| Sub-band Size | | RB | 8 |
| csi-ReportingBand | |  | 1111111 |
| CSI-Report periodicity and offset | | slot | Not configured |
| Aperiodic Report Slot Offset | |  | 3 |
| CSI request | |  | 1 in slots i, where mod(i, 5) = 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 configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (2,1) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,1) |
| CodebookSubsetRestriction |  | 11111111 |
| RI Restriction |  | 00000001 |
| Physical channel for CSI report | |  | PUSCH |
| CQI/RI/PMI delay | | ms | 6 |
| Maximum number of HARQ transmission | |  | 4 |
| Measurement channel (Note 4) | |  | R.PDSCH.1-6.1 FDD  R.PDSCH.1-3.1 HD-FDD |
| PDSCH & PDSCH DMRS Precoding configuration for random Precoding | |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity |
| 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.  Note 4: Applied reference channel depends on the supported operation mode: FDD or HD-FDD | | | |

Table 6.3.1.1.1-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| *g* | 1.3 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.1.1.1.

6.3.1.1.1.4 Test description

6.3.1.1.1.4.1 Initial conditions

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

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

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

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

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

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

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.1.1.1.3\_1 and as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause6.3.1.1.1.4.3.

6.3.1.1.1.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.2.1.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format 0\_1 with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-5 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format 0\_1 with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ g which is specified in table 6.3.1.1.1.5-1, then the test is pass. Otherwise, the test is failed.

6.3.1.1.1.4.3 Message contents

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

6.3.1.1.1.4.3.1 Message exceptions

Table 6.3.1.1.1.4.3.1-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | Aperiodic |  |  |
| } |  |  |  |

Table 6.3.1.1.1.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| Row4 | 001 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 13 |  |  |
| } |  |  |  |

Table 6.3.1.1.1.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| Row5 | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.3.1.1.1.4.3.1-4: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
| periodicityAndOffset | Not present |  |  |

Table 6.3.1.1.1.4.3.1-5: *CSI-ResourcePeriodicityAndOffset*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.2-43 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset CHOICE { |  |  |  |
| Slots5 | 1 |  |  |
| } |  |  |  |

Table 6.3.1.1.1.4.3.1-6: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| moreThanTwo SEQUENCE { |  |  |  |
| n1-n2 CHOICE { |  |  |  |
| two-one-TypeI-SinglePanel-Restriction | 11111111 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 00000001 |  |  |

Table 6.3.1.1.1.4.3.1-7: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 0 |  |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | [1111111] |  |  |
| } |  |  |  |
| } |  |  |  |
| subbandSize | 8 |  |  |
| } |  |  |  |

6.3.1.1.1.5 Test requirement

Table 6.3.1.1.1.5-1: Test requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| *g* | 1.29 |

#### 6.3.1.2 TDD

##### 6.3.1.2.1 1Rx TDD Single PMI with 4TX TypeI-SinglePanel Codebook for RedCap

Editor’s Note: This test case is incomplete in following aspects:

- Connection diagram for TE is TBD.

6.3.1.2.1.1 Test purpose

The purpose of this test is to test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.1.2.1.2 Test applicability

This test applies to all types of NR RedCap UE with 1Rx from Release 17 onwards.

6.3.1.2.1.3 Minimum conformance requirements

For the parameters specified in Table 6.3.1.2.1-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.1.2.1-2.

Table 6.3.1.2.1.3-1: Test parameters (single layer)

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** |
| Bandwidth | | MHz | 20 |
| Subcarrier spacing | | kHz | 30 |
| Duplex Mode | |  | TDD |
| TDD DL-UL configuration | |  | FR1.30-1 as specified in Annex A |
| Propagation channel | |  | TDLA30-5 |
| Antenna configuration | |  | High ULA 4 x 1 |
| Beamforming Model | |  | As specified in 38.101-4 [7] Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 5,(4) |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | (9) |
| CSI-RS  periodicity and offset | slot | 10/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 4, (0) |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | (13) |
| CSI-RS  periodicity and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) |  | (4,9) |
| CSI-IM timeConfig  periodicity and offset | slot | Not configured |
| ReportConfigType | |  | Aperiodic |
| CQI-table | |  | Table 1 |
| reportQuantity | |  | cri-RI-PMI-CQI |
| timeRestrictionForChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | Not configured |
| cqi-FormatIndicator | |  | Wideband |
| pmi-FormatIndicator | |  | Wideband |
| Sub-band Size | | RB | 8 |
| csi-ReportingBand | |  | 1111111 |
| CSI-Report periodicity 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 |
| reportTriggerSize | |  | 1 |
| CSI-AperiodicTriggerStateList | |  | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (2,1) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,1) |
| CodebookSubsetRestriction |  | 11111111 |
| RI Restriction |  | 00000001 |
| Physical channel for CSI report | |  | PUSCH |
| CQI/RI/PMI delay | | ms | 5.5 |
| Maximum number of HARQ transmission | |  | 4 |
| Measurement channel | |  | R.PDSCH.2-8.4 TDD |
| PDSCH & PDSCH DMRS Precoding configuration for random Precoding | |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity |
| 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-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 38.101-4 [7] Annex B.2.3.2.3. | | | |

Table 6.3.1.2.1-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| *g* | 1.3 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.1.2.1.

6.3.1.2.1.4 Test description

6.3.1.2.1.4.1 Initial conditions

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

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

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

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

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

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

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.1.2.1.3\_1 and as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause6.3.1.2.1.4.3.

6.3.1.2.1.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.2.1.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format 0\_1 with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-5 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format 0\_1 with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ g which is specified in table 6.3.1.2.1.5-1, then the test is pass. Otherwise, the test is failed.

6.3.1.2.1.4.3 Message contents

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

6.3.1.2.1.4.3.1 Message exceptions

Table 6.3.1.2.1.4.3.1-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | Aperiodic |  |  |
| } |  |  |  |

Table 6.3.1.2.1.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| Row4 | 001 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 13 |  |  |
| } |  |  |  |

Table 6.3.1.2.1.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| Row5 | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.3.1.2.1.4.3.1-4: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |

Table 6.3.1.2.1.4.3.1-5: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| moreThanTwo SEQUENCE { |  |  |  |
| n1-n2 CHOICE { |  |  |  |
| two-one-TypeI-SinglePanel-Restriction | 11111111 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 00000001 |  |  |

Table 6.3.1.2.1.4.3.1-6: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 0 |  |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | [1111111] |  |  |
| } |  |  |  |
| } |  |  |  |
| subbandSize | 8 |  |  |
| } |  |  |  |

6.3.1.2.1.5 Test requirement

Table 6.3.1.2.1.5-1: Test requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| *g* | 1.29 |

### 6.3.2 2RX requirements

#### 6.3.2.1 FDD

##### 6.3.2.1.1 2Rx FDD FR1 Single PMI with 4TX TypeI-SinglePanel codebook for both SA and NSA

6.3.2.1.1.1 Test purpose

The purpose of this test is to test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.2.1.1.2 Test applicability

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

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

6.3.2.1.1.3 Minimum conformance requirements

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 6.3.2.1.1.3-1: Test parameters (single layer)

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** |
| Bandwidth | | MHz | 10 |
| Subcarrier spacing | | kHz | 15 |
| Duplex Mode | |  | FDD |
| Propagation channel | |  | TDLA30-5 |
| Antenna configuration | |  | High XP 4 x 2  (N1,N2) = (2,1) |
| Beamforming Model | |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (9,-) |
| CSI-RS  interval and offset | slot | 5/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 4, (0,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (13,-) |
| CSI-RS  interval and offset |  | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Patten 0 |
| 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 |
| timeRestrictionForChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | 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 |
| reportTriggerSize | |  | 1 |
| CSI-AperiodicTriggerStateList | |  | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (2,1) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,1) |
| CodebookSubsetRestriction |  | 11111111 |
| RI Restriction |  | 00000001 |
| Physical channel for CSI report | |  | PUSCH |
| CQI/RI/PMI delay | | ms | 6 |
| Maximum number of HARQ transmission | |  | 4 |
| Measurement channel | |  | R.PDSCH.1-6.1 FDD |
| PDSCH & PDSCH DMRS Precoding configuration for random Precoding | |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity |
| Note 1: For random precoder selection, the precoder shall be updated in each slot (1 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-3), this reported PMI cannot be applied at the eNB 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 |
| ** | 1.3 |

6.3.2.1.1.4 Test description

6.3.2.1.1.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.2.1.1.3\_1 and as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause6.3.2.1.1.4.3.

6.3.2.1.1.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.2.1.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-5 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.2.1.1.5-1, then the test is pass. Otherwise, the test is fail.

6.3.2.1.1.4.3 Message contents

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

6.3.2.1.1.4.3.1 Message exceptions for SA

Table 6.3.2.1.1.4.3.1-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | Aperiodic |  |  |
| } |  |  |  |

Table 6.3.2.1.1.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| Row4 | 001 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 13 |  |  |
| } |  |  |  |

Table 6.3.2.1.1.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| Row5 | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.3.2.1.1.4.3.1-4: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
| periodicityAndOffset | CSI-ResourcePeriodicityAndOffset |  |  |

Table 6.3.2.1.1.4.3.1-5: *CSI-ResourcePeriodicityAndOffset*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.2-43 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset CHOICE { |  |  |  |
| Slots5 | 1 |  |  |
| } |  |  |  |

Table 6.3.2.1.1.4.3.1-6: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| moreThanTwo SEQUENCE { |  |  |  |
| n1-n2 CHOICE { |  |  |  |
| two-one-TypeI-SinglePanel-Restriction | 11111111 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 00000001 |  |  |

Table 6.3.2.1.1.4.3.1-7: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 0 |  |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | [1111111] |  |  |
| } |  |  |  |
| } |  |  |  |
| subbandSize | 8 |  |  |
| } |  |  |  |

6.3.2.1.1.4.3.2 Message exceptions for NSA

Same as in clause 6.3.2.1.1.4.3.1.

6.3.2.1.1.5 Test requirement

Table 6.3.2.1.1.5-1: Test requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 1.29 |

##### 6.3.2.1.2 2Rx FDD FR1 Single PMI with 8TX TypeI-SinglePanel codebook for both SA and NSA

6.3.2.1.2.1 Test purpose

The purpose of this test is to test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.2.1.2.2 Test applicability

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

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

6.3.2.1.2.3 Minimum conformance requirements

For the parameters specified in Table 6.3.2.1.2.3-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.1.2.3-2.

Table 6.3.2.1.2.3-1: 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 8 x 2  (N1,N2) = (4,1) |
| Beamforming Model | |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (9,-) |
| CSI-RS  interval and offset | slot | 5/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 8 |
| CDM Type |  | CDM4 (FD2, TD2) |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 8, (4,6) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (5,-) |
| CSI-RS  interval and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| 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 |
| timeRestrictionForChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | 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 |
| reportTriggerSize | |  | 1 |
| CSI-AperiodicTriggerStateList | |  | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (4,1) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,1) |
| CodebookSubsetRestriction |  | 0x FFFF |
| RI Restriction |  | 00000010 |
| 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 |
| PDSCH & PDSCH DMRS Precoding configuration for random Precoding | |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity |
| Note 1: For random precoder selection, the precoder shall be updated in each slot (1 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 eNB 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 6.3.2.1.2.3-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 1.5 |

6.3.2.1.2.4 Test description

6.3.2.1.2.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.2.1.2.3-1 and as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.2.1.2.4.3.

6.3.2.1.2.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.1.2.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.2.1.2.5-1, then the test is pass. Otherwise, the test is fail.

6.3.2.1.2.4.3 Message contents

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

6.3.2.1.2.4.3.1 Message exceptions for SA

Table 6.3.2.1.2.4.3.1-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | aperiodic |  |  |
| } |  |  |  |

Table 6.3.2.1.2.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 001100 |  |  |
| } |  |  |  |
| nrofPorts | p8 |  |  |
| firstOFDMSymbolInTimeDomain | 5 |  |  |
| cdm-Type | cdm4-FD2-TD2 |  |  |
| } |  |  |  |

Table 6.3.2.1.2.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table5.4.2.0-21 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.3.2.1.2.4.3.1-4: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
|  |  |  |  |

Table 6.3.2.1.2.4.3.1-5: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| moreThanTwo SEQUENCE { |  |  |  |
| n1-n2 CHOICE { |  |  |  |
| four-one-TypeI-SinglePanel-Restriction | FFFF |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 00000010 |  |  |

Table 6.3.2.1.2.4.3.1-6: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 5 |  |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |
|  |  |  |  |
| } |  |  |  |

6.3.2.1.2.4.3.2 Message exceptions for NSA

Same as in clause 6.3.2.1.2.4.3.1.6.3.2.1.2.5 Test requirement

Table 6.3.2.1.2.5-1: Test requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 1.49 |

##### 6.3.2.1.3 2Rx FDD FR1 Multiple PMI with 16Tx Type I – SinglePanel Codebook for both SA and NSA

6.3.2.1.3.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.2.1.3.2 Test applicability

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

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

6.3.2.1.3.3 Minimum conformance requirements

For the parameters specified in Table 6.3.2.1.3.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.1.3.3-2.

Table 6.3.2.1.3.3-1: Test parameters (dual-layer)

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Bandwidth | | MHz | 10 |
| Subcarrier spacing | | kHz | 15 |
| Duplex Mode | |  | FDD |
| Propagation channel | |  | TDLC300-5 |
| Antenna configuration | |  | High XP 16 x 2  (N1,N2) = (4,2) |
| Beamforming Model | |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, 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 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 16 |
| CDM Type |  | CDM4 (FD2, TD2) |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1, k2, k3) |  | Row 12, (2, 4, 6, 8) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (5, -) |
| CSI-RS  interval and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| 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 |
| timeRestrictionForChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | 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 | |  | 5 |
| CSI request | |  | 1 in slots i, where mod(i, 5) = 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 configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (4,2) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,4) |
| CodebookSubsetRestriction |  | 0x FFFF |
| RI Restriction |  | 00000010 |
| 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 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-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 6.3.2.1.3.3-2: Minimum requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 2.5 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.2.1.3.

6.3.2.1.3.4 Test description

6.3.2.1.3.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.10 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.2.1.3.3-1 and as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.2.1.3.4.3.

6.3.2.1.3.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.1.3.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.2.1.3.5-1, then the test is pass. Otherwise, the test is fail.

6.3.2.1.3.4.3 Message contents

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

6.3.2.1.3.4.3.1 Message exceptions for SA

Table 6.3.2.1.3.4.3.1-1: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 011110 |  |  |
| } |  |  |  |
| nrofPorts | P16 |  |  |
| firstOFDMSymbolInTimeDomain | 5 |  |  |
| cdm-Type | cdm4-FD2-TD2 |  |  |
| } |  |  |  |

Table 6.3.2.1.3.4.3.1-2: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-14 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| moreThanTwo SEQUENCE { |  |  |  |
| n1-n2 CHOICE { |  |  |  |
| four-two-TypeI-SinglePanel-Restriction | FFFF FFFF FFFF FFFF |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 00000010 |  |  |

Table 6.3.2.1.3.4.3.1-3: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 5 |  |  |
| } |  |  |  |
|  |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| pmi-FormatIndicator | subbandPMI |  |  |
| } |  |  |  |
|  |  |  |  |
| } |  |  |  |

6.3.2.1.3.4.3.2 Message exceptions for NSA

Same as in clause 6.3.2.1.3.4.3.1.

6.3.2.1.3.5 Test requirement

Table 6.3.2.1.3.5-1: Test requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 2.49 |

##### 6.3.2.1.4 2Rx FDD FR1 Single PMI with 32Tx Type1 - SinglePanel codebook for both SA and NSA

6.3.2.1.4.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.2.1.4.2 Test applicability

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

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

6.3.2.1.4.3 Minimum conformance requirements

For the parameters specified in Table 6.3.2.1.4.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.1.4.3-2.

Table 6.3.2.1.4.3-1: 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 Model | |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, 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 |
| 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 (k0, k1, k2, k3) |  | Row 17, (2, 4, 6, 8) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (5, 12) |
| CSI-RS  interval and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| 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 |
| timeRestrictionForChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | 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 |
| reportTriggerSize | |  | 1 |
| CSI-AperiodicTriggerStateList | |  | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (4,4) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,4) |
| CodebookSubsetRestriction |  | 0x FFFF |
| RI Restriction |  | 00000010 |
| 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 FDD |
| PDSCH & PDSCH DMRS Precoding configuration for random Precoding | |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity |
| 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 6.3.2.1.4.3-2: Minimum requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 5.0 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.2.1.4.

6.3.2.1.4.4 Test description

6.3.2.1.4.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.10 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.2.1.4.3-1 and as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.2.1.4.4.3.

6.3.2.1.4.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.1.4.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.2.1.4.5-1, then the test is pass. Otherwise, the test is fail.

6.3.2.1.4.4.3 Message contents

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

6.3.2.1.4.4.3.1 Message exceptions for SA

Table 6.3.2.1.4.4.3.1-1: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 011110 |  |  |
| } |  |  |  |
| nrofPorts | P32 |  |  |
| firstOFDMSymbolInTimeDomain | 5 |  |  |
| cdm-Type | cdm4-FD2-TD2 |  |  |
| } |  |  |  |

Table 6.3.2.1.4.4.3.1-2: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-14 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| moreThanTwo SEQUENCE { |  |  |  |
| n1-n2 CHOICE { |  |  |  |
| four-four-TypeI-SinglePanel-Restriction | FFFF FFFF FFFF FFFF  FFFF FFFF FFFF FFFF  FFFF FFFF FFFF FFFF  FFFF FFFF FFFF FFFF |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 00000010 |  |  |

Table 6.3.2.1.4.4.3.1-3: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 5 |  |  |
| } |  |  |  |
| } |  |  |  |

6.3.2.1.4.4.3.2 Message exceptions for NSA

Same as in clause 6.3.2.1.4.4.3.1.

6.3.2.1.4.5 Test requirement

Table 6.3.2.1.4.5-1: Test requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 4.99 |

##### 6.3.2.1.5 2Rx FDD FR1 Multiple PMI with 16Tx TypeII codebook for both SA and NSA

6.3.2.1.5.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.2.1.5.2 Test applicability

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

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

6.3.2.1.5.3 Minimum conformance requirements

For the parameters specified in Table 6.3.2.1.5.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.1.5.3-2.

Table 6.3.2.1.5.3-1: 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 2  (N1,N2) = (4,2) |
| Beamforming Model | |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, 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 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 16 |
| CDM Type |  | CDM4 (FD2, TD2) |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1, k2, k3) |  | Row 12, (2, 4, 6, 8) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (5, -) |
| CSI-RS  interval and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| 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 |
| timeRestrictionForChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | 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 | |  | 5 |
| CSI request | |  | 1 in slots i, where mod(i, 5) = 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 configuration | Codebook Type |  | typeII |
| L (*numberOfBeams*) |  | 2 |
| NPSK (*phaseAlphabetSize*) |  | 8 |
| *subbandAmplitude* |  | True |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (4,2) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,4) |
| CodebookSubsetRestriction |  | 0x 7FF  FFFF 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 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. The random precoder generation shall follow 'typeI-SinglePanel' codebook configuration as specified in table 6.3.2.1.3.3-1.  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 6.3.2.1.5.3-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 1.9 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.2.1.5.

6.3.2.1.5.4 Test description

6.3.2.1.5.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.10 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.2.1.5.3-1 and as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.2.1.4.4.3.

6.3.2.1.5.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.1.5.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities, and the random precoder generation shall follow the codebook configuration as specified in Table 6.3.2.1.3.3-1. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.2.1.5.5-1, then the test is pass. Otherwise, the test is fail.

6.3.2.1.5.4.3 Message contents

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

6.3.2.1.5.4.3.1 Message exceptions for SA

Table 6.3.2.1.5.4.3.1-1: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | ‘011110’B |  |  |
| } |  |  |  |
| nrofPorts | P16 |  |  |
| firstOFDMSymbolInTimeDomain | 5 |  |  |
| cdm-Type | cdm4-FD2-TD2 |  |  |
| } |  |  |  |

Table 6.3.2.1.5.4.3.1-2: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-14 | | | |
| Information Element | Value/remark | Comment | Condition |
| CodebookConfig ::= SEQUENCE { |  |  |  |
| codebookType CHOICE { |  |  |  |
| type2 SEQUENCE { |  |  |  |
| subType CHOICE { |  |  |  |
| typeII SEQUENCE { |  |  |  |
| n1-n2-codebookSubsetRestriction CHOICE { |  |  |  |
| four-two | 0x 7FF FFFF  FFFF FFFF FFFF |  |  |
| } |  |  |  |
| typeII-RI-Restriction | ‘10’B |  |  |
| } |  |  |  |
| } |  |  |  |
| phaseAlphabetSize | 8 |  |  |
| subbandAmplitude | TRUE |  |  |
| numberOfBeams | 2 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.3.2.1.5.4.3.1-3: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 5 |  |  |
| } |  |  |  |
|  |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| pmi-FormatIndicator | subbandPMI |  |  |
| } |  |  |  |
| } |  |  |  |

6.3.2.1.5.4.3.2 Message exceptions for NSA

Same as in clause 6.3.2.1.5.4.3.1.

6.3.2.1.5.5 Test requirement

Table 6.3.2.1.5.5-1: Test requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 1.89 |

##### 6.3.2.1.6 2Rx FDD FR1 Multiple PMI with 16Tx Enhanced TypeII codebook for both SA and NSA

6.3.2.1.6.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.2.1.6.2 Test applicability

This test applies to all types of NR UE release 16 and forward supporting Enhanced Type II codebook with at least 16 ports per CSI-RS resource.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and Enhanced Type II codebook with at least 16 ports per CSI-RS resource.

6.3.2.1.6.3 Minimum conformance requirements

For the parameters specified in Table 6.3.2.1.6.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.1.6.3-2.

Table 6.3.2.1.6.3-1: 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 2  (N1,N2) = (4,2) |
| Beamforming Model | |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, 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 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 16 |
| CDM Type |  | CDM4 (FD2, TD2) |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1, k2, k3) |  | Row 12, (2, 4, 6, 8) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (5, -) |
| CSI-RS  interval and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| 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 |
| timeRestrictionForChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | Not configured |
| cqi-FormatIndicator | |  | Wideband |
| pmi-FormatIndicator | |  | Not configured |
| Sub-band Size | | RB | 4 |
| 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 |
| reportTriggerSize | |  | 1 |
| CSI-AperiodicTriggerStateList | |  | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM |
| Codebook configuration | Codebook Type |  | typeII-r16 |
| *paramCombination-r16* |  | 6  (L =4, *pν* =1/2, β=1/2 ) |
| R*(numberOfPMISubbandsPerCQISubband-r16)* |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (4,2) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,4) |
| CodebookSubsetRestriction |  | 0x 7FF  FFFF 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 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 probability of each applicable i1, i2 combination. The random precoder generation shall follow 'typeI-SinglePanel' codebook configuration as specified in table 6.3.2.1.3.3-1.  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 6.3.2.1.6.3-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 2.2 |

The normative reference for this requirement is TS 38.101-4 [5], clause 6.3.2.1.6.

6.3.2.1.6.4 Test description

6.3.2.1.6.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.10 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.2.1.6.3-1 as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.2.1.6.4.3.

6.3.2.1.6.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.1.6.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format 0\_1 with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format 0\_1 with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.2.1.6.5-1, then the test is pass. Otherwise, the test is fail.

6.3.2.1.6.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2.

6.3.2.1.6.4.3.1 Message exceptions for SA

Table 6.3.2.1.6.4.3.1-1: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ReportConfig ::= SEQUENCE { |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| pmi-FormatIndicator | Not present |  |  |
| } |  |  |  |
| codebookConfig | Not present |  |  |
| subbandSize | Value1 |  |  |
| codebookConfig-r16 | CodebookConfig-r16 |  |  |
| } |  |  |  |

Table 6.3.2.1.6.4.3.1-2: *CodebookConfig-r16* (Table 6.3.2.1.6.4.3.1-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.331 [6], clause 6.3.2 | | | |
| Information Element | Value/remark | Comment | Condition |
| CodebookConfig-r16 ::= SEQUENCE { |  |  |  |
| codebookType CHOICE { |  |  |  |
| type2 SEQUENCE { |  |  |  |
| subType CHOICE { |  |  |  |
| typeII-r16 SEQUENCE { |  |  |  |
| N1-n2-codebookSubsetRestriction-r16 |  |  |  |
| Four-two | 0x 7FF  FFFF FFFF FFFF FFFF |  |  |
| } |  |  |  |
| typeII-RI-Restriction-r16 | 0010 |  |  |
| } |  |  |  |
| } |  |  |  |
| numberOfPMI-SubbandsPerCQI-Subband-r16 | 1 |  |  |
| paramCombinatin-r16 | 6 | (L =4, pν =1/2, β=1/2 ) |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

6.3.2.1.6.4.3.2 Message exceptions for NSA

Same as in clause 6.3.2.1.6.4.3.1.

6.3.2.1.6.5 Test requirement

Table 6.3.2.1.6.5-1: Test requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 2.19 |

##### 6.3.2.1.7 2Rx FDD FR1 Single PMI with 8TX TypeI-SinglePanel codebook for both SA and NSA

6.3.2.1.7.1 Test purpose

The purpose of this test is to test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.2.1.7.2 Test applicability

This test applies to all types of NR UE release 17 and forward.

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

6.3.2.1.7.3 Minimum conformance requirements

For the parameters specified in Table 6.3.2.1.2.3-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.1.7.3-2.

Table 6.3.2.1.7-1: Test parameters (dual-layer)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | | Unit | Value | | |
| TRxP #1(Note 1) | | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | | |  | TRxP #1 | | |
| PDCCH configuration | | | TCI state | |  | TCI State #1 | | |
| CORESETPoolIndex | |  | 0 | | |
| CSI-RS for tracking | | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | | |
| Density | |  | 3 | | |
| CSI-RS periodicity | | Slots | 20 | | |
| CSI-RS offset | | Slots | 10 for CSI-RS resources 1 and 2  11 for CSI-RS resources 3 and 4 | | 10 for CSI-RS resources 5 and 6  11 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | | |
| Duplex mode | | | | |  | FDD | | |
| Bandwidth | | | | | MHz | 10 | | |
| Subcarrier spacing | | | | | kHz | 15 | | |
| Active DL BWP index | | | | |  | 1 | | |
| Propagation channel | | | | |  | TDLA30-10 | | |
| Antenna configuration per TRxP | | | | |  | High XP 8 x 2 (N1,N2) = (4,1) | | |
| Beamforming Model | | | | |  | As specified in Annex B.4.1 (Note 4) | | |
| PDSCH configuration | Mapping type | | | |  | Type A | | |
| k0 | | | |  | 0 | | |
| Starting symbol (S) | | | |  | 2 | | |
| Length (L) | | | |  | 12 | | |
| PRB bundling type | | | |  | Static | | |
| PRB bundling size | | | |  | 2 | | |
| Resource allocation type | | | |  | Type 1 | | |
| RBG size | | | |  | Config2 | | |
| VRB-to-PRB mapping type | | | |  | Non-interleaved | | |
| VRB-to-PRB mapping interleaver bundle size | | | |  | N/A | | |
| PDSCH DMRS configuration | Antenna port indexes | | | |  | 1000 | | 1002 |
| TCI state | | | |  | TCI State #1 | | TCI State #2 |
| DMRS Type | | | |  | Type 1 | | |
| Number of additional DMRS | | | |  | 1 | | |
| Maximum number of OFDM symbols for DL front loaded DMRS | | | |  | 1 | | |
| TCI State #1 | Type 1 QCL information | | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | | N/A |
| QCL Type |  | Type A | | N/A |
| Type 2 QCL information | | | CSI-RS resource |  | N/A | | N/A |
| QCL Type |  | N/A | | N/A |
| TCI State #2 | Type 1 QCL information | | | CSI-RS resource |  | N/A | | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | | Type A |
| Type 2 QCL information | | | CSI-RS resource |  | N/A | | N/A |
| QCL Type |  | N/A | | N/A |
| Resource allocation | | | | |  | Full-overlapping | | |
| Timing offset of the second TRxP from the first TRxP | | | | | us | 0 | | |
| Frequency offset of the second TRxP from the first TRxP | | | | | Hz | 0 | | |
| Number of HARQ Processes | | | | |  | 4 | | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | | | |  | 2 | | |
| ZP CSI-RS configuration | | CSI-RS resource Type | | |  | Periodic | | |
| Number of CSI-RS ports (*X*) | | |  | 4 | | |
| CDM Type | | |  | FD-CDM2 | | |
| Density (ρ) | | |  | 1 | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | | |  | Row 5,(4) | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | | |  | (9) | | |
| CSI-RS  periodicity and offset | | | slot | 5/1 | | |
| NZP CSI-RS for CSI acquisition | | CSI-RS resource ID | | |  | Resource #9 | Resource #10 | |
| CSI-RS resource Type | | |  | Aperiodic | Aperiodic | |
| Number of CSI-RS ports (*X*) | | |  | 8 | 8 | |
| CDM Type | | |  | CDM4 (FD2, TD2) | CDM4 (FD2, TD2) | |
| Density (ρ) | | |  | 1 | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | | |  | Row 8, (4,6) | Row 8, (4,6) | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | | |  | (5) | (9) | |
| CSI-RS  periodicity and offset | | | slot | Not configured | Not configured | |
| aperiodicTriggeringOffset | | |  | 0 | 0 | |
| CSI-IM configuration | | CSI-IM resource Type | | |  | Aperiodic | | |
| CSI-IM RE pattern | | |  | Pattern 0 | | |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) | | |  | (4,9) | | |
| CSI-IM timeConfig  periodicity and offset | | | slot | Not configured | | |
| ReportConfigType | | | | |  | Aperiodic | | |
| CQI-table | | | | |  | Table 1 | | |
| reportQuantity | | | | |  | cri-RI-PMI-CQI | | |
| csi-ReportMode | | | | |  | Mode1 | | |
| numberOfSingleTRP-CSI-Mode1 | | | | |  |  | | |
| CMR pairing and grouping | | | | |  | CMR group #1: {NZP CSI-RS resource #9}, with  CMR group #2: {NZP CSI-RS resource #10}, with  CMR paring: {NZP CSI-RS resource #9, NZP CSI-RS resource #10} | | |
| timeRestrictionForChannelMeasurements | | | | |  | Not configured | | |
| timeRestrictionForInterferenceMeasurements | | | | |  | Not configured | | |
| cqi-FormatIndicator | | | | |  | Wideband | | |
| pmi-FormatIndicator | | | | |  | Wideband | | |
| Sub-band Size | | | | | RB | 8 | | |
| csi-ReportingBand | | | | |  | 1111111 | | |
| CSI-Report periodicity 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 | | |
| reportTriggerSize | | | | |  | 1 | | |
| CSI-AperiodicTriggerStateList | | | | |  | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM | | |
| Codebook configuration | | CodebookType | | |  | typeI-SinglePanel | | |
| CodebookMode | | |  | 1 | | |
| (CodebookConfig-N1,CodebookConfig-N2) | | |  | (4,1) | | |
| (CodebookConfig-O1,CodebookConfig-O2) | | |  | (4,1) | | |
| CodebookSubsetRestriction | | |  | 0x FFFF | | |
| RI Restriction | | |  | 00000001 (1 MIMO layer per TRxP) | | |
| Physical channel for CSI report | | | | |  | PUSCH | | |
| CQI/RI/PMI delay | | | | | ms | 8 | | |
| Maximum number of HARQ transmission | | | | |  | 4 | | |
| Measurement channel | | | | |  | R.PDSCH.1-6.4 | | |
| PDSCH & PDSCH DMRS Precoding configuration for random Precoding | | | | |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband 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)  Note 2: 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 3: 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 4: Randomization of the principle beam direction per TRxP shall be used as specified in Annex B.2.3.2.3. | | | | | | | | |

Table 6.3.2.1.7.3-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 1.6 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.2.1.7.

6.3.2.1.7.4 Test description

6.3.2.1.2.7.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.2.1.7.3-1 and as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.2.1.2.7.3.

6.3.2.1.2.7.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.1.7.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.2.1.7.5-1, then the test is pass. Otherwise, the test is fail.

6.3.2.1.7.4.3 Message contents

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

6.3.2.1.7.4.3.1 Message exceptions for SA

Table 6.3.2.1.7.4.3.1-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | aperiodic |  |  |
| } |  |  |  |

Table 6.3.2.1.7.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 001100 |  |  |
| } |  |  |  |
| nrofPorts | p8 |  |  |
| firstOFDMSymbolInTimeDomain | 5,9 |  |  |
| cdm-Type | cdm4-FD2-TD2 |  |  |
| } |  |  |  |

Table 6.3.2.1.7.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table5.4.2.0-21 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.3.2.1.7.4.3.1-4: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
|  |  |  |  |

Table 6.3.2.1.7.4.3.1-5: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| moreThanTwo SEQUENCE { |  |  |  |
| n1-n2 CHOICE { |  |  |  |
| four-one-TypeI-SinglePanel-Restriction | FFFF |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 00000001 |  |  |

Table 6.3.2.1.7.4.3.1-6: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 5 |  |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |
|  |  |  |  |
| } |  |  |  |

Table 6.3.2.1.7.4.3.1-7: Physical layer parameters for DCI format 1\_1

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

Table 6.3.2.1.7.4.3.1-8: *CellGroupConfig*

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

Table 6.3.2.1.7.4.3.1-9: *ControlResourceSet*

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

Table 6.3.2.1.7.4.3.1-10: *PDSCH-Config*

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

Table 6.3.2.1.7.4.3.1-11: *TCI-State*

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

Table 6.3.2.1.7.4.3.1-12: *NZP-CSI-RS-Resource*

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

6.3.2.1.7.4.3.2 Message exceptions for NSA

Same as in clause 6.3.2.1.7.4.3.1.

6.3.2.1.7.5 Test requirement

Table 6.3.2.1.7.5-1: Test requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 1.59 |

#### 6.3.2.2 TDD

##### 6.3.2.2.1 2Rx TDD FR1 Single PMI with 4TX TypeI-SinglePanel codebook for both SA and NSA

6.3.2.2.1.1 Test Purpose

The purpose of this test is to test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.2.2.1.2 Test applicability

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

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

6.3.2.2.1.3 Minimum Conformance Requirements

For the parameters specified in Table 6.3.2.2.1.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.2.1.3-2.

Table 6.3.2.2.1.3-1: Test parameters (single layer)

| Parameter | | Unit | Test 1 |
| --- | --- | --- | --- |
| Bandwidth | | MHz | 40 |
| Subcarrier spacing | | kHz | 30 |
| Duplex Mode | |  | TDD |
| TDD DL-UL configuration | |  | FR1.30-1 as specified in Annex A |
| DL BWP configuration #1 | First PRB |  | 0 |
| Number of contiguous PRB |  | 106 |
| Subcarrier spacing | kHz | 30 |
| Propagation channel | |  | TDLA30-5 |
| Antenna configuration | |  | High XP 4 x 2  (N1,N2) = (2,1) |
| Beamforming Model | |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (9,-) |
| CSI-RS  interval and offset | slot | 10/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 4, (0,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (13,-) |
| CSI-RS  interval and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Patten 0 |
| 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 |
| timeRestrictionForChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | 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 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 configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (2,1) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,1) |
| CodebookSubsetRestriction |  | 11111111 |
| RI Restriction |  | 00000001 |
| 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 |
| PDSCH & PDSCH DMRS Precoding configuration for random Precoding | |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity |
| Note 1: For random precoder selection, the precoder shall be updated in each slot (0.5 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 eNB downlink before slot#[(n+4)].  Note 3: Randomization of the principle beam direction shall be used as specified inAnnex B.2.3.2.3. | | | |

Table 6.3.2.2.1.3-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 1.3 |

6.3.2.2.1.4 Test Description

6.3.2.2.1.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.2.2.1.3-1 as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.2.2.1.4.3.

6.3.2.2.1.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.2.1.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-5 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.2.2.1.5-1, then the test is pass. Otherwise, the test is fail.

6.3.2.2.1.4.3 Message contents

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

6.3.2.2.1.4.3\_1 Message exceptions for SA

Table 6.3.2.2.1.4.3\_1-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | aperiodic |  |  |
| } |  |  |  |

Table 6.3.2.2.1.4.3\_1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause5.4.2, Table 5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| Row4 | 001 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 13 |  |  |
| } |  |  |  |

Table 6.3.2.2.1.4.3\_1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause5.4.2, Table5.4.2.0-21 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.3.2.2.1.4.3\_1-4: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |

Table 6.3.2.2.1.4.3\_1-5: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| moreThanTwo SEQUENCE { |  |  |  |
| n1-n2 CHOICE { |  |  |  |
| two-one-TypeI-SinglePanel-Restriction | 11111111 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 00000001 |  |  |

Table 6.3.2.2.1.4.3\_1-6: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 0 |  |  |
| } |  |  |  |
|  |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |
| subbandSize | value2 |  |  |
| } |  |  |  |

6.3.2.2.1.4.3\_2 Message exceptions for NSA

Same as in clause 6.2.2.1.2.1.4.3\_1.

6.3.2.2.1.5 Test Requirements

Table 6.3.2.2.1.5-1: Test requirement (TDD)

|  |  |
| --- | --- |
| Parameter | Test 1 |
|  | 1.29 |

##### 6.3.2.2.2 2Rx TDD FR1 Single PMI with 8TX TypeI-SinglePanel codebook for both SA and NSA

6.3.2.2.2.1 Test purpose

The purpose of this test is to test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.2.2.2.2 Test applicability

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

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

6.3.2.2.2.3 Minimum conformance requirements

For the parameters specified in Table 6.3.2.2.2.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.2.2.3-2.

Table 6.3.2.2.2.3-1: 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 |
| DL BWP configuration #1 | First PRB |  | 0 |
| Number of contiguous PRB |  | 106 |
| Subcarrier spacing | kHz | 30 |
| Propagation channel | |  | TDLA30-5 |
| Antenna configuration | |  | High XP 8 x 2  (N1,N2) = (4,1) |
| Beamforming Model | |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (9,-) |
| CSI-RS  interval and offset | slot | 10/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 8 |
| CDM Type |  | CDM4 (FD2, TD2) |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 8, (4,6) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (5,-) |
| CSI-RS  interval and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Patten 0 |
| 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 |
| timeRestrictionForIChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | 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 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 configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (4,1) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,1) |
| CodebookSubsetRestriction |  | 0x FFFF |
| RI Restriction |  | 00000010 |
| Physical channel for CSI report | |  | PUSCH |
| CQI/RI/PMI delay | | ms | 6.5 |
| Maximum number of HARQ transmission | |  | 4 |
| Measurement channel | |  | R.PDSCH.2-8.2 TDD |
| PDSCH & PDSCH DMRS Precoding configuration for random Precoding | |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity |
| Note 1: For random precoder selection, the precoder shall be updated in each slot (0.5 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-6)], this reported PMI cannot be applied at the eNB downlink before slot#[(n+6)].  Note 3: Randomization of the principle beam direction shall be used as specified inAnnex B.2.3.2.3. | | | |

Table 6.3.2.2.2.3-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 1.5 |

6.3.2.2.2.4 Test description

6.3.2.2.2.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.2.2.2.3-1 as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.2.2.2.4.3.

6.3.2.2.2.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.2.2.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.2.2.2.5-1, then the test is pass. Otherwise, the test is fail.

6.3.2.2.2.4.3 Message contents

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

6.3.2.2.2.4.3\_1 Message exceptions for SA

Table 6.3.2.2.2.4.3\_1-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | aperiodic |  |  |
| } |  |  |  |

Table 6.3.2.2.2.4.3\_1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 001100 |  |  |
| } |  |  |  |
| nrofPorts | p8 |  |  |
| firstOFDMSymbolInTimeDomain | 5 |  |  |
| cdm-Type | cdm4-FD2-TD2 |  |  |
| } |  |  |  |

Table 6.3.2.2.2.4.3\_1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table5.4.2.0-21 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.3.2.2.2.4.3\_1-4: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
|  |  |  |  |

Table 6.3.2.2.2.4.3\_1-5: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| moreThanTwo SEQUENCE { |  |  |  |
| n1-n2 CHOICE { |  |  |  |
| four-one-TypeI-SinglePanel-Restriction | FFFF |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 00000010 |  |  |

Table 6.3.2.2.2.4.3\_1-6: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 8 |  |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |
|  |  |  |  |
| } |  |  |  |

6.3.2.2.2.4.3\_2 Message exceptions for NSA

Same as in clause 6.3.2.2.2.4.3\_1.

6.3.2.2.2.5 Test requirement

Table 6.3.2.2.2.5-1: Test requirement (TDD)

|  |  |
| --- | --- |
| Parameter | Test 1 |
|  | 1.49 |

##### 6.3.2.2.3 2Rx TDD FR1 Multiple PMI with 16Tx Type1 - SinglePanel codebook for both SA and NSA

6.3.2.2.3.1 Test purpose

The purpose of this test is to test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.2.2.3.2 Test applicability

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

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

6.3.2.2.3.3 Minimum conformance requirements

For the parameters specified in Table 6.3.2.2.3.3-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.2.3.3-2.

Table 6.3.2.2.3.3-1: 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 channel | |  | TDLC300-5 |
| Antenna configuration | |  | High XP 16 x 2  (N1,N2) = (4,2) |
| Beamforming Model | |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (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*) |  | 16 |
| CDM Type |  | CDM4 (FD2, TD2) |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1, k2, k3) |  | Row 12, (2, 4, 6, 8) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (5, -) |
| CSI-RS  interval and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| 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 |
| timeRestrictionForIChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | 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 |
| reportTriggerSize | |  | 1 |
| CSI-AperiodicTriggerStateList | |  | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (4,2) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,4) |
| CodebookSubsetRestriction |  | 0x FFFF |
| RI Restriction |  | 00000010 |
| Physical channel 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 |
| 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 6.3.2.2.3.3-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 2.5 |

The normative reference for this requirement is TS 38.101-4 [5], clause 6.3.2.2.3.

6.3.2.2.3.4 Test description

6.3.2.2.3.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.10 for TE diagram and section A.3.2.3 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.2.2.3.3-1 as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.2.2.3.4.3.

6.3.2.2.3.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.2.3.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.2.2.3.5-1, then the test is pass. Otherwise, the test is fail.

6.3.2.2.3.4.3 Message contents

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

6.3.2.2.3.4.3\_1 Message exceptions for SA

Table 6.3.2.2.3.4.3\_1-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | aperiodic |  |  |
| } |  |  |  |

Table 6.3.2.2.3.4.3\_1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table 5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 011110 |  |  |
| } |  |  |  |
| nrofPorts | p16 |  |  |
| firstOFDMSymbolInTimeDomain | 5 |  |  |
| cdm-Type | cdm4-FD2-TD2 |  |  |
| } |  |  |  |

Table 6.3.2.2.3.4.3\_1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table 5.4.2.0-21 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.3.2.2.3.4.3\_1-4: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
|  |  |  |  |

Table 6.3.2.2.3.4.3\_1-5: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| moreThanTwo SEQUENCE { |  |  |  |
| n1-n2 CHOICE { |  |  |  |
| four-one-TypeI-SinglePanel-Restriction | FFFF |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 00000010 |  |  |

Table 6.3.2.2.3.4.3\_1-6: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 8 |  |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |
|  |  |  |  |
| } |  |  |  |

6.3.2.2.3.4.3\_2 Message exceptions for NSA

Same as in clause 6.3.2.2.3.4.3\_1.

6.3.2.2.3.5 Test requirement

Table 6.3.2.2.3.5-1: Test requirement (TDD)

|  |  |
| --- | --- |
| Parameter | Test 1 |
|  | 2.49 |

##### 6.3.2.2.4 2Rx TDD FR1 Single PMI with 32Tx Type1 - SinglePanel codebook for both SA and NSA

6.3.2.2.4.1 Test purpose

The purpose of this test is to test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.2.2.4.2 Test applicability

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

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

6.3.2.2.4.3 Minimum conformance requirements

For the parameters specified in Table 6.3.2.2.4.3-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.2.4.3-2.

Table 6.3.2.2.4.3-1: 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 channel | |  | TDLA30-5 |
| Antenna configuration | |  | High XP 32 x 2  (N1,N2) = (4,4) |
| Beamforming Model | |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (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 (k0, k1, k2, k3) |  | Row 17, (2, 4, 6, 8) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (5, 12) |
| CSI-RS  interval and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| 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 |
| timeRestrictionForIChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | 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 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 configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (4,4) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,4) |
| CodebookSubsetRestriction |  | 0x FFFF |
| RI Restriction |  | 00000010 |
| Physical channel 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 |
| PDSCH & PDSCH DMRS Precoding configuration for random Precoding | |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity |
| 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 6.3.2.2.4.3-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 5.0 |

The normative reference for this requirement is TS 38.101-4 [5], clause 6.3.2.2.4.

6.3.2.2.4.4 Test description

6.3.2.2.4.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.10TBD for TE diagram and section A.3.2.3 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.2.2.4.3-1 as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.2.2.4.4.3.

6.3.2.2.4.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.2.4.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.2.2.4.5-1, then the test is pass. Otherwise, the test is fail.

6.3.2.2.4.4.3 Message contents

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

6.3.2.2.4.4.3\_1 Message exceptions for SA

Table 6.3.2.2.4.4.3\_1-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | aperiodic |  |  |
| } |  |  |  |

Table 6.3.2.2.4.4.3\_1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table 5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 011110 |  |  |
| } |  |  |  |
| nrofPorts | p32 |  |  |
| firstOFDMSymbolInTimeDomain | 5 |  |  |
| cdm-Type | cdm4-FD2-TD2 |  |  |
| } |  |  |  |

Table 6.3.2.2.4.4.3\_1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table 5.4.2.0-21 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.3.2.2.4.4.3\_1-4: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
|  |  |  |  |

Table 6.3.2.2.4.4.3\_1-5: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| moreThanTwo SEQUENCE { |  |  |  |
| n1-n2 CHOICE { |  |  |  |
| four-one-TypeI-SinglePanel-Restriction | FFFF |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 00000010 |  |  |

Table 6.3.2.2.4.4.3\_1-6: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 8 |  |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |
|  |  |  |  |
| } |  |  |  |

6.3.2.2.4.4.3\_2 Message exceptions for NSA

Same as in clause 6.3.2.2.4.4.3\_1.

6.3.2.2.4.5 Test requirement

Table 6.3.2.2.4.5-1: Test requirement (TDD)

|  |  |
| --- | --- |
| Parameter | Test 1 |
|  | 4.99 |

##### 6.3.2.2.5 2Rx TDD FR1 Multiple PMI with 16Tx TypeII codebook for both SA and NSA

6.3.2.2.5.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.2.2.5.2 Test applicability

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

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

6.3.2.2.5.3 Minimum conformance requirements

For the parameters specified in Table 6.3.2.2.5.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.2.5.3-2.

Table 6.3.2.2.5.3-1: 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 channel | |  | TDLA30-5 |
| Antenna configuration | |  | XP Medium 16 x 2  (N1,N2) = (4,2) |
| Beamforming Model | |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (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*) |  | 16 |
| CDM Type |  | CDM4 (FD2, TD2) |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1, k2, k3) |  | Row 12, (2, 4, 6, 8) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (5, -) |
| CSI-RS  interval and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| 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 |
| timeRestrictionForIChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | 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 |
| reportTriggerSize | |  | 1 |
| CSI-AperiodicTriggerStateList | |  | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM |
| Codebook configuration | Codebook Type |  | typeII |
| L (*numberOfBeams*) |  | 2 |
| NPSK (*phaseAlphabetSize*) |  | 8 |
| *subbandAmplitude* |  | True |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (4,2) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,4) |
| CodebookSubsetRestriction |  | 0x 7FF  FFFF FFFF FFFF FFFF |
| RI Restriction (typeII-RI-Restriction) |  | 10 |
| Physical channel 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 |
| 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. The random precoder 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 6.3.2.2.5.3-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 1.9 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.2.2.5.

6.3.2.2.5.4 Test description

6.3.2.2.5.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.10 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.2.2.5.3-1 and as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.2.1.4.4.3.

6.3.2.2.5.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.2.5.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities, and the random precoder generation shall follow the codebook configuration as specified in Table 6.3.2.2.3.3-1. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.2.2.5.5-1, then the test is pass. Otherwise, the test is fail.

6.3.2.2.5.4.3 Message contents

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

6.3.2.2.5.4.3.1 Message exceptions for SA

Table 6.3.2.2.5.4.3.1-1: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | ‘011110’B |  |  |
| } |  |  |  |
| nrofPorts | P16 |  |  |
| firstOFDMSymbolInTimeDomain | 5 |  |  |
| cdm-Type | cdm4-FD2-TD2 |  |  |
| } |  |  |  |

Table 6.3.2.2.5.4.3.1-2: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-14 | | | |
| Information Element | Value/remark | Comment | Condition |
| CodebookConfig ::= SEQUENCE { |  |  |  |
| codebookType CHOICE { |  |  |  |
| type2 SEQUENCE { |  |  |  |
| subType CHOICE { |  |  |  |
| typeII SEQUENCE { |  |  |  |
| n1-n2-codebookSubsetRestriction CHOICE { |  |  |  |
| four-two | 0x 7FF FFFF  FFFF FFFF FFFF |  |  |
| } |  |  |  |
| typeII-RI-Restriction | ‘10’B |  |  |
| } |  |  |  |
| } |  |  |  |
| phaseAlphabetSize | 8 |  |  |
| subbandAmplitude | TRUE |  |  |
| numberOfBeams | 2 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.3.2.2.5.4.3.1-3: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 5 |  |  |
| } |  |  |  |
|  |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| pmi-FormatIndicator | subbandPMI |  |  |
| } |  |  |  |
| } |  |  |  |

6.3.2.2.5.4.3.2 Message exceptions for NSA

Same as in clause 6.3.2.2.5.4.3.1.

6.3.2.2.5.5 Test requirement

Table 6.3.2.2.5.5-1: Test requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 1.89 |

##### 6.3.2.2.6 2Rx TDD FR1 Multiple PMI with 16Tx Enhanced TypeII codebook for both SA and NSA

6.3.2.2.6.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.2.2.6.2 Test applicability

This test applies to all types of NR UE release 16 and forward supporting Enhanced Type II codebook with at least 16 ports per CSI-RS resource.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and Enhanced Type II codebook with at least 16 ports per CSI-RS resource.

6.3.2.2.6.3 Minimum conformance requirements

For the parameters specified in Table 6.3.2.2.6.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.2.6.3-2.

Table 6.3.2.2.6.3-1: 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 channel | |  | TDLA30-5 |
| Antenna configuration | |  | XP Medium 16 x 2  (N1,N2) = (4,2) |
| Beamforming Model | |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (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*) |  | 16 |
| CDM Type |  | CDM4 (FD2, TD2) |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1, k2, k3) |  | Row 12, (2, 4, 6, 8) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (5, -) |
| CSI-RS  interval and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| 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 |
| timeRestrictionForIChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | Not configured |
| cqi-FormatIndicator | |  | Wideband |
| pmi-FormatIndicator | |  | Not configured |
| 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 |
| reportTriggerSize | |  | 1 |
| CSI-AperiodicTriggerStateList | |  | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM |
| Codebook configuration | Codebook Type |  | typeII-r16 |
| *paramCombination-r16* |  | 6  (L =4, *pν* =1/2, β=1/2 ) |
| R*(numberOfPMISubbandsPerCQISubband-r16)* |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (4,2) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,4) |
| CodebookSubsetRestriction |  | 0x 7FF  FFFF FFFF FFFF FFFF |
| RI Restriction (typeII-RI-Restriction-r16) |  | 0010 |
| Physical channel 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 |
| 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. The random precoder 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 6.3.2.2.6.3-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 2.2 |

The normative reference for this requirement is TS 38.101-4 [5], clause 6.3.2.2.6.

6.3.2.2.6.4 Test description

6.3.2.2.6.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.10 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.2.2.6.3-1 as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.2.2.6.4.3.

6.3.2.2.6.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.2.6.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format 0\_1 with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format 0\_1 with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.2.2.6.5-1, then the test is pass. Otherwise, the test is fail.

6.3.2.2.6.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2.

6.3.2.2.6.4.3.1 Message exceptions for SA

Table 6.3.2.2.6.4.3.1-1: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ReportConfig ::= SEQUENCE { |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| pmi-FormatIndicator | Not present |  |  |
| } |  |  |  |
| codebookConfig | Not present |  |  |
| subbandSize | Value1 |  |  |
| codebookConfig-r16 | CodebookConfig-r16 |  |  |
| } |  |  |  |

Table 6.3.2.2.6.4.3.1-2: *CodebookConfig-r16* (Table 6.3.2.2.6.4.3.1-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.331 [6], clause 6.3.2 | | | |
| Information Element | Value/remark | Comment | Condition |
| CodebookConfig-r16 ::= SEQUENCE { |  |  |  |
| codebookType CHOICE { |  |  |  |
| type2 SEQUENCE { |  |  |  |
| subType CHOICE { |  |  |  |
| typeII-r16 SEQUENCE { |  |  |  |
| N1-n2-codebookSubsetRestriction-r16 |  |  |  |
| Four-two | 0x 7FF  FFFF FFFF FFFF FFFF |  |  |
| } |  |  |  |
| typeII-RI-Restriction-r16 | 0010 |  |  |
| } |  |  |  |
| } |  |  |  |
| numberOfPMI-SubbandsPerCQI-Subband-r16 | 1 |  |  |
| paramCombinatin-r16 | 6 | (L =4, pν =1/2, β=1/2 ) |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

6.3.2.2.6.4.3.2 Message exceptions for NSA

Same as in clause 6.3.2.2.6.4.3.1.

6.3.2.2.6.5 Test requirement

Table 6.3.2.2.6.5-1: Test requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 2.19 |

##### 6.3.2.2.7 2Rx TDD Single PMI with 4TX TypeI-SinglePanel Codebook for RedCap

6.3.2.2.7.1 Test Purpose

The purpose of this test is to test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.2.2.7.2 Test applicability

This test applies to all types of NR RedCap UE with 2Rx from Release 17 onwards.

6.3.2.2.7.3 Minimum Conformance Requirements

For the parameters specified in Table 6.3.2.2.7.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.2.7.3-2.

Table 6.3.2.2.7.3-1: Test parameters (single layer)

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** |
| Bandwidth | | MHz | 20 |
| Subcarrier spacing | | kHz | 30 |
| Duplex Mode | |  | TDD |
| TDD DL-UL configuration | |  | FR1.30-1 as specified in Annex A |
| Propagation channel | |  | TDLA30-5 |
| Antenna configuration | |  | High XP 4 x 2  (N1,N2) = (2,1) |
| Beamforming Model | |  | As specified in 38.101-4 [5] Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 5,(4) |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | (9) |
| CSI-RS  periodicity and offset | slot | 10/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 4, (0) |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | (13) |
| CSI-RS  periodicity and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) |  | (4,9) |
| CSI-IM timeConfig  periodicity and offset | slot | Not configured |
| ReportConfigType | |  | Aperiodic |
| CQI-table | |  | Table 1 |
| reportQuantity | |  | cri-RI-PMI-CQI |
| timeRestrictionForChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | Not configured |
| cqi-FormatIndicator | |  | Wideband |
| pmi-FormatIndicator | |  | Wideband |
| Sub-band Size | | RB | 8 |
| csi-ReportingBand | |  | 1111111 |
| CSI-Report periodicity 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 |
| reportTriggerSize | |  | 1 |
| CSI-AperiodicTriggerStateList | |  | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (2,1) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,1) |
| CodebookSubsetRestriction |  | 11111111 |
| RI Restriction |  | 00000001 |
| Physical channel for CSI report | |  | PUSCH |
| CQI/RI/PMI delay | | ms | 5.5 |
| Maximum number of HARQ transmission | |  | 4 |
| Measurement channel | |  | R.PDSCH.2-8.4 TDD |
| PDSCH & PDSCH DMRS Precoding configuration for random Precoding | |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity |
| 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-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 38.101-4 [5] Annex B.2.3.2.3. | | | |

Table 6.3.2.2.7.3-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 1.3 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.2.2.7.

6.3.2.2.7.4 Test Description

6.3.2.2.7.4.1 Initial conditions

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.8 for TE diagram and section A.3.2.3 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.2.2.7.3-1 as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, connected without release *On* according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.2.2.7.4.3.

6.3.2.2.7.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.2.7.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format 0\_1 with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-5 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.2.2.7.5-1, then the test is pass. Otherwise, the test is fail.

6.3.2.2.7.4.3 Message contents

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

6.3.2.2.7.4.3.1 Message exceptions

Table 6.3.2.2.7.4.3.1-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | aperiodic |  |  |
| } |  |  |  |

Table 6.3.2.2.7.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| Row4 | 001 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 13 |  |  |
| } |  |  |  |

Table 6.3.2.2.7.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-21 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.3.2.2.7.4.3.1-4: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |

Table 6.3.2.2.7.4.3.1-5: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| moreThanTwo SEQUENCE { |  |  |  |
| n1-n2 CHOICE { |  |  |  |
| two-one-TypeI-SinglePanel-Restriction | 11111111 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 00000001 |  |  |

Table 6.3.2.2.7.4.3.1-6: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 0 |  |  |
| } |  |  |  |
|  |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |
| subbandSize | value2 |  |  |
| } |  |  |  |

6.3.2.2.7.5 Test Requirements

Table 6.3.2.2.7.5-1: Test requirement (TDD)

|  |  |
| --- | --- |
| Parameter | Test 1 |
|  | 1.29 |

##### 6.3.2.2.8 Single PMI with 8 ports TypeI-SinglePanel Codebook for Single-DCI based transmission scheme

6.3.2.2.8.1 Test purpose

The purpose of this test is to test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.2.2.8.2 Test applicability

This test applies to all types of NR UE release 17 and forward.

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

6.3.2.2.8.3 Minimum conformance requirements

For the parameters specified in Table 6.3.2.2.8.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.2.8.3-2.

Table 6.3.2.2.8.3-1: Test parameters (dual-layer)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | | Unit | Value | | |
| TRxP #1(Note 1) | | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | | |  | TRxP #1 | | |
| PDCCH configuration | | | TCI state | |  | TCI State #1 | | |
| CORESETPoolIndex | |  | 0 | | |
| CSI-RS for tracking | | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | | |
| Density | |  | 3 | | |
| CSI-RS periodicity | | Slots | 40 | | |
| CSI-RS offset | | Slots | 20 for CSI-RS resources 1 and 2  21 for CSI-RS resources 3 and 4 | | 20 for CSI-RS resources 5 and 6  21 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | | |
| Duplex mode | | | | |  | TDD | | |
| Bandwidth | | | | | MHz | 40 | | |
| Subcarrier spacing | | | | | kHz | 30 | | |
| TDD DL-UL configurations | | | | |  | FR1.30-1 as specified in Annex A | | |
| Active DL BWP index | | | | |  | 1 | | |
| Propagation channel | | | | |  | TDLA30-10 | | |
| Antenna configuration per TRxP | | | | |  | High XP 8 x 2 (N1,N2) = (4,1) | | |
| Beamforming Model | | | | |  | As specified in Annex B.4.1 (Note 4) | | |
| PDSCH configuration | Mapping type | | | |  | Type A | | |
| k0 | | | |  | 0 | | |
| Starting symbol (S) | | | |  | 2 | | |
| Length (L) | | | |  | 12 | | |
| PRB bundling type | | | |  | Static | | |
| PRB bundling size | | | |  | 2 | | |
| Resource allocation type | | | |  | Type 1 | | |
| RBG size | | | |  | Config2 | | |
| VRB-to-PRB mapping type | | | |  | Non-interleaved | | |
| VRB-to-PRB mapping interleaver bundle size | | | |  | N/A | | |
| PDSCH DMRS configuration | Antenna port indexes | | | |  | 1000 | | 1002 |
| TCI state | | | |  | TCI State #1 | | TCI State #2 |
| DMRS Type | | | |  | Type 1 | | |
| Number of additional DMRS | | | |  | 1 | | |
| Maximum number of OFDM symbols for DL front loaded DMRS | | | |  | 1 | | |
| TCI State #1 | Type 1 QCL information | | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | | N/A |
| QCL Type |  | Type A | | N/A |
| Type 2 QCL information | | | CSI-RS resource |  | N/A | | N/A |
| QCL Type |  | N/A | | N/A |
| TCI State #2 | Type 1 QCL information | | | CSI-RS resource |  | N/A | | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | | Type A |
| Type 2 QCL information | | | CSI-RS resource |  | N/A | | N/A |
| QCL Type |  | N/A | | N/A |
| Resource allocation | | | | |  | Full-overlapping | | |
| Timing offset of the second TRxP from the first TRxP | | | | | us | 0 | | |
| Frequency offset of the second TRxP from the first TRxP | | | | | Hz | 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 | | |
| ZP CSI-RS configuration | | CSI-RS resource Type | | |  | Periodic | | |
| Number of CSI-RS ports (*X*) | | |  | 4 | | |
| CDM Type | | |  | FD-CDM2 | | |
| Density (ρ) | | |  | 1 | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | | |  | Row 5,(4) | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | | |  | (9) | | |
| CSI-RS  periodicity and offset | | | slot | 10/1 | | |
| NZP CSI-RS for CSI acquisition | | CSI-RS resource ID | | |  | Resource #9 | Resource #10 | |
| CSI-RS resource Type | | |  | Aperiodic | Aperiodic | |
| Number of CSI-RS ports (*X*) | | |  | 8 | 8 | |
| CDM Type | | |  | CDM4 (FD2, TD2) | CDM4 (FD2, TD2) | |
| Density (ρ) | | |  | 1 | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | | |  | Row 8, (4,6) | Row 8, (4,6) | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | | |  | (5) | (9) | |
| CSI-RS  periodicity and offset | | | slot | Not configured | Not configured | |
| aperiodicTriggeringOffset | | |  | 0 | 0 | |
| CSI-IM configuration | | CSI-IM resource Type | | |  | Aperiodic | | |
| CSI-IM RE pattern | | |  | Pattern 0 | | |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) | | |  | (4,9) | | |
| CSI-IM timeConfig  periodicity and offset | | | slot | Not configured | | |
| ReportConfigType | | | | |  | Aperiodic | | |
| CQI-table | | | | |  | Table 1 | | |
| reportQuantity | | | | |  | cri-RI-PMI-CQI | | |
| csi-ReportMode | | | | |  | Mode1 | | |
| numberOfSingleTRP-CSI-Mode1 | | | | |  |  | | |
| CMR pairing and grouping | | | | |  | CMR group #1: {NZP CSI-RS resource #9}, with  CMR group #2: {NZP CSI-RS resource #10}, with  CMR paring: {NZP CSI-RS resource #9, NZP CSI-RS resource #10} | | |
| timeRestrictionForChannelMeasurements | | | | |  | Not configured | | |
| timeRestrictionForInterferenceMeasurements | | | | |  | Not configured | | |
| cqi-FormatIndicator | | | | |  | Wideband | | |
| pmi-FormatIndicator | | | | |  | Wideband | | |
| Sub-band Size | | | | | RB | 8 | | |
| csi-ReportingBand | | | | |  | 1111111 | | |
| CSI-Report periodicity and offset | | | | | slot | Not configured | | |
| Aperiodic Report Slot Offset | | | | |  | 5 | | |
| 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 configuration | | CodebookType | | |  | typeI-SinglePanel | | |
| CodebookMode | | |  | 1 | | |
| (CodebookConfig-N1,CodebookConfig-N2) | | |  | (4,1) | | |
| (CodebookConfig-O1,CodebookConfig-O2) | | |  | (4,1) | | |
| CodebookSubsetRestriction | | |  | 0x FFFF | | |
| RI Restriction | | |  | 00000001 (1 MIMO layer per TRxP) | | |
| Physical channel for CSI report | | | | |  | PUSCH | | |
| CQI/RI/PMI delay | | | | | ms | 6.5 | | |
| Maximum number of HARQ transmission | | | | |  | 4 | | |
| Measurement channel | | | | |  | R.PDSCH.2-8.5 TDD | | |
| PDSCH & PDSCH DMRS Precoding configuration for random Precoding | | | | |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband 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)  Note 2: 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 3: 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 4: Randomization of the principle beam direction per TRxP shall be used as specified in Annex B.2.3.2.3. | | | | | | | | |

Table 6.3.2.2.8.3-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| *g* | 1.6 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.2.2.8.

6.3.2.2.8.4 Test description

6.3.2.2.8.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.2.2.8.3-1 as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.2.2.8.4.3.

6.3.2.2.8.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.2.8.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ g which is specified in table 6.3.2.2.8.5-1, then the test is pass. Otherwise, the test is fail.

6.3.2.2.8.4.3 Message contents

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

6.3.2.2.8.4.3\_1 Message exceptions for SA

Table 6.3.2.2.8.4.3\_1-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | aperiodic |  |  |
| } |  |  |  |

Table 6.3.2.2.8.4.3\_1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 001100 |  |  |
| } |  |  |  |
| nrofPorts | p8 |  |  |
| firstOFDMSymbolInTimeDomain | 5, 9 |  |  |
| cdm-Type | cdm4-FD2-TD2 |  |  |
| } |  |  |  |

Table 6.3.2.2.8.4.3\_1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table5.4.2.0-21 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.3.2.2.8.4.3\_1-4: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |

Table 6.3.2.2.8.4.3\_1-5: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| moreThanTwo SEQUENCE { |  |  |  |
| n1-n2 CHOICE { |  |  |  |
| four-one-TypeI-SinglePanel-Restriction | FFFF |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 00000001 |  |  |

Table 6.3.2.2.8.4.3\_1-6: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 8 |  |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |
|  |  |  |  |
| } |  |  |  |

Table 6.3.2.2.8.4.3\_1-7: Physical layer parameters for DCI format 1\_1

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

Table 6.3.2.2.8.4.3\_1-8: *CellGroupConfig*

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

Table 6.3.2.2.8.4.3\_1-9: *ControlResourceSet*

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

Table 6.3.2.2.8.4.3\_1-10: *PDSCH-Config*

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

Table 6.3.2.2.8.4.3\_1-11: *TCI-State*

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

Table 6.3.2.2.8.4.3\_1-12: *NZP-CSI-RS-Resource*

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

6.3.2.2.8.4.3\_2 Message exceptions for NSA

Same as in clause 6.3.2.2.8.4.3\_1.

6.3.2.2.8.5 Test requirement

Table 6.3.2.2.8.5-1: Test requirement (TDD)

|  |  |
| --- | --- |
| Parameter | Test 1 |
| g | 1.59 |

### 6.3.3 4RX requirements

#### 6.3.3.1 FDD

##### 6.3.3.1.1 4Rx FDD FR1 Single PMI with 4TX TypeI-SinglePanel codebook for both SA and NSA

6.3.3.1.1.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.3.1.1.2 Test applicability

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

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

6.3.3.1.1.3 Minimum conformance requirements

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 6.3.3.1.1.3-1: Test parameters (single layer)

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** |
| Bandwidth | | MHz | 10 |
| Subcarrier spacing | | kHz | 15 |
| Duplex Mode | |  | FDD |
| Propagation channel | |  | TDLA30-5 |
| Antenna configuration | |  | High XP 4 x 4  (N1,N2) = (2,1) |
| Beamforming Model | |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (9,-) |
| CSI-RS  interval and offset | slot | 5/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 4, (0,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (13,-) |
| CSI-RS  interval and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| 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 |
| timeRestrictionForChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | 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 |
| reportTriggerSize | |  | 1 |
| CSI-AperiodicTriggerStateList | |  | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (2,1) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,1) |
| CodebookSubsetRestriction |  | 11111111 |
| RI Restriction |  | 00000001 |
| Physical channel for CSI report | |  | PUSCH |
| CQI/RI/PMI delay | | ms | 6 |
| Maximum number of HARQ transmission | |  | 4 |
| Measurement channel | |  | R.PDSCH.1-6.1 FDD |
| PDSCH & PDSCH DMRS Precoding configuration for random Precoding | |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity |
| Note 1: For random precoder selection, the precoder shall be updated in each slot (1 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-3), this reported PMI cannot be applied at the eNB 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 6.3.3.1.1.3-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 1.3 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.3.1.1.

6.3.3.1.1.4 Test description

6.3.3.1.1.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.3.1.1\_1 and as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.3.1.1.4.3.

6.3.3.1.1.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.2.2.1.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-5 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.2.1.1.5-1, then the test is pass. Otherwise, the test is fail.

6.3.3.1.1.4.3 Message contents

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

6.3.3.1.1.4.3.1 Message exceptions for SA

Table 6.3.3.1.1.4.3.1-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | Aperiodic |  |  |
| } |  |  |  |

Table 6.3.3.1.1.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| Row4 | 001 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 13 |  |  |
| } |  |  |  |

Table 6.3.3.1.1.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| Row5 | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.3.3.1.1.4.3.1-4: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
| periodicityAndOffset | CSI-ResourcePeriodicityAndOffset |  |  |

Table 6.3.3.1.1.4.3.1-5: *CSI-ResourcePeriodicityAndOffset*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.2-43 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset CHOICE { |  |  |  |
| Slots5 | 1 |  |  |
| } |  |  |  |

Table 6.3.3.1.1.4.3.1-6: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| moreThanTwo SEQUENCE { |  |  |  |
| n1-n2 CHOICE { |  |  |  |
| two-one-TypeI-SinglePanel-Restriction | 11111111 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 00000001 |  |  |

Table 6.3.3.1.1.4.3.1-7: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 0 |  |  |
| } |  |  |  |
|  |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | [1111111] |  |  |
| } |  |  |  |
| } |  |  |  |
| subbandSize | 8 |  |  |
| } |  |  |  |

6.3.3.1.1.4.3.2 Message exceptions for NSA

Same as in clause 6.3.3.1.1.4.3.1.

6.3.3.1.1.5 Test requirement

Table 6.3.3.1.1.5-1: Test requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 1.29 |

##### 6.3.3.1.2 4Rx FDD FR1 Single PMI with 8TX TypeI-SinglePanel codebook for both SA and NSA

6.3.3.1.2.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.3.1.2.2 Test applicability

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

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

6.3.3.1.2.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.1.2.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.1.2.3-2.

Table 6.3.3.1.2.3-1: 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 8 x 4  (N1,N2) = (4,1) |
| Beamforming Model | |  | As specified in Section Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (9,-) |
| CSI-RS  interval and offset | slot | 5/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 8 |
| CDM Type |  | CDM4 (FD2, TD2) |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1) |  | Row 8, (4,6) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (5,-) |
| CSI-RS  interval and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Patten 0 |
| 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 |
| timeRestrictionForChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | 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 |
| reportTriggerSize | |  | 1 |
| CSI-AperiodicTriggerStateList | |  | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (4,1) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,1) |
| CodebookSubsetRestriction |  | 0x FFFF |
| RI Restriction |  | 00000010 |
| 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 FDD |
| PDSCH & PDSCH DMRS Precoding configuration for random Precoding | |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity |
| Note 1: For random precoder selection, the precoder shall be updated in each slot (1 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 eNB 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 6.3.3.1.2.3-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 1.5 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.3.1.2.

6.3.3.1.2.4 Test description

6.3.3.1.2.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.3.1.2.3-1and as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.3.1.2.4.3.

6.3.3.1.2.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.3.1.2.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-5 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.3.1.2.5-1, then the test is pass. Otherwise, the test is fail.

6.3.3.1.2.4.3 Message contents

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

6.3.3.1.2.4.3.1 Message exceptions for SA

Table 6.3.3.1.2.4.3.1-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | aperiodic |  |  |
| } |  |  |  |

Table 6.3.3.1.2.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 001100 |  |  |
| } |  |  |  |
| nrofPorts | p8 |  |  |
| firstOFDMSymbolInTimeDomain | 5 |  |  |
| cdm-Type | cdm4-FD2-TD2 |  |  |
| } |  |  |  |

Table 6.3.3.1.2.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table5.4.2.0-21 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.3.3.1.2.4.3.1-4: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
|  |  |  |  |

Table 6.3.3.1.2.4.3.1-5: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| moreThanTwo SEQUENCE { |  |  |  |
| n1-n2 CHOICE { |  |  |  |
| four-one-TypeI-SinglePanel-Restriction | FFFF |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 00000010 |  |  |

Table 6.3.3.1.2.4.3.1-6: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 5 |  |  |
| } |  |  |  |
|  |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |
|  |  |  |  |
| } |  |  |  |

6.3.3.1.2.4.3.2 Message exceptions for NSA

Same as in clause 6.3.3.1.2.4.3.

6.3.3.1.2.5 Test requirement

Table 6.3.3.1.2.5-1: Test requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 1.49 |

##### 6.3.3.1.3 4Rx FDD FR1 Multiple PMI with 16Tx Type I – SinglePanel Codebook for both SA and NSA

6.3.3.1.3.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.3.1.3.2 Test applicability

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

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

6.3.3.1.3.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.1.3.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.1.3.3-2.

Table 6.3.3.1.3.3-1: Test parameters (dual-layer)

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Bandwidth | | MHz | 10 |
| Subcarrier spacing | | kHz | 15 |
| Duplex Mode | |  | FDD |
| Propagation channel | |  | TDLC300-5 |
| Antenna configuration | |  | High XP 16 x 4  (N1,N2) = (4,2) |
| Beamforming Model | |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, 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 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 16 |
| CDM Type |  | CDM4 (FD2, TD2) |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1, k2, k3) |  | Row 12, (2, 4, 6, 8) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (5, -) |
| CSI-RS  interval and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| 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 |
| timeRestrictionForChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | 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 | |  | 5 |
| CSI request | |  | 1 in slots i, where mod(i, 5) = 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 configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (4,2) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,4) |
| CodebookSubsetRestriction |  | 0x FFFF |
| RI Restriction |  | 00000010 |
| 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 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-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 6.3.3.1.3.3-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 3.0 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.3.1.3.

6.3.3.1.3.4 Test description

6.3.3.1.3.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.10 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.3.1.3.3-1 and as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.3.1.3.4.3.

6.3.3.1.3.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.3.1.3.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.3.1.3.5-1, then the test is pass. Otherwise, the test is fail.

6.3.3.1.3.4.3 Message contents

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

6.3.3.1.3.4.3.1 Message exceptions for SA

Table 6.3.3.1.3.4.3.1-1: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 011110 |  |  |
| } |  |  |  |
| nrofPorts | P16 |  |  |
| firstOFDMSymbolInTimeDomain | 5 |  |  |
| cdm-Type | cdm4-FD2-TD2 |  |  |
| } |  |  |  |

Table 6.3.3.1.3.4.3.1-2: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-14 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| moreThanTwo SEQUENCE { |  |  |  |
| n1-n2 CHOICE { |  |  |  |
| four-two-TypeI-SinglePanel-Restriction | FFFF FFFF FFFF FFFF |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 00000010 |  |  |

Table 6.3.3.1.3.4.3.1-3: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 5 |  |  |
| } |  |  |  |
|  |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| pmi-FormatIndicator | subbandPMI |  |  |
| } |  |  |  |
|  |  |  |  |
| } |  |  |  |

6.3.3.1.3.4.3.2 Message exceptions for NSA

Same as in clause 6.3.3.1.3.4.3.1.

6.3.3.1.3.5 Test requirement

Table 6.3.3.1.3.5-1: Test requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 2.99 |

##### 6.3.3.1.4 4Rx FDD FR1 Single PMI with 32Tx Type1 - SinglePanel codebook for both SA and NSA

6.3.3.1.4.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.3.1.4.2 Test applicability

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

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

6.3.3.1.4.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.1.4.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.1.4.3-2.

Table 6.3.3.1.4.3-1: 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 4  (N1,N2) = (4,4) |
| Beamforming Model | |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, 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 |
| 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 (k0, k1, k2, k3) |  | Row 17, (2, 4, 6, 8) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (5, 12) |
| CSI-RS  interval and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| 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 |
| timeRestrictionForChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | 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 |
| reportTriggerSize | |  | 1 |
| CSI-AperiodicTriggerStateList | |  | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (4,4) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,4) |
| CodebookSubsetRestriction |  | 0x FFFF |
| RI Restriction |  | 00000010 |
| 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 FDD |
| PDSCH & PDSCH DMRS Precoding configuration for random Precoding | |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity |
| 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 6.3.3.1.4.3-2: Minimum requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 7.0 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.3.1.4.

6.3.3.1.4.4 Test description

6.3.3.1.4.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.10 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.3.1.4.3-1 and as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.3.1.4.4.3.

6.3.3.1.4.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.3.1.4.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.3.1.4.5-1, then the test is pass. Otherwise, the test is fail.

6.3.3.1.4.4.3 Message contents

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

6.3.3.1.4.4.3.1 Message exceptions for SA

Table 6.3.3.1.4.4.3.1-1: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping:: = SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 011110 |  |  |
| } |  |  |  |
| nrofPorts | P32 |  |  |
| firstOFDMSymbolInTimeDomain | 5 |  |  |
| cdm-Type | cdm4-FD2-TD2 |  |  |
| } |  |  |  |

Table 6.3.3.1.4.4.3.1-2: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-14 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| moreThanTwo SEQUENCE { |  |  |  |
| n1-n2 CHOICE { |  |  |  |
| four-four-TypeI-SinglePanel-Restriction | FFFF FFFF FFFF FFFF  FFFF FFFF FFFF FFFF  FFFF FFFF FFFF FFFF  FFFF FFFF FFFF FFFF |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 00000010 |  |  |

Table 6.3.3.1.4.4.3.1-3: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 5 |  |  |
| } |  |  |  |
| } |  |  |  |

6.3.3.1.4.4.3.2 Message exceptions for NSA

Same as in clause 6.3.3.1.4.4.3.1.

6.3.3.1.4.5 Test requirement

Table 6.3.3.1.4.5-1: Test requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 6.99 |

##### 6.3.3.1.5 4Rx FDD FR1 Multiple PMI with 16Tx TypeII codebook for both SA and NSA

6.3.3.1.5.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.3.1.5.2 Test applicability

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

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

6.3.3.1.5.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.1.5.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.1.5.3-2.

Table 6.3.3.1.5.3-1: 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 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, 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 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 16 |
| CDM Type |  | CDM4 (FD2, TD2) |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1, k2, k3) |  | Row 12, (2, 4, 6, 8) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (5, -) |
| CSI-RS  interval and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| 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 |
| timeRestrictionForChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | 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 | |  | 5 |
| CSI request | |  | 1 in slots i, where mod(i, 5) = 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 configuration | Codebook Type |  | typeII |
| L (*numberOfBeams*) |  | 2 |
| NPSK (*phaseAlphabetSize*) |  | 8 |
| *subbandAmplitude* |  | True |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (4,2) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,4) |
| CodebookSubsetRestriction |  | 0x 7FF  FFFF 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 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. 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 6.3.3.1.5.3-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 1.9 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.3.1.5.

6.3.3.1.5.4 Test description

6.3.3.1.5.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.10 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.3.1.5.3-1 and as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.2.1.4.4.3.

6.3.3.1.5.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.3.1.5.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities, and the random precoder generation shall follow the codebook configuration as specified in Table 6.3.3.1.3.3-1. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.3.1.5.5-1, then the test is pass. Otherwise, the test is fail.

6.3.3.1.5.4.3 Message contents

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

6.3.3.1.5.4.3.1 Message exceptions for SA

Table 6.3.3.1.5.4.3.1-1: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | ‘011110’B |  |  |
| } |  |  |  |
| nrofPorts | P16 |  |  |
| firstOFDMSymbolInTimeDomain | 5 |  |  |
| cdm-Type | cdm4-FD2-TD2 |  |  |
| } |  |  |  |

Table 6.3.3.1.5.4.3.1-2: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-14 | | | |
| Information Element | Value/remark | Comment | Condition |
| CodebookConfig ::= SEQUENCE { |  |  |  |
| codebookType CHOICE { |  |  |  |
| type2 SEQUENCE { |  |  |  |
| subType CHOICE { |  |  |  |
| typeII SEQUENCE { |  |  |  |
| n1-n2-codebookSubsetRestriction CHOICE { |  |  |  |
| four-two | 0x 7FF FFFF  FFFF FFFF FFFF |  |  |
| } |  |  |  |
| typeII-RI-Restriction | ‘10’B |  |  |
| } |  |  |  |
| } |  |  |  |
| phaseAlphabetSize | 8 |  |  |
| subbandAmplitude | TRUE |  |  |
| numberOfBeams | 2 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.3.3.1.5.4.3.1-3: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 5 |  |  |
| } |  |  |  |
|  |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| pmi-FormatIndicator | subbandPMI |  |  |
| } |  |  |  |
| } |  |  |  |

6.3.3.1.5.4.3.2 Message exceptions for NSA

Same as in clause 6.3.3.1.5.4.3.1.

6.3.3.1.5.5 Test requirement

Table 6.3.3.1.5.5-1: Test requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 1.89 |

##### 6.3.3.1.6 4Rx FDD FR1 Multiple PMI with 16Tx Enhanced TypeII codebook for both SA and NSA

6.3.3.1.6.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.3.1.6.2 Test applicability

This test applies to all types of NR UE release 16 and forward supporting Enhanced Type II codebook with at least 16 ports per CSI-RS resource.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and Enhanced Type II codebook with at least 16 ports per CSI-RS resource.

6.3.3.1.6.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.1.6.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.1.6.3-2.

Table 6.3.3.1.6.3-1: 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 2  (N1,N2) = (4,2) |
| Beamforming Model | |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, 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 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 16 |
| CDM Type |  | CDM4 (FD2, TD2) |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1, k2, k3) |  | Row 12, (2, 4, 6, 8) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (5, -) |
| CSI-RS  interval and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| 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 |
| timeRestrictionForChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | Not configured |
| cqi-FormatIndicator | |  | Wideband |
| pmi-FormatIndicator | |  | Not configured |
| Sub-band Size | | RB | 4 |
| 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 |
| reportTriggerSize | |  | 1 |
| CSI-AperiodicTriggerStateList | |  | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM |
| Codebook configuration | Codebook Type |  | typeII-r16 |
| *paramCombination-r16* |  | 6  (L =4, *pν* =1/2, β=1/2 ) |
| R*(numberOfPMISubbandsPerCQISubband-r16)* |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (4,2) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,4) |
| CodebookSubsetRestriction |  | 0x 7FF  FFFF 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 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 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 AnnexB.2.3.2.3A. The value of relative power ratio (p) shall be fixed as 1 during the test. | | | |

Table 6.3.3.1.6.3-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 2.2 |

The normative reference for this requirement is TS 38.101-4 [5], clause 6.3.3.1.6.

6.3.3.1.6.4 Test description

6.3.3.1.6.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.10 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.3.1.6.3-1 and as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.3.1.6.4.3.

6.3.3.1.6.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.3.1.6.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format 0\_1 with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format 0\_1 with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.3.1.6.5-1, then the test is pass. Otherwise, the test is fail.

6.3.3.1.6.4.3 Message contents

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

6.3.3.1.6.4.3.1 Message exceptions for SA

Table 6.3.3.1.6.4.3.1-1: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ReportConfig ::= SEQUENCE { |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| pmi-FormatIndicator | subbandPMI |  |  |
| } |  |  |  |
| codebookConfig | Not present |  |  |
| subbandSize | Value1 |  |  |
| codebookConfig-r16 | CodebookConfig-r16 |  |  |
| } |  |  |  |

Table 6.3.3.1.6.4.3.1-2: *CodebookConfig-r16* (Table 6.3.3.1.6.4.3.1-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.331 [6], clause 6.3.2 | | | |
| Information Element | Value/remark | Comment | Condition |
| CodebookConfig-r16 ::= SEQUENCE { |  |  |  |
| codebookType CHOICE { |  |  |  |
| type2 SEQUENCE { |  |  |  |
| subType CHOICE { |  |  |  |
| typeII-r16 SEQUENCE { |  |  |  |
| N1-n2-codebookSubsetRestriction-r16 |  |  |  |
| Four-two | 0x 7FF  FFFF FFFF FFFF FFFF |  |  |
| } |  |  |  |
| typeII-RI-Restriction-r16 | 0010 |  |  |
| } |  |  |  |
| } |  |  |  |
| numberOfPMI-SubbandsPerCQI-Subband-r16 | 1 |  |  |
| paramCombinatin-r16 | 6 | (L =4, pν =1/2, β=1/2 ) |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

6.3.3.1.6.4.3.2 Message exceptions for NSA

Same as in clause 6.3.3.1.6.4.3.1.

6.3.3.1.6.5 Test requirement

Table 6.3.3.1.6.5-1: Test requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 2.19 |

##### 6.3.3.1.7 Single PMI with 8 ports TypeI-SinglePanel Codebook for Single-DCI based transmission scheme

6.3.3.1.7.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.3.1.7.2 Test applicability

This test applies to all types of NR UE release 17 and forward.

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

6.3.3.1.7.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.1.7.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.1.7.3-2.

Table 6.3.3.1.7.3-1: Test parameters (dual-layer)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | | Unit | Value | | |
| TRxP #1(Note 1) | | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | | |  | TRxP #1 | | |
| PDCCH configuration | | | TCI state | |  | TCI State #1 | | |
| CORESETPoolIndex | |  | 0 | | |
| CSI-RS for tracking | | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | | |
| Density | |  | 3 | | |
| CSI-RS periodicity | | Slots | 20 | | |
| CSI-RS offset | | Slots | 10 for CSI-RS resources 1 and 2  11 for CSI-RS resources 3 and 4 | | 10 for CSI-RS resources 5 and 6  11 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | | |
| Duplex mode | | | | |  | FDD | | |
| Bandwidth | | | | | MHz | 10 | | |
| Subcarrier spacing | | | | | kHz | 15 | | |
| Active DL BWP index | | | | |  | 1 | | |
| Propagation channel | | | | |  | TDLA30-10 | | |
| Antenna configuration per TRxP | | | | |  | High XP 8 x 4 (N1,N2) = (4,1) | | |
| Beamforming Model | | | | |  | As specified in Annex B.4.1 (Note 4) | | |
| PDSCH configuration | Mapping type | | | |  | Type A | | |
| k0 | | | |  | 0 | | |
| Starting symbol (S) | | | |  | 2 | | |
| Length (L) | | | |  | 12 | | |
| PRB bundling type | | | |  | Static | | |
| PRB bundling size | | | |  | 2 | | |
| Resource allocation type | | | |  | Type 1 | | |
| RBG size | | | |  | Config2 | | |
| VRB-to-PRB mapping type | | | |  | Non-interleaved | | |
| VRB-to-PRB mapping interleaver bundle size | | | |  | N/A | | |
| PDSCH DMRS configuration | Antenna port indexes | | | |  | 1000 | | 1002 |
| TCI state | | | |  | TCI State #1 | | TCI State #2 |
| DMRS Type | | | |  | Type 1 | | |
| Number of additional DMRS | | | |  | 1 | | |
| Maximum number of OFDM symbols for DL front loaded DMRS | | | |  | 1 | | |
| TCI State #1 | Type 1 QCL information | | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | | N/A |
| QCL Type |  | Type A | | N/A |
| Type 2 QCL information | | | CSI-RS resource |  | N/A | | N/A |
| QCL Type |  | N/A | | N/A |
| TCI State #2 | Type 1 QCL information | | | CSI-RS resource |  | N/A | | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | | Type A |
| Type 2 QCL information | | | CSI-RS resource |  | N/A | | N/A |
| QCL Type |  | N/A | | N/A |
| Resource allocation | | | | |  | Full-overlapping | | |
| Timing offset of the second TRxP from the first TRxP | | | | | us | 0 | | |
| Frequency offset of the second TRxP from the first TRxP | | | | | Hz | 0 | | |
| Number of HARQ Processes | | | | |  | 4 | | |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | | | |  | 2 | | |
| ZP CSI-RS configuration | | CSI-RS resource Type | | |  | Periodic | | |
| Number of CSI-RS ports (*X*) | | |  | 4 | | |
| CDM Type | | |  | FD-CDM2 | | |
| Density (ρ) | | |  | 1 | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | | |  | Row 5,(4) | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | | |  | (9) | | |
| CSI-RS  periodicity and offset | | | slot | 5/1 | | |
| NZP CSI-RS for CSI acquisition | | CSI-RS resource ID | | |  | Resource #9 | Resource #10 | |
| CSI-RS resource Type | | |  | Aperiodic | Aperiodic | |
| Number of CSI-RS ports (*X*) | | |  | 8 | 8 | |
| CDM Type | | |  | CDM4 (FD2, TD2) | CDM4 (FD2, TD2) | |
| Density (ρ) | | |  | 1 | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | | |  | Row 8, (4,6) | Row 8, (4,6) | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | | |  | (5) | (9) | |
| CSI-RS  periodicity and offset | | | slot | Not configured | Not configured | |
| aperiodicTriggeringOffset | | |  | 0 | 0 | |
| CSI-IM configuration | | CSI-IM resource Type | | |  | Aperiodic | | |
| CSI-IM RE pattern | | |  | Pattern 0 | | |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) | | |  | (4,9) | | |
| CSI-IM timeConfig  periodicity and offset | | | slot | Not configured | | |
| ReportConfigType | | | | |  | Aperiodic | | |
| CQI-table | | | | |  | Table 1 | | |
| reportQuantity | | | | |  | cri-RI-PMI-CQI | | |
| csi-ReportMode | | | | |  | Mode1 | | |
| numberOfSingleTRP-CSI-Mode1 | | | | |  |  | | |
| CMR pairing and grouping | | | | |  | CMR group #1: {NZP CSI-RS resource #9}, with  CMR group #2: {NZP CSI-RS resource #10}, with  CMR paring: {NZP CSI-RS resource #9, NZP CSI-RS resource #10} | | |
| timeRestrictionForChannelMeasurements | | | | |  | Not configured | | |
| timeRestrictionForInterferenceMeasurements | | | | |  | Not configured | | |
| cqi-FormatIndicator | | | | |  | Wideband | | |
| pmi-FormatIndicator | | | | |  | Wideband | | |
| Sub-band Size | | | | | RB | 8 | | |
| csi-ReportingBand | | | | |  | 1111111 | | |
| CSI-Report periodicity 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 | | |
| reportTriggerSize | | | | |  | 1 | | |
| CSI-AperiodicTriggerStateList | | | | |  | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM | | |
| Codebook configuration | | CodebookType | | |  | typeI-SinglePanel | | |
| CodebookMode | | |  | 1 | | |
| (CodebookConfig-N1,CodebookConfig-N2) | | |  | (4,1) | | |
| (CodebookConfig-O1,CodebookConfig-O2) | | |  | (4,1) | | |
| CodebookSubsetRestriction | | |  | 0x FFFF | | |
| RI Restriction | | |  | 00000001 (1 MIMO layer per TRxP) | | |
| Physical channel for CSI report | | | | |  | PUSCH | | |
| CQI/RI/PMI delay | | | | | ms | 8 | | |
| Maximum number of HARQ transmission | | | | |  | 4 | | |
| Measurement channel | | | | |  | R.PDSCH.1-6.4 | | |
| PDSCH & PDSCH DMRS Precoding configuration for random Precoding | | | | |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband 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)  Note 2: 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 3: 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 4: Randomization of the principle beam direction per TRxP shall be used as specified in Annex B.2.3.2.3. | | | | | | | | |

Table 6.3.3.1.7.3-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 1.6 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.3.1.7.

6.3.3.1.7.4 Test description

6.3.3.1.7.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.3.1.7.3-1and as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.3.1.7.4.3.

6.3.3.1.7.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.3.1.7.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-5 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.3.1.7.5-1, then the test is pass. Otherwise, the test is fail.

6.3.3.1.7.4.3 Message contents

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

6.3.3.1.7.4.3.1 Message exceptions for SA

Table 6.3.3.1.7.4.3.1-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | aperiodic |  |  |
| } |  |  |  |

Table 6.3.3.1.7.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 001100 |  |  |
| } |  |  |  |
| nrofPorts | p8 |  |  |
| firstOFDMSymbolInTimeDomain | 5, 9 |  |  |
| cdm-Type | cdm4-FD2-TD2 |  |  |
| } |  |  |  |

Table 6.3.3.1.7.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table5.4.2.0-21 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.3.3.1.7.4.3.1-4: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
|  |  |  |  |

Table 6.3.3.1.7.4.3.1-5: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| moreThanTwo SEQUENCE { |  |  |  |
| n1-n2 CHOICE { |  |  |  |
| four-one-TypeI-SinglePanel-Restriction | FFFF |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 00000001 |  |  |

Table 6.3.3.1.7.4.3.1-6: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 5 |  |  |
| } |  |  |  |
|  |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |
|  |  |  |  |
| } |  |  |  |

Table 6.3.3.1.7.4.3.1-7: Physical layer parameters for DCI format 1\_1

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

Table 6.3.3.1.7.4.3.1-8: *CellGroupConfig*

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

Table 6.3.3.1.7.4.3.1-9: *ControlResourceSet*

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

Table 6.3.3.1.7.4.3.1-10: *PDSCH-Config*

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

Table 6.3.3.1.7.4.3.1-11: *TCI-State*

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

Table 6.3.3.1.7.4.3.1-12: *NZP-CSI-RS-Resource*

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

6.3.3.1.7.4.3.2 Message exceptions for NSA

Same as in clause 6.3.3.1.7.4.3.

6.3.3.1.7.5 Test requirement

Table 6.3.3.1.7.5-1: Test requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 1.59 |

#### 6.3.3.2 TDD

##### 6.3.3.2.1 4Rx TDD FR1 Single PMI with 4TX TypeI-SinglePanel codebook for both SA and NSA

6.3.3.2.1.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.3.2.1.2 Test applicability

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

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

6.3.3.2.1.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.2.1.3-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.2.1.3-2.

Table 6.3.3.2.1.3-1: Test parameters (single layer)

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** |
| Bandwidth | | MHz | 40 |
| Subcarrier spacing | | kHz | 30 |
| Duplex Mode | |  | TDD |
| TDD DL-UL configuration | |  | FR1.30-1 as specified in Annex A |
| Propagation channel | |  | TDLA30-5 |
| Antenna configuration | |  | High XP 4 x 4  (N1,N2) = (2,1) |
| Beamforming Model | |  | As specified in Section Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (9,-) |
| CSI-RS  interval and offset | slot | 10/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 4, (0,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (13,-) |
| CSI-RS  interval and offset |  | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Patten 0 |
| 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 |
| timeRestrictionForChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | 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 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 configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (2,1) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,1) |
| CodebookSubsetRestriction |  | 11111111 |
| RI Restriction |  | 00000001 |
| 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 |
| PDSCH & PDSCH DMRS Precoding configuration for random Precoding | |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity |
| Note 1: For random precoder selection, the precoder shall be updated in each slot (0.5 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 eNB 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 6.3.3.2.1.3-2: Minimum requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 1.3 |

6.3.3.2.1.4 Test description

6.3.3.2.1.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.3.2.1.3-1 and as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release On for SA or (EN-DC, DC bearer MCG and SCG, Connected without Release On) for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.3.2.1.4.3.

6.3.3.2.1.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.3.2.1.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-5 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.3.1.1.5-1, then the test is pass. Otherwise, the test is fail.

6.3.3.2.1.4.3 Message contents

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

6.3.3.2.1.4.3.1 Message exceptions for SA

Table 6.3.3.2.1.4.3.1-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | Aperiodic |  |  |
| } |  |  |  |

Table 6.3.3.2.1.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause5.4.2, Table5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| Row4 | 001 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 13 |  |  |
| } |  |  |  |

Table 6.3.3.2.1.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table5.4.2.0-21 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| Row5 | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.3.3.2.1.4.3.1-4: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |

Table 6.3.3.2.1.4.3.1-5: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| moreThanTwo SEQUENCE { |  |  |  |
| n1-n2 CHOICE { |  |  |  |
| two-one-TypeI-SinglePanel-Restriction | 11111111 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 00000001 |  |  |

Table 6.3.3.2.1.4.3.1-6: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 0 |  |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | [1111111] |  |  |
| } |  |  |  |
| } |  |  |  |
| subbandSize | value2 |  |  |
| } |  |  |  |

6.3.3.2.1.4.3.2 Message exception for NSA

Same as in 6.3.3.2.1.4.3.1.

6.3.3.2.1.5 Test requirement

Table 6.3.3.2.1.5-1: Test requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 1.29 |

##### 6.3.3.2.2 4Rx TDD FR1 Single PMI with 8TX TypeI-SinglePanel codebook for both SA and NSA

6.3.3.2.2.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.3.2.2.2 Test applicability

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

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

6.3.3.2.2.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.2.2.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.2.2.3-2.

Table 6.3.3.2.2.3-1: 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 channel | |  | TDLA30-5 |
| Antenna configuration | |  | High XP 8 x 4  (N1,N2) = (4,1) |
| Beamforming Model | |  | As specified in Section Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (9,-) |
| CSI-RS  interval and offset | slot | 10/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 8 |
| CDM Type |  | CDM4 (FD2, TD2) |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 8, (4,6) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (5,-) |
| CSI-RS  interval and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Patten 0 |
| 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 |
| timeRestrictionForChannnelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | 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 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 configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (4,1) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,1) |
| CodebookSubsetRestriction |  | 0x FFFF |
| RI Restriction |  | 00000010 |
| Physical channel for CSI report | |  | PUSCH |
| CQI/RI/PMI delay | | ms | 6.5 |
| Maximum number of HARQ transmission | |  | 4 |
| Measurement channel | |  | R.PDSCH.2-8.2 TDD |
| PDSCH & PDSCH DMRS Precoding configuration for random Precoding | |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity |
| Note 1: For random precoder selection, the precoder shall be updated in each slot (0.5 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-6)], this reported PMI cannot be applied at the eNB 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 6.3.3.2.2.3-2: Minimum requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 1.5 |

6.3.3.2.2.4 Test description

6.3.3.2.2.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.2.1-2 and Table 6.3.3.2.2.3-1and as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.3.2.2.4.3.

6.3.3.2.2.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.3.2.2.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-5 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.3.2.2.5-1, then the test is pass. Otherwise, the test is fail.

6.3.3.2.2.4.3 Message contents

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

6.3.3.2.2.4.3.1 Message contents for SA

Table 6.3.3.2.2.4.3.1-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | Aperiodic |  |  |
| } |  |  |  |

Table 6.3.3.2.2.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause5.4.2, Table5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 001100 |  |  |
| } |  |  |  |
| nrofPorts | p8 |  |  |
| firstOFDMSymbolInTimeDomain | 5 |  |  |
| cdm-Type | cdm4-FD2-TD2 |  |  |
| } |  |  |  |

Table 6.3.3.2.2.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table5.4.2.0-21 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.3.3.2.2.4.3.1-4: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
|  |  |  |  |

Table 6.3.3.2.2.4.3.1-5: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| moreThanTwo SEQUENCE { |  |  |  |
| n1-n2 CHOICE { |  |  |  |
| four-one-TypeI-SinglePanel-Restriction | FFFF |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 00000010 |  |  |

Table 6.3.3.2.2.4.3.1-6: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 8 |  |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |
|  |  |  |  |
| } |  |  |  |

6.3.3.2.2.4.3.2 Message contents for NSA

Same as in clause 6.3.3.2.2.4.3.1.

6.3.3.2.2.5 Test requirement

Table 6.3.3.2.2.5-1: Test requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 1.49 |

##### 6.3.3.2.3 4Rx TDD FR1 Multiple PMI with 16Tx Type1 - SinglePanel codebook for both SA and NSA

6.3.3.2.3.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.3.2.3.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports.

6.3.3.2.3.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.2.3.3-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.2.3.3-2.

Table 6.3.3.2.3.3-1: 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 channel | |  | TDLC300-5 |
| Antenna configuration | |  | High XP 16 x 4  (N1,N2) = (4,2) |
| Beamforming Model | |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (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*) |  | 16 |
| CDM Type |  | CDM4 (FD2, TD2) |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1, k2, k3) |  | Row 12, (2, 4, 6, 8) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (5, -) |
| CSI-RS  interval and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| 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 |
| timeRestrictionForChannnelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | 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 |
| reportTriggerSize | |  | 1 |
| CSI-AperiodicTriggerStateList | |  | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (4,2) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,4) |
| CodebookSubsetRestriction |  | 0x FFFF |
| RI Restriction |  | 00000010 |
| Physical channel 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 |
| 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 6.3.3.2.3.3-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 3.0 |

The normative reference for this requirement is TS 38.101-4 [5], clause 6.3.3.2.3.

6.3.3.2.3.4 Test description

6.3.3.2.3.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.10 for TE diagram and section A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.2.1-2 and Table 6.3.3.2.3.3-1and as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.3.2.3.4.3.

6.3.3.2.3.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.3.2.3.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.3.2.3.5-1, then the test is pass. Otherwise, the test is fail.

6.3.3.2.3.4.3 Message contents

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

6.3.3.2.3.4.3.1 Message contents for SA

Table 6.3.3.2.3.4.3.1-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | Aperiodic |  |  |
| } |  |  |  |

Table 6.3.3.2.3.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause5.4.2, Table 5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 011110 |  |  |
| } |  |  |  |
| nrofPorts | p16 |  |  |
| firstOFDMSymbolInTimeDomain | 5 |  |  |
| cdm-Type | cdm4-FD2-TD2 |  |  |
| } |  |  |  |

Table 6.3.3.2.3.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table 5.4.2.0-21 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.3.3.2.3.4.3.1-4: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
|  |  |  |  |

Table 6.3.3.2.3.4.3.1-5: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| moreThanTwo SEQUENCE { |  |  |  |
| n1-n2 CHOICE { |  |  |  |
| four-two-TypeI-SinglePanel-Restriction | FFFF FFFF FFFF FFFF |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 00000010 |  |  |

Table 6.3.3.2.3.4.3.1-6: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 8 |  |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| pmi-FormatIndicator | subbandPMI |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |
|  |  |  |  |
| } |  |  |  |

6.3.3.2.3.4.3.2 Message contents for NSA

Same as in clause 6.3.3.2.3.4.3.1.

6.3.3.2.3.5 Test requirement

Table 6.3.3.2.3.5-1: Test requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 2.99 |

##### 6.3.3.2.4 4Rx TDD FR1 Single PMI with 32Tx Type1 - SinglePanel codebook for both SA and NSA

6.3.3.2.4.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.3.2.4.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports.

6.3.3.2.4.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.2.4.3-1 and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.2.4.3-2.

Table 6.3.3.2.4.3-1: 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 channel | |  | TDLA30-5 |
| Antenna configuration | |  | High XP 32 x 4  (N1,N2) = (4,4) |
| Beamforming Model | |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (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 (k0, k1, k2, k3) |  | Row 17, (2, 4, 6, 8) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (5, 12) |
| CSI-RS  interval and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| 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 |
| timeRestrictionForChannnelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | 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 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 configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (4,4) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,4) |
| CodebookSubsetRestriction |  | 0x  FFFF FFFF FFFF FFFF  FFFF FFFF FFFF FFFF  FFFF FFFF FFFF FFFF  FFFF FFFF FFFF FFFF |
| RI Restriction |  | 00000010 |
| Physical channel 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 |
| PDSCH & PDSCH DMRS Precoding configuration for random Precoding | |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity |
| 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 6.3.3.2.4.3-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 7.0 |

The normative reference for this requirement is TS 38.101-4 [5], clause 6.3.3.2.4.

6.3.3.2.4.4 Test description

6.3.3.2.4.4.1 Initial conditions

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

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

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

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

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 4.3.1.1.

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.10 for TE diagram and section A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.2.1-2 and Table 6.3.3.2.4.3-1and as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.3.2.4.4.3.

6.3.3.2.4.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.3.2.4.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CQI feedback via PDCCH DCI format 0\_1 with aperiodic CSI request triggered. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format 0\_1 with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.3.2.4.5-1, then the test is pass. Otherwise, the test is fail.

6.3.3.2.4.4.3 Message contents

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

6.3.3.2.4.4.3.1 Message contents for SA

Table 6.3.3.2.4.4.3.1-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | Aperiodic |  |  |
| } |  |  |  |

Table 6.3.3.2.4.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause5.4.2, Table 5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 011110 |  |  |
| } |  |  |  |
| nrofPorts | p32 |  |  |
| firstOFDMSymbolInTimeDomain | 5 |  |  |
| cdm-Type | cdm4-FD2-TD2 |  |  |
| } |  |  |  |

Table 6.3.3.2.4.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table 5.4.2.0-21 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.3.3.2.4.4.3.1-4: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
|  |  |  |  |

Table 6.3.3.2.4.4.3.1-5: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| moreThanTwo SEQUENCE { |  |  |  |
| n1-n2 CHOICE { |  |  |  |
| four-four-TypeI-SinglePanel-Restriction | FFFF FFFF FFFF FFFF FFFF FFFF FFFF FFFF |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 00000010 |  |  |

Table 6.3.3.2.4.4.3.1-6: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 8 |  |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| pmi-FormatIndicator | subbandPMI |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |
|  |  |  |  |
| } |  |  |  |

6.3.3.2.4.4.3.2 Message contents for NSA

Same as in clause 6.3.3.2.4.4.3.1.

6.3.3.2.4.5 Test requirement

Table 6.3.3.2.4.5-1: Test requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 6.99 |

##### 6.3.3.2.5 4Rx TDD FR1 Multiple PMI with 16Tx TypeII codebook for both SA and NSA

6.3.3.2.5.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.3.2.5.2 Test applicability

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

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

6.3.3.2.5.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.2.5.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.2.5.3-2.

Table 6.3.3.2.5.3-1: 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 channel | |  | TDLA30-5 |
| Antenna configuration | |  | XP Medium 16 x 4  (N1,N2) = (4,2) |
| Beamforming Model | |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (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*) |  | 16 |
| CDM Type |  | CDM4 (FD2, TD2) |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1, k2, k3) |  | Row 12, (2, 4, 6, 8) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (5, -) |
| CSI-RS  interval and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| 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 |
| timeRestrictionForIChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | 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 |
| reportTriggerSize | |  | 1 |
| CSI-AperiodicTriggerStateList | |  | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM |
| Codebook configuration | Codebook Type |  | typeII |
| L (*numberOfBeams*) |  | 2 |
| NPSK (*phaseAlphabetSize*) |  | 8 |
| *subbandAmplitude* |  | True |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (4,2) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,4) |
| CodebookSubsetRestriction |  | 0x 7FF  FFFF FFFF FFFF FFFF |
| RI Restriction (typeII-RI-Restriction) |  | 10 |
| Physical channel 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 |
| 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. The random precoder 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).  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 6.3.3.2.5.3-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 1.8 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.3.2.5.

6.3.3.2.5.4 Test description

6.3.3.2.5.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.10 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.3.2.5.3-1 and as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.2.1.4.4.3.

6.3.3.2.5.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.3.2.5.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities, and the random precoder generation shall follow the codebook configuration as specified in Table 6.3.3.2.3.3-1. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.3.2.5.5-1, then the test is pass. Otherwise, the test is fail.

6.3.3.2.5.4.3 Message contents

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

6.3.3.2.5.4.3.1 Message exceptions for SA

Table 6.3.3.2.5.4.3.1-1: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | ‘011110’B |  |  |
| } |  |  |  |
| nrofPorts | P16 |  |  |
| firstOFDMSymbolInTimeDomain | 5 |  |  |
| cdm-Type | cdm4-FD2-TD2 |  |  |
| } |  |  |  |

Table 6.3.3.2.5.4.3.1-2: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-14 | | | |
| Information Element | Value/remark | Comment | Condition |
| CodebookConfig ::= SEQUENCE { |  |  |  |
| codebookType CHOICE { |  |  |  |
| type2 SEQUENCE { |  |  |  |
| subType CHOICE { |  |  |  |
| typeII SEQUENCE { |  |  |  |
| n1-n2-codebookSubsetRestriction CHOICE { |  |  |  |
| four-two | 0x 7FF FFFF  FFFF FFFF FFFF |  |  |
| } |  |  |  |
| typeII-RI-Restriction | ‘10’B |  |  |
| } |  |  |  |
| } |  |  |  |
| phaseAlphabetSize | 8 |  |  |
| subbandAmplitude | TRUE |  |  |
| numberOfBeams | 2 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.3.3.2.5.4.3.1-3: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 5 |  |  |
| } |  |  |  |
|  |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| pmi-FormatIndicator | subbandPMI |  |  |
| } |  |  |  |
| } |  |  |  |

6.3.3.2.5.4.3.2 Message exceptions for NSA

Same as in clause 6.3.3.2.5.4.3.1.

6.3.3.2.5.5 Test requirement

Table 6.3.3.2.5.5-1: Test requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 1.79 |

##### 6.3.3.2.6 4Rx TDD FR1 Multiple PMI with 16Tx Enhanced TypeII codebook for both SA and NSA

6.3.3.2.6.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.3.2.6.2 Test applicability

This test applies to all types of NR UE release 16 and forward supporting Enhanced Type II codebook with at least 16 ports per CSI-RS resource.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and Enhanced Type II codebook with at least 16 ports per CSI-RS resource.

6.3.3.2.6.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.2.6.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.2.6.3-2.

Table 6.3.3.2.6.3-1: 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 channel | |  | TDLA30-5 |
| Antenna configuration | |  | XP Medium 16 x 2  (N1,N2) = (4,2) |
| Beamforming Model | |  | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1) |  | Row 5, (4,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (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*) |  | 16 |
| CDM Type |  | CDM4 (FD2, TD2) |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1, k2, k3) |  | Row 12, (2, 4, 6, 8) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (5, -) |
| CSI-RS  interval and offset | slot | Not configured |
| aperiodicTriggeringOffset |  | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic |
| CSI-IM RE pattern |  | Pattern 0 |
| 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 |
| timeRestrictionForIChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | Not configured |
| cqi-FormatIndicator | |  | Wideband |
| pmi-FormatIndicator | |  | Not configured |
| 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 |
| reportTriggerSize | |  | 1 |
| CSI-AperiodicTriggerStateList | |  | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM |
| Codebook configuration | Codebook Type |  | typeII-r16 |
| *paramCombination-r16* |  | 6  (L =4, *pν* =1/2, β=1/2 ) |
| R*(numberOfPMISubbandsPerCQISubband-r16)* |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (4,2) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,4) |
| CodebookSubsetRestriction |  | 0x 7FF  FFFF FFFF FFFF FFFF |
| RI Restriction (typeII-RI-Restriction-r16) |  | 0010 |
| Physical channel 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 |
| 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. The random precoder 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).  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 6.3.3.2.6.3-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
| ** | 2.2 |

The normative reference for this requirement is TS 38.101-4 [5], clause 6.3.3.2.6.

6.3.3.2.6.4 Test description

6.3.3.2.6.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.10 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.3.3.2.6.3-1 as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.3.2.6.4.3.

6.3.3.2.6.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.3.2.6.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format 0\_1 with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-6 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format 0\_1 with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.3.2.6.5-1, then the test is pass. Otherwise, the test is fail.

6.3.3.2.6.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2.

6.3.3.2.6.4.3.1 Message exceptions for SA

Table 6.3.3.2.6.4.3.1-1: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2.5, Table 5.4.2.5-13 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ReportConfig ::= SEQUENCE { |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| pmi-FormatIndicator | Not present |  |  |
| } |  |  |  |
| codebookConfig | Not present |  |  |
| subbandSize | Value1 |  |  |
| codebookConfig-r16 | CodebookConfig-r16 |  |  |
| } |  |  |  |

Table 6.3.3.2.6.4.3.1-2: *CodebookConfig-r16* (Table 6.3.3.2.6.4.3.1-1)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.331 [6], clause 6.3.2 | | | |
| Information Element | Value/remark | Comment | Condition |
| CodebookConfig-r16 ::= SEQUENCE { |  |  |  |
| codebookType CHOICE { |  |  |  |
| type2 SEQUENCE { |  |  |  |
| subType CHOICE { |  |  |  |
| typeII-r16 SEQUENCE { |  |  |  |
| N1-n2-codebookSubsetRestriction-r16 |  |  |  |
| Four-two | 0x 7FF  FFFF FFFF FFFF FFFF |  |  |
| } |  |  |  |
| typeII-RI-Restriction-r16 | 0010 |  |  |
| } |  |  |  |
| } |  |  |  |
| numberOfPMI-SubbandsPerCQI-Subband-r16 | 1 |  |  |
| paramCombinatin-r16 | 6 | (L =4, pν =1/2, β=1/2 ) |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

6.3.3.2.6.4.3.2 Message exceptions for NSA

Same as in clause 6.3.3.2.6.4.3.1.

6.3.3.2.6.5 Test requirement

Table 6.3.3.2.6.5-1: Test requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 2.19 |

##### 6.3.3.2.7 Single PMI with 8 ports TypeI-SinglePanel Codebook for Single-DCI based transmission scheme

6.3.3.2.7.1 Test purpose

To test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

6.3.3.2.7.2 Test applicability

This test applies to all types of NR UE release 17 and forward.

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

6.3.3.2.7.3 Minimum conformance requirements

For the parameters specified in Table 6.3.3.2.7.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.2.7.3-2.

Table 6.3.3.2.7.3-1: Test parameters (dual-layer)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | | | Unit | Value | | |
| TRxP #1(Note 1) | | TRxP #2(Note 1) |
| Transmit TRxP of SSB | | | | |  | TRxP #1 | | |
| PDCCH configuration | | | TCI state | |  | TCI State #1 | | |
| CORESETPoolIndex | |  | 0 | | |
| CSI-RS for tracking | | | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resources 1,2,3,4 | | k0=1 for CSI-RS resources 5,6,7,8 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resources 1 and 3  l0 = 10 for CSI-RS resources 2 and 4 | | l0 = 6 for CSI-RS resources 5 and 7  l0 = 10 for CSI-RS resources 6 and 8 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 | | 1 for CSI-RS resource 5,6,7,8 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4,5,6,7,8 | | |
| Density | |  | 3 | | |
| CSI-RS periodicity | | Slots | 40 | | |
| CSI-RS offset | | Slots | 20 for CSI-RS resources 1 and 2  21 for CSI-RS resources 3 and 4 | | 20 for CSI-RS resources 5 and 6  21 for CSI-RS resources 7 and 8 |
| QCL info | |  | TCI state #0 | | |
| Duplex mode | | | | |  | TDD | | |
| Bandwidth | | | | | MHz | 40 | | |
| Subcarrier spacing | | | | | kHz | 30 | | |
| TDD DL-UL configurations | | | | |  | FR1.30-1 as specified in Annex A | | |
| Active DL BWP index | | | | |  | 1 | | |
| Propagation channel | | | | |  | TDLA30-10 | | |
| Antenna configuration per TRxP | | | | |  | High XP 8 x 4 (N1,N2) = (4,1) | | |
| Beamforming Model | | | | |  | As specified in Annex B.4.1 (Note 4) | | |
| PDSCH configuration | Mapping type | | | |  | Type A | | |
| k0 | | | |  | 0 | | |
| Starting symbol (S) | | | |  | 2 | | |
| Length (L) | | | |  | 12 | | |
| PRB bundling type | | | |  | Static | | |
| PRB bundling size | | | |  | 2 | | |
| Resource allocation type | | | |  | Type 1 | | |
| RBG size | | | |  | Config2 | | |
| VRB-to-PRB mapping type | | | |  | Non-interleaved | | |
| VRB-to-PRB mapping interleaver bundle size | | | |  | N/A | | |
| PDSCH DMRS configuration | Antenna port indexes | | | |  | 1000 | | 1002 |
| TCI state | | | |  | TCI State #1 | | TCI State #2 |
| DMRS Type | | | |  | Type 1 | | |
| Number of additional DMRS | | | |  | 1 | | |
| Maximum number of OFDM symbols for DL front loaded DMRS | | | |  | 1 | | |
| TCI State #1 | Type 1 QCL information | | | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking’ configuration | | N/A |
| QCL Type |  | Type A | | N/A |
| Type 2 QCL information | | | CSI-RS resource |  | N/A | | N/A |
| QCL Type |  | N/A | | N/A |
| TCI State #2 | Type 1 QCL information | | | CSI-RS resource |  | N/A | | CSI-RS resource 5 from 'CSI-RS for tracking’ configuration |
| QCL Type |  | N/A | | Type A |
| Type 2 QCL information | | | CSI-RS resource |  | N/A | | N/A |
| QCL Type |  | N/A | | N/A |
| Resource allocation | | | | |  | Full-overlapping | | |
| Timing offset of the second TRxP from the first TRxP | | | | | us | 0 | | |
| Frequency offset of the second TRxP from the first TRxP | | | | | Hz | 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 | | |
| ZP CSI-RS configuration | | CSI-RS resource Type | | |  | Periodic | | |
| Number of CSI-RS ports (*X*) | | |  | 4 | | |
| CDM Type | | |  | FD-CDM2 | | |
| Density (ρ) | | |  | 1 | | |
| First subcarrier index in the PRB used for CSI-RS (k0) | | |  | Row 5,(4) | | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | | |  | (9) | | |
| CSI-RS  periodicity and offset | | | slot | 10/1 | | |
| NZP CSI-RS for CSI acquisition | | CSI-RS resource ID | | |  | Resource #9 | Resource #10 | |
| CSI-RS resource Type | | |  | Aperiodic | Aperiodic | |
| Number of CSI-RS ports (*X*) | | |  | 8 | 8 | |
| CDM Type | | |  | CDM4 (FD2, TD2) | CDM4 (FD2, TD2) | |
| Density (ρ) | | |  | 1 | 1 | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | | |  | Row 8, (4,6) | Row 8, (4,6) | |
| First OFDM symbol in the PRB used for CSI-RS (l0) | | |  | (5) | (9) | |
| CSI-RS  periodicity and offset | | | slot | Not configured | Not configured | |
| aperiodicTriggeringOffset | | |  | 0 | 0 | |
| CSI-IM configuration | | CSI-IM resource Type | | |  | Aperiodic | | |
| CSI-IM RE pattern | | |  | Pattern 0 | | |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) | | |  | (4,9) | | |
| CSI-IM timeConfig  periodicity and offset | | | slot | Not configured | | |
| ReportConfigType | | | | |  | Aperiodic | | |
| CQI-table | | | | |  | Table 1 | | |
| reportQuantity | | | | |  | cri-RI-PMI-CQI | | |
| csi-ReportMode | | | | |  | Mode1 | | |
| numberOfSingleTRP-CSI-Mode1 | | | | |  |  | | |
| CMR pairing and grouping | | | | |  | CMR group #1: {NZP CSI-RS resource #9}, with  CMR group #2: {NZP CSI-RS resource #10}, with  CMR paring: {NZP CSI-RS resource #9, NZP CSI-RS resource #10} | | |
| timeRestrictionForChannelMeasurements | | | | |  | Not configured | | |
| timeRestrictionForInterferenceMeasurements | | | | |  | Not configured | | |
| cqi-FormatIndicator | | | | |  | Wideband | | |
| pmi-FormatIndicator | | | | |  | Wideband | | |
| Sub-band Size | | | | | RB | 8 | | |
| csi-ReportingBand | | | | |  | 1111111 | | |
| CSI-Report periodicity and offset | | | | | slot | Not configured | | |
| Aperiodic Report Slot Offset | | | | |  | 5 | | |
| 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 configuration | | CodebookType | | |  | typeI-SinglePanel | | |
| CodebookMode | | |  | 1 | | |
| (CodebookConfig-N1,CodebookConfig-N2) | | |  | (4,1) | | |
| (CodebookConfig-O1,CodebookConfig-O2) | | |  | (4,1) | | |
| CodebookSubsetRestriction | | |  | 0x FFFF | | |
| RI Restriction | | |  | 00000001 (1 MIMO layer per TRxP) | | |
| Physical channel for CSI report | | | | |  | PUSCH | | |
| CQI/RI/PMI delay | | | | | ms | 6.5 | | |
| Maximum number of HARQ transmission | | | | |  | 4 | | |
| Measurement channel | | | | |  | R.PDSCH.2-8.5 TDD | | |
| PDSCH & PDSCH DMRS Precoding configuration for random Precoding | | | | |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband 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)  Note 2: 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 3: 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 4: Randomization of the principle beam direction per TRxP shall be used as specified in Annex B.2.3.2.3. | | | | | | | | |

Table 6.3.3.2.7.3-2: Minimum requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
|  | 1.6 |

The normative reference for this requirement is TS 38.101-4 [5] clause 6.3.3.2.7.

6.3.3.2.7.4 Test description

6.3.3.2.7.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7 for TE diagram and section A.3.2.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.2.1-2 and Table 6.3.3.2.7.3-1and as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, Connected without release *On* for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without Release On)* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 6.3.3.2.7.4.3.

6.3.3.2.7.4.2 Test procedure

1. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 6.3.3.2.7.3-1 as appropriate.

2. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

3. Set SNR to. The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-5 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure according to Annex G.3.3.

4. Calculate. If the ratio ≥ which is specified in table 6.3.3.2.7.5-1, then the test is pass. Otherwise, the test is fail.

6.3.3.2.7.4.3 Message contents

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

6.3.3.2.7.4.3.1 Message contents for SA

Table 6.3.3.2.7.4.3.1-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | Aperiodic |  |  |
| } |  |  |  |

Table 6.3.3.2.7.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause5.4.2, Table5.4.2.0-15 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 001100 |  |  |
| } |  |  |  |
| nrofPorts | p8 |  |  |
| firstOFDMSymbolInTimeDomain | 5,9 |  |  |
| cdm-Type | cdm4-FD2-TD2 |  |  |
| } |  |  |  |

Table 6.3.3.2.7.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 5.4.2, Table5.4.2.0-21 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.3.3.2.7.4.3.1-4: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
|  |  |  |  |

Table 6.3.3.2.7.4.3.1-5: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| moreThanTwo SEQUENCE { |  |  |  |
| n1-n2 CHOICE { |  |  |  |
| four-one-TypeI-SinglePanel-Restriction | FFFF |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 00000001 |  |  |

Table 6.3.3.2.7.4.3.1-6: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 8 |  |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |
|  |  |  |  |
| } |  |  |  |

Table 6.3.3.2.7.4.3.1-7: Physical layer parameters for DCI format 1\_1

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

Table 6.3.3.2.7.4.3.1-8: *CellGroupConfig*

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

Table 6.3.3.2.7.4.3.1-9: *ControlResourceSet*

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

Table 6.3.3.2.7.4.3.1-10: *PDSCH-Config*

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

Table 6.3.3.2.7.4.3.1-11: *TCI-State*

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

Table 6.3.3.2.7.4.3.1-12: *NZP-CSI-RS-Resource*

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

6.3.3.2.7.4.3.2 Message contents for NSA

Same as in clause 6.3.3.2.7.4.3.1.

6.3.3.2.7.5 Test requirement

Table 6.3.3.2.7.5-1: Test requirement

|  |  |
| --- | --- |
| Parameter | Test 1 |
|  | 1.59 |

## 6.4 Reporting of Rank Indicator (RI)

### 6.4.1 1RX requirements (Void)

### 6.4.2 2RX requirements

#### 6.4.2.1 FDD

##### 6.4.2.1\_1 2Rx FDD FR1 RI reporting for both SA and NSA

6.4.2.1\_1.1 Test Purpose

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.

6.4.2.1\_1.2 Test applicability

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

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

6.4.2.1\_1.3 Minimum Conformance Requirements

The minimum performance requirement in Table 6.4.2.1\_1.3-2 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 ≥ ;

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 ≥ ;

For the parameters specified in Table 6.4.2.1\_1.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.4.2.1\_1.3-2.

Table 6.4.2.1\_1.3-1: RI Test (FDD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Test 1** | **Test 2** | **Test 3** |
| Bandwidth | | | MHz | 10 | 10 | 10 |
| Subcarrier spacing | | | kHz | 15 | 15 | 15 |
| Duplex Mode | | |  | FDD | FDD | FDD |
| SNR | | | dB | 0 | 20 | 20 |
| Propagation channel | | |  | TDLA30-5 | TDLA30-5 | TDLA30-5 |
| Antenna configuration | | |  | ULA Low 2x2 | ULA Low 2x2 | ULA 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 |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | Periodic | Periodic |
| Number of CSI-RS ports (*X*) | |  | 4 | 4 | 4 |
| CDM Type | |  | FD-CDM2 | FD-CDM2 | FD-CDM2 |
| Density (ρ) | |  | 1 | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5,(4) | Row (5,4) | Row 5,(4) |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | (9) | (9) | (9) |
| CSI-RS  periodicity and offset | | slot | 5/1 | 5/1 | 5/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | Periodic | Periodic |
| Number of CSI-RS ports (*X*) | |  | 2 | 2 | 2 |
| CDM Type | |  | FD-CDM2 | FD-CDM2 | FD-CDM2 |
| Density (ρ) | |  | 1 | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0 ) | |  | Row 3 (6) | Row 3 (6) | Row 3 (6) |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | (13) | (13) | (13) |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 5/1 | 5/1 | 5/1 |
| CSI-IM configuration | CSI-IM resource Type | |  | Periodic | Periodic | Periodic |
| CSI-IM RE pattern | |  | Pattern 0 | Pattern 0 | Pattern 0 |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) | |  | (4,9) | (4,9) | (4,9) |
| CSI-IM timeConfig  periodicity and offset | | slot | 5/1 | 5/1 | 5/1 |
| ReportConfigType | | |  | Periodic | Periodic | Periodic |
| CQI-table | | |  | Table 2 | Table 2 | Table 2 |
| reportQuantity | | |  | cri-RI-PMI-CQI | cri-RI-PMI-CQI | cri-RI-PMI-CQI |
| timeRestrictionForChannelMeasurements | | |  | not configured | not configured | not configured |
| timeRestrictionForInterferenceMeasurements | | |  | not configured | not configured | not configured |
| cqi-FormatIndicator | | |  | Wideband | Wideband | Wideband |
| pmi-FormatIndicator | | |  | Wideband | Wideband | Wideband |
| Sub-band Size | | | RB | 8 | 8 | 8 |
| csi-ReportingBand | | |  | 1111111 | 1111111 | 1111111 |
| CSI-Report periodicity and offset | | | slot | 5/0 | 5/0 | 5/0 |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | typeI-SinglePanel | typeI-SinglePanel |
| Codebook Mode |  | 1 | 1 | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | N/A | N/A | N/A |
| 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 | | |  | PUCCH | PUCCH | PUCCH |
| CQI/RI/PMI delay | | | ms | 8 | 8 | 8 |
| 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.4-2. TBS.2-1 is used for Rank 1 case. TBS.2-2 is used for Rank 2 case. | | | | | | |

Table 6.4.2.1\_1.3-2: Minimum requirement (FDD)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Test 1** | **Test 2** | **Test 3** |
| **1 | N/A | 1.05 | 0.9 |
| **2 | 1.0 | N/A | N/A |

The normative reference for this requirement is TS 38.101-4 [2] clause 6.4.2.1.

6.4.2.1\_1.4 Test Description

6.4.2.1\_1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state. The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 of 38.521-1.

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

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

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

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

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

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.4.2.1\_1.3-1 as appropriate.

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

4. Propagation conditions for the NR cell are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, *Connected without release On* and Test Mode ON for SA or EN-DC, DC bearer *MCG* and *SCG, Connected without release On* and Test Mode ON for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 6.4.2.1\_1.4.3.

6.4.2.1\_1.4.2 Test procedure

1. Set the parameters of bandwidth, reference channel, the propagation condition, antenna configuration, antenna correlation, Codebook configuration, Beamforming Model, RI configuration and SNR according to Table 6.4.2.1\_1.3-1 as appropriate.

2. The SS shall send PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE reported CQI (wideband CQI), PMI and fixed RI as defined in Table 6.4.2.1\_1.3-1. The SS sends downlink MAC padding bits on the DL RMC. Measure theaccording to Annex G.3. 3.

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

4. The SS shall transmit an RRC Connection Reconfiguration message to set codebookSubsetRestriction as for UE reported RI according to Table 6.4.2.1\_1.3-1.

5. The UE shall transmit RRC Connection Reconfiguration Complete message.

6. Propagation conditions are set according to Table 6.4.2.1\_1.3-1.

7. The SS shall send PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE reported CQI (wideband CQI), PMI and RI. The SS sends downlink MAC padding bits on the DL RMC. Measure according to Annex G.3.3.  
If the ratio ( / ) satisfies the requirement in Table 6.4.2.1\_1.5-1, then pass the UE for this test and go to step 8. Otherwise, declare a FAIL verdict.

8. If all tests have not been done, then repeat the same procedure (steps 1 to 7) with test conditions according to the Table 6. 4.2. 1\_1.3-2 for the other Tests as appropriate. Otherwise, declare a PASS verdict.

6.4.2.1\_1.4.3 Message Contents

6.4.2.1\_1.4.3.1 Message exceptions for SA

Table 6.4.2.1\_1.4.3.1-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | periodic |  |  |
| } |  |  |  |

Table 6.4.2.1\_1.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 001000 | row3, k0=6 |  |
| } |  |  |  |
| nrofPorts | p2 |  |  |
| firstOFDMSymbolInTimeDomain | 13 |  |  |
| } |  |  |  |

Table 6.4.2.1\_1.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 | row5, k0=4 |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.4.2.1\_1.4.3.1-4: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
| periodicityAndOffset | CSI-ResourcePeriodicityAndOffset |  |  |

Table 6.4.2.1\_1.4.3.1-5: *CSI-ResourcePeriodicityAndOffset*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-43 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset CHOICE { |  |  |  |
| Slots5 | 1 |  |  |
| } |  |  |  |

Table 6.4.2.1\_1.4.3.1-6: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| Two SEQUENCE { |  |  |  |
|  |  |  |  |
| twoTX-CodebookSubsetRestriction | 010000 | Fixed rank 2 |  |
|  | 000011 | Fixed rank 1 |  |
| 010011 | Following rank |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 11111111 | Non restriction |  |

Table 6.4.2.1\_1.4.3.1-7: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| periodic SEQUENCE { |  |  |  |
| reportSlotConfig CHOICE { | slots5 |  |  |
| slots5 | 0 |  |  |
| } |  |  |  |
| pucch-CSI-ResourceList | 9 | PUCCH format Id=9 |  |
| } |  |  |  |
|  |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

6.4.2.1\_1.4.3.2 Message exceptions for NSA

Same as in clause 6.4.2.1\_1.4.3.1.

6.4.2.1\_1.5 Test Requirements

Table 6.4.2.1\_1.5-1: Test Requirement (FDD)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Test 1** | **Test 2** | **Test 3** |
| **1 | N/A | 1.04 | 0.89 |
| **2 | 0.99 | N/A | N/A |

##### 6.4.2.1.1 2Rx FDD FR1 RI reporting for RedCap

6.4.2.1.1.1 Test Purpose

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.

6.4.2.1.1.2 Test applicability

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

6.4.2.1.1.3 Minimum Conformance Requirements

The minimum performance requirement in Table 6.4.2.1.1.3-2 is defined as the ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be ≥ .

For the parameters specified in Table 6.4.2.1.1.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.4.2.1.1.3-2.

Table 6.4.2.1.1.3-1: RI Test (FDD)

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** |
| Bandwidth | | MHz | 10 |
| Subcarrier spacing | | kHz | 15 |
| Duplex Mode | |  | FDD |
| SNR | | dB | 20 |
| Propagation channel | |  | TDLA30-5 |
| Antenna configuration | |  | ULA Low 2x2 |
| Beamforming Model | |  | As defined in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 5,(4) |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | (9) |
| CSI-RS  periodicity and offset | slot | 10/5 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 2 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 3 (6) |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | (13) |
| NZP CSI-RS-timeConfig  periodicity and offset | slot | 10/5 |
| 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 | 10/5 |
| ReportConfigType | |  | Periodic |
| CQI-table | |  | Table 1 |
| reportQuantity | |  | cri-RI-PMI-CQI |
| timeRestrictionForChannelMeasurements | |  | not configured |
| timeRestrictionForInterferenceMeasurements | |  | not configured |
| cqi-FormatIndicator | |  | Wideband |
| pmi-FormatIndicator | |  | Wideband |
| Sub-band Size | | RB | 8 |
| csi-ReportingBand | |  | 1111111 |
| CSI-Report periodicity and offset | | slot | 10/9 |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | N/A |
| CodebookSubsetRestriction |  | 000011 for fixed rank 1, 010011 for following rank |
| RI Restriction |  | N/A |
| Physical channel for CSI report | |  | PUCCH |
| CQI/RI/PMI delay | | ms | 10 |
| Maximum number of HARQ transmission | |  | 1 |
| RI Configuration | |  | Fixed RI = 1 and follow RI |
| Note 1: Measurement channels are specified in Table A.4-1. TBS.1-3 is used for Rank 1 case. TBS.1-4 is used for Rank 2 case. | | | |

Table 6.4.2.1.1.3-2: Minimum requirement (FDD)

|  |  |
| --- | --- |
|  | **Test 1** |
| **1 | 1.05 |

The normative reference for this requirement is TS 38.101-4 [2] clause 6.4.2.1.1.

6.4.2.1.1.4 Test Description

6.4.2.1.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state. The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 of 38.521-1.

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

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

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

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

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.4.2.1.1.3-1 as appropriate.

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

4. Propagation conditions for the NR cell are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, *Connected without Release On, Test Mode* On according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 6.4.2.1.1.4.3.

6.4.2.1.1.4.2 Test procedure

1. Set the parameters of bandwidth, reference channel, the propagation condition, antenna configuration, antenna correlation, Codebook configuration, Beamforming Model, RI configuration and SNR according to Table 6.4.2.1.1.3-1 as appropriate.

2. The SS shall send PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE reported CQI (wideband CQI), PMI and fixed RI as defined in Table 6.4.2.1.1.3-1. The SS sends downlink MAC padding bits on the DL RMC. Measure theaccording to Annex G.3. 3.

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

4. The SS shall transmit an RRC Connection Reconfiguration message to set codebookSubsetRestriction as for UE reported RI according to Table 6.4.2.1.1.3-1.

5. The UE shall transmit RRC Connection Reconfiguration Complete message.

6. Propagation conditions are set according to Table 6.4.2.1.1.3-1.

7. The SS shall send PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE reported CQI (wideband CQI), PMI and RI. The SS sends downlink MAC padding bits on the DL RMC. Measure according to Annex G.3.3.  
If the ratio ( / ) satisfies the requirement in Table 6.4.2.1.1.5-1, then pass the UE. Otherwise, declare a FAIL verdict.

6.4.2.1.1.4.3 Message Contents

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

Table 6.4.2.1.1.4.3-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | periodic |  |  |
| } |  |  |  |

Table 6.4.2.1.1.4.3-2: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 001000 | row3, k0=6 |  |
| } |  |  |  |
| nrofPorts | p2 |  |  |
| firstOFDMSymbolInTimeDomain | 13 |  |  |
| } |  |  |  |

Table 6.4.2.1.1.4.3-3: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 | row5, k0=4 |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.4.2.1.1.4.3-4: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
| periodicityAndOffset | CSI-ResourcePeriodicityAndOffset |  |  |

Table 6.4.2.1.1.4.3-5: *CSI-ResourcePeriodicityAndOffset*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-43 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset CHOICE { |  |  |  |
| Slots10 | 5 |  |  |
| } |  |  |  |

Table 6.4.2.1.1.4.3-6: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| Two SEQUENCE { |  |  |  |
|  |  |  |  |
| twoTX-CodebookSubsetRestriction | 000011 | Fixed rank 1 |  |
|  | 010011 | Following rank |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 11111111 | Non restriction |  |

Table 6.4.2.1.1.4.3-7: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| periodic SEQUENCE { |  |  |  |
| reportSlotConfig CHOICE { | slots10 |  |  |
| slots10 | 9 |  |  |
| } |  |  |  |
| pucch-CSI-ResourceList | 9 | PUCCH format Id=9 |  |
| } |  |  |  |
|  |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |
| cqi-Table | table1 |  |  |
| } |  |  |  |

6.4.2.1.1.5 Test Requirements

Table 6.4.2.1.1.5-1: Test Requirement (FDD)

|  |  |
| --- | --- |
|  | **Test 1** |
| **1 | 1.04 |

#### 6.4.2.2 TDD

##### 6.4.2.2\_1 2Rx TDD FR1 RI reporting for both SA and NSA

6.4.2.2\_1.1 Test Purpose

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.

6.4.2.2\_1.2 Test applicability

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

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

6.4.2.2\_1.3 Minimum Conformance Requirements

The minimum performance requirement in Table 6.4.2.2\_1.3-2 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 ≥ ;

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 ≥ ;

For the parameters specified in Table 6.4.2.2\_1.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.4.2.2\_1.3-2.

Table 6.4.2.2\_1.3-1: RI Test (TDD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | Test 2 | Test 3 |
| Bandwidth | | | MHz | 40 | 40 | 40 |
| Subcarrier spacing | | | kHz | 30 | 30 | 30 |
| Duplex Mode | | |  | TDD | TDD | TDD |
| TDD Slot Configuration | | |  | FR1.30-1 | FR1.30-1 | FR1.30-1 |
| SNR | | | dB | 0 | 20 | 20 |
| Propagation channel | | |  | TDLA30-5 | TDLA30-5 | TDLA30-5 |
| Antenna configuration | | |  | ULA Low 2x2 | ULA Low 2x2 | ULA 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 |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | Periodic | Periodic |
| Number of CSI-RS ports (*X*) | |  | 4 | 4 | 4 |
| CDM Type | |  | FD-CDM2 | FD-CDM2 | FD-CDM2 |
| Density (ρ) | |  | 1 | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5, (4) | Row 5, (4) | Row 5, (4) |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | (9) | (9) | (9) |
| CSI-RS  periodicity and offset | | slot | 10/1 | 10/1 | 10/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Periodic | Periodic | Periodic |
| Number of CSI-RS ports (*X*) | |  | 2 | 2 | 2 |
| CDM Type | |  | FD-CDM2 | FD-CDM2 | FD-CDM2 |
| Density (ρ) | |  | 1 | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 3 (6) | Row 3 (6) | Row 3 (6) |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | (13) | (13) | (13) |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 10/1 | 10/1 | 10/1 |
| CSI-IM configuration | CSI-IM resource Type | |  | Periodic | Periodic | Periodic |
| CSI-IM RE pattern | |  | Pattern 0 | Pattern 0 | Pattern 0 |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) | |  | (4,9) | (4,9) | (4,9) |
| CSI-IM timeConfig  periodicity and offset | | slot | 10/1 | 10/1 | 10/1 |
| ReportConfigType | | |  | Periodic | Periodic | Periodic |
| CQI-table | | |  | Table 2 | Table 2 | Table 2 |
| reportQuantity | | |  | cri-RI-PMI-CQI | cri-RI-PMI-CQI | cri-RI-PMI-CQI |
| timeRestrictionForChannelMeasurements | | |  | not configured | not configured | not configured |
| timeRestrictionForInterferenceMeasurements | | |  | not configured | not configured | not configured |
| cqi-FormatIndicator | | |  | Wideband | Wideband | Wideband |
| pmi-FormatIndicator | | |  | Wideband | Wideband | Wideband |
| Sub-band Size | | | RB | 16 | 16 | 16 |
| csi-ReportingBand | | |  | 1111111 | 1111111 | 1111111 |
| CSI-Report periodicity and offset | | | slot | 10/9 | 10/9 | 10/9 |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | typeI-SinglePanel | typeI-SinglePanel |
| Codebook Mode |  | 1 | 1 | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | N/A | N/A | N/A |
| 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 | | |  | PUCCH | PUCCH | PUCCH |
| CQI/RI/PMI delay | | | ms | 9.5 | 9.5 | 9.5 |
| 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.4-2. TBS.2-3 is used for Rank 1 case. TBS.2-4 is used for Rank 2 case. | | | | | | |

Table 6.4.2.2\_1.3-2: Minimum requirement (TDD)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Test 1 | Test 2 | Test 3 |
| **1 | N/A | 1.05 | 0.9 |
| **2 | 1.0 | N/A | N/A |

The normative reference for this requirement is TS 38.101-4 [2] clause 6.4.2.2.

6.4.2.2\_1.4 Test Description

6.4.2.2\_1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state. The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 of 38.521-1.

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7 for TE diagram and section A.3.2.3 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.4.2.2\_1.3-1 as appropriate.

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

4. Propagation conditions for the NR cell are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, *Connected without release On* and Test Mode ON for SA or EN-DC, DC bearer *MCG* and *SCG, Connected without release On* and Test Mode ON for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 6.4.2.2\_1.4.3.

6.4.2.2\_1.4.2 Test procedure

1. Set the parameters of bandwidth, reference channel, the propagation condition, antenna configuration, antenna correlation, Codebook configuration, Beamforming Model, RI configuration and SNR according to Table 6.4.2.2\_1.3-1 as appropriate.

2. The SS shall send PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE reported CQI (wideband CQI), PMI and fixed RI as defined in Table 6.4.2.2\_1.3-1. The SS sends downlink MAC padding bits on the DL RMC. Measure theaccording to Annex G.3. 3.

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

4. The SS shall transmit an RRC Connection Reconfiguration message to set codebookSubsetRestriction as for UE reported RI according to Table 6.4.2.2\_1.3-1.

5. The UE shall transmit RRC Connection Reconfiguration Complete message.

6. Propagation conditions are set according to Table 6.4.2.2\_1.3-1.

7. The SS shall send PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE reported CQI (wideband CQI), PMI and RI. The SS sends downlink MAC padding bits on the DL RMC. Measure according to Annex G.3.3.  
If the ratio ( / ) satisfies the requirement in Table 6.4.2.2\_1.5-1, then pass the UE for this test and go to step 8. Otherwise, declare a FAIL verdict.

8. If all tests have not been done, then repeat the same procedure (steps 1 to 7) with test conditions according to the Table 6.4.2.2\_1.3-2 for the other Tests as appropriate. Otherwise, declare a PASS verdict.

6.4.2.2\_1.4.3 Message Contents

6.4.2.2\_1.4.3.1 Message Contents for SA

Table 6.4.2.2\_1.4.3.1-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | periodic |  |  |
| } |  |  |  |

Table 6.4.2.2\_1.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 001000 | row3, k0=6 |  |
| } |  |  |  |
| nrofPorts | p2 |  |  |
| firstOFDMSymbolInTimeDomain | 13 |  |  |
| } |  |  |  |

Table 6.4.2.2\_1.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 | row5, k0=4 |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.4.2.2\_1.4.3.1-4: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
| periodicityAndOffset | CSI-ResourcePeriodicityAndOffset |  |  |

Table 6.4.2.2\_1.4.3.1-5: *CSI-ResourcePeriodicityAndOffset*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.2-43 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset CHOICE { |  |  |  |
| Slots10 | 1 |  |  |
| } |  |  |  |

Table 6.4.2.2\_1.4.3.1-6: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| Two SEQUENCE { |  |  |  |
|  |  |  |  |
| twoTX-CodebookSubsetRestriction | 010000 | Fixed rank 2 |  |
|  | 000011 | Fixed rank 1 |  |
| 010011 | Following rank |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 11111111 | Non restriction |  |

Table 6.4.2.2\_1.4.3.1-7: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| periodic SEQUENCE { |  |  |  |
| reportSlotConfig CHOICE { | slots10 |  |  |
| slots10 | 9 |  |  |
| } |  |  |  |
| pucch-CSI-ResourceList | 9 | PUCCH format Id=9 |  |
| } |  |  |  |
|  |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

6.4.2.2\_1.4.3.2 Message exceptions for NSA

Same as in clause 6.4.2.1.2.1.4.3\_1.

6.4.2.2\_1.5 Test Requirements

Table 6.4.2.2\_1.5-1: Test Requirement (TDD)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Test 1 | Test 2 | Test 3 |
| **1 | N/A | 1.04 | 0.89 |
| **2 | 0.99 | N/A | N/A |

##### 6.4.2.2.1 2Rx TDD FR1 RI reporting for RedCap

6.4.2.2.1.1 Test Purpose

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.

6.4.2.2.1.2 Test applicability

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

6.4.2.2.1.3 Minimum Conformance Requirements

The minimum performance requirement in Table 6.4.2.2.1.3-2 is defined as the ratio of the throughput obtained when transmitting based on UE reported RI and that obtained when transmitting with fixed rank 1 shall be ≥ .

For the parameters specified in Table 6.4.2.2.1.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.4.2.2.1.3-2.

Table 6.4.2.2.1.3-1: RI Test (TDD)

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** |
| Bandwidth | | MHz | 20 |
| Subcarrier spacing | | kHz | 30 |
| Duplex Mode | |  | TDD |
| TDD Slot Configuration | |  | FR1.30-1 |
| SNR | | dB | 20 |
| Propagation channel | |  | TDLA30-5 |
| Antenna configuration | |  | ULA Low 2x2 |
| Beamforming Model | |  | As defined in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 5,(4) |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | (9) |
| CSI-RS  periodicity and offset | slot | 10/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 2 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) |  | Row 3 (6) |
| First OFDM symbol in the PRB used for CSI-RS (l0) |  | (13) |
| 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 |
| ReportConfigType | |  | Periodic |
| CQI-table | |  | Table 1 |
| reportQuantity | |  | cri-RI-PMI-CQI |
| timeRestrictionForChannelMeasurements | |  | not configured |
| timeRestrictionForInterferenceMeasurements | |  | not configured |
| cqi-FormatIndicator | |  | Wideband |
| pmi-FormatIndicator | |  | Wideband |
| Sub-band Size | | RB | 8 |
| csi-ReportingBand | |  | 1111111 |
| CSI-Report periodicity and offset | | slot | 10/9 |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | N/A |
| CodebookSubsetRestriction |  | 000011 for fixed rank 1, 010011 for following rank |
| RI Restriction |  | N/A |
| Physical channel for CSI report | |  | PUCCH |
| CQI/RI/PMI delay | | ms | 9.5 |
| Maximum number of HARQ transmission | |  | 1 |
| RI Configuration | |  | Fixed RI = 1 and follow RI |
| Note 1: Measurement channels are specified in Table A.4-1. TBS.1-5 is used for Rank 1 case. TBS.1-6 is used for Rank 2 case. | | | |

Table 6.4.2.2.1.3-2: Minimum requirement (TDD)

|  |  |
| --- | --- |
|  | **Test 1** |
| **1 | 1.05 |

The normative reference for this requirement is TS 38.101-4 [2] clause 6.4.2.2.1.

6.4.2.2.1.4 Test Description

6.4.2.2.1.4.1 Initial conditions

Initial conditions are a set of test configurations the UE needs to be tested in and the steps for the SS to take with the UE to reach the correct measurement state. The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 of 38.521-1.

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

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

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

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

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.4.2.2.1.3-1 as appropriate.

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

4. Propagation conditions for the NR cell are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, *Connected without Release On, Test Mode* On according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 6.4.2.2.1.4.3.

6.4.2.2.1.4.2 Test procedure

1. Set the parameters of bandwidth, reference channel, the propagation condition, antenna configuration, antenna correlation, Codebook configuration, Beamforming Model, RI configuration and SNR according to Table 6.4.2.2.1.3-1 as appropriate.

2. The SS shall send PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE reported CQI (wideband CQI), PMI and fixed RI as defined in Table 6.4.2.2.1.3-1. The SS sends downlink MAC padding bits on the DL RMC. Measure theaccording to Annex G.3. 3.

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

4. The SS shall transmit an RRC Connection Reconfiguration message to set codebookSubsetRestriction as for UE reported RI according to Table 6.4.2.2.1.3-1.

5. The UE shall transmit RRC Connection Reconfiguration Complete message.

6. Propagation conditions are set according to Table 6.4.2.2.1.3-1.

7. The SS shall send PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE reported CQI (wideband CQI), PMI and RI. The SS sends downlink MAC padding bits on the DL RMC. Measure according to Annex G.3.3.  
If the ratio ( / ) satisfies the requirement in Table 6.4.2.2.1.5-1, then pass the UE. Otherwise, declare a FAIL verdict.

6.4.2.2.1.4.3 Message Contents

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

Table 6.4.2.2.1.4.3-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | periodic |  |  |
| } |  |  |  |

Table 6.4.2.2.1.4.3-2: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 001000 | row3, k0=6 |  |
| } |  |  |  |
| nrofPorts | p2 |  |  |
| firstOFDMSymbolInTimeDomain | 13 |  |  |
| } |  |  |  |

Table 6.4.2.2.1.4.3-3: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 | row5, k0=4 |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.4.2.2.1.4.3-4: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
| periodicityAndOffset | CSI-ResourcePeriodicityAndOffset |  |  |

Table 6.4.2.2.1.4.3-5: *CSI-ResourcePeriodicityAndOffset*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-43 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset CHOICE { |  |  |  |
| Slots10 | 1 |  |  |
| } |  |  |  |

Table 6.4.2.2.1.4.3-6: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| Two SEQUENCE { |  |  |  |
| twoTX-CodebookSubsetRestriction | 000011 | Fixed rank 1 |  |
|  | 010011 | Following rank |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 11111111 | Non restriction |  |

Table 6.4.2.2.1.4.3-7: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| periodic SEQUENCE { |  |  |  |
| reportSlotConfig CHOICE { | slots10 |  |  |
| slots10 | 9 |  |  |
| } |  |  |  |
| pucch-CSI-ResourceList | 9 | PUCCH format Id=9 |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |
| cqi-Table | table1 |  |  |
| } |  |  |  |

6.4.2.2.1.5 Test Requirements

Table 6.4.2.2.1.5-1: Test Requirement (FDD)

|  |  |
| --- | --- |
|  | **Test 1** |
| **1 | 1.04 |

### 6.4.3 4RX requirements

#### 6.4.3.1 FDD

##### 6.4.3.1\_1 4Rx FDD FR1 RI reporting for both SA and NSA

6.4.3.1\_1.1 Test Purpose

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.

6.4.3.1\_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports.

6.4.3.1\_1.3 Minimum Conformance Requirements

The minimum performance requirement in Table 6.4.3.1\_1.3-2 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 ≥ ;

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 ≥ ;

For the parameters specified in Table 6.4.3.1\_1.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.4.3.1\_1.3-2.

Table 6.4.3.1\_1.3-1: RI Test (FDD)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Test 1** | **Test 2** | **Test 3** | **Test 4** |
| Bandwidth | | | MHz | 10 | 10 | 10 | 10 |
| Subcarrier spacing | | | kHz | 15 | 15 | 15 | 15 |
| Duplex Mode | | |  | FDD | FDD | FDD | FDD |
| SNR | | | dB | -2 | 16 | 16 | 22 |
| Propagation channel | | |  | TDLA30-5 | TDLA30-5 | TDLA30-5 | TDLA30-5 |
| Antenna configuration | | |  | ULA Low 2x4 | ULA Low 2x4 | ULA High 2x4 | ULA Low 4x4 |
| Beamforming Model | | |  | As defined in Annex B.4.1 | As defined in Annex B.4.1 | As defined in Annex B.4.1 | As defined in Annex B.4.1 |
| ZP CSI-RS configuration | 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 |
| Density (ρ) | |  | 1 | 1 | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0 ) | |  | Row 5, (4) | Row 5, (4) | Row 5, (4) | Row 5, (4) |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | (9) | (9) | (9) | (9) |
| CSI-RS  periodicity and offset | | slot | 5/1 | 5/1 | 5/1 | 5/1 |
| NZP CSI-RS for CSI acquisition | 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 |
| Density (ρ) | |  | 1 | 1 | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0 ) | |  | Row 3 (6) | Row 3 (6) | Row 3 (6) | Row 4 (0) |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | (13) | (13) | (13) | (13) |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 5/1 | 5/1 | 5/1 | 5/1 |
| CSI-IM configuration | CSI-IM resource Type | |  | Periodic | Periodic | Periodic | Periodic |
| CSI-IM RE pattern | |  | Pattern 0 | Pattern 0 | Pattern 0 | Pattern 0 |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) | |  | (4,9) | (4,9) | (4,9) | (4,9) |
| CSI-IM timeConfig  periodicity and offset | | slot | 5/1 | 5/1 | 5/1 | 5/1 |
| ReportConfigType | | |  | Periodic | Periodic | Periodic | Periodic |
| CQI-table | | |  | Table 2 | Table 2 | Table 2 | Table 2 |
| reportQuantity | | |  | cri-RI-PMI-CQI | cri-RI-PMI-CQI | cri-RI-PMI-CQI | cri-RI-PMI-CQI |
| timeRestrictionForChannelMeasurements | | |  | not configured | not configured | not configured | not configured |
| timeRestrictionForInterferenceMeasurements | | |  | not configured | not configured | not configured | not configured |
| cqi-FormatIndicator | | |  | Wideband | Wideband | Wideband | Wideband |
| pmi-FormatIndicator | | |  | Wideband | Wideband | Wideband | Wideband |
| Sub-band Size | | | RB | 8 | 8 | 8 | 8 |
| csi-ReportingBand | | |  | 1111111 | 1111111 | 1111111 | 1111111 |
| CSI-Report periodicity and offset | | | slot | 5/0 | 5/0 | 5/0 | 5/0 |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | typeI-SinglePanel | typeI-SinglePanel | typeI-SinglePanel |
| Codebook Mode |  | 1 | 1 | 1 | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | N/A | N/A | N/A | (2,1) |
| 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 | 11111111 |
| RI Restriction |  | N/A | N/A | N/A | 00000010 for fixed Rank 2 and 00001111 for follow RI |
| Physical channel for CSI report | | |  | PUCCH | PUCCH | PUCCH | PUCCH |
| CQI/RI/PMI delay | | | ms | 8 | 8 | 8 | 8 |
| Maximum number of HARQ transmission | | |  | 1 | 1 | 1 | 1 |
| RI Configuration | | |  | Fixed RI = 2 and follow RI | Fixed RI = 1 and follow RI | Fixed RI = 1 and follow RI | Fixed RI = 2 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\_1.3-2: Minimum requirement (FDD)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Test 1** | **Test 2** | **Test 3** | **Test 4** |
| **1 | N/A | 1.05 | 0.9 | N/A |
| **2 | 0.9 | N/A | N/A | 0.9 |

The normative reference for this requirement is TS 38.101-4 [2] clause 6.4.3.1.

6.4.3.1\_1.4 Test Description

6.4.3.1\_1.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.4 or A.3.1.7.5 for TE diagram and section A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1, Table 6.4.3.1\_1.3-1 as appropriate.

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

4. Propagation conditions for the NR cell are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, *Connected without release On* and Test Mode ON for SA or (EN-DC, DC bearer *MCG* and *SCG, Connected without release On* for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 6.4.3.1\_1.4.3.

6.4.3.1\_1.4.2 Test procedure

1. Set the parameters of bandwidth, reference channel, the propagation condition, antenna configuration, antenna correlation, Codebook configuration, Beamforming Model, RI configuration and SNR according to Table 6.4.3.1\_1.3-1 as appropriate.

2. The SS shall send PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE reported CQI (wideband CQI), PMI and fixed RI as defined in Table 6.4.3.1\_1.3-1. The SS sends downlink MAC padding bits on the DL RMC. Measure theaccording to Annex G.3. 3.

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

4. The SS shall transmit an RRC Connection Reconfiguration message to set codebookSubsetRestriction as for UE reported RI according to Table 6.4.3.1\_1.3-1.

5. The UE shall transmit RRC Connection Reconfiguration Complete message.

6. Propagation conditions are set according to Table 6.4.3.1\_1.3-1.

7. The SS shall send PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE reported CQI (wideband CQI), PMI and RI. The SS sends downlink MAC padding bits on the DL RMC. Measure according to Annex G.3.3.  
If the ratio ( / ) satisfies the requirement in Table 6.4.3.1\_1.5-1, then pass the UE for this test and go to step 8. Otherwise, declare a FAIL verdict.

8. If all tests have not been done, then repeat the same procedure (steps 1 to 7) with test conditions according to the Table 6.4.3.1\_1.3-2 for the other Tests as appropriate. Otherwise, declare a PASS verdict.

6.4.3.1\_1.4.3 Message Contents

6.4.3.1\_1.4.3.1 Message exceptions for SA

Table 6.4.3.1\_1.4.3.1-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | periodic |  |  |
| } |  |  |  |

Table 6.4.3.1\_1.4.3.1-2: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 001000 | row3, k0=6 for test 1,2,3 |  |
| row 4 | 001 | row4, k0=0 for test 4 |  |
| } |  |  |  |
| nrofPorts | p2 | Test 1,2,3 |  |
|  | p4 | Test 4 |  |
| firstOFDMSymbolInTimeDomain | 13 |  |  |
| } |  |  |  |

Table 6.4.3.1\_1.4.3.1-3: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 | row5, k0=4 |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.4.3.1\_1.4.3.1-4: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
| periodicityAndOffset | CSI-ResourcePeriodicityAndOffset |  |  |

Table 6.4.3.1\_1.4.3.1-5: *CSI-ResourcePeriodicityAndOffset*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-43 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset CHOICE { |  |  |  |
| Slots5 | 1 |  |  |
| } |  |  |  |

Table 6.4.3.1\_1.4.3.1-6: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| Two SEQUENCE { |  |  |  |
|  |  |  |  |
| twoTX-CodebookSubsetRestriction | 010000 | Fixed rank 2 |  |
|  | 000011 | Fixed rank 1 |  |
| 010011 | Following rank for test 1,2,3 |  |
|  | 11111111 | Test 4 |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 11111111 | Non restriction for test 1,2,3 |  |
|  | 00000010 | For fixed Rank2 for test 4 |  |
|  | 00001111 | For follow RI for test 4 |  |

Table 6.4.3.1\_1.4.3.1-7: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| periodic SEQUENCE { |  |  |  |
| reportSlotConfig CHOICE { | slots5 |  |  |
| slots5 | 0 |  |  |
| } |  |  |  |
| pucch-CSI-ResourceList | 8 | PUCCH format Id=8 |  |
| } |  |  |  |
|  |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

6.4.3.1\_1.4.3.2 Message exceptions for NSA

Same as in clause 6.4.3.1\_1.4.3.1.

6.4.3.1\_1.5 Test Requirements

Table 6.4.3.1\_1.5-1: Minimum requirement (FDD)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Test 1** | **Test 2** | **Test 3** | **Test 4** |
| **1 | N/A | 1.04 | 0.89 | N/A |
| **2 | 0.89 | N/A | N/A | 0.89 |

#### 6.4.3.2 TDD

##### 6.4.3.2\_1 4Rx TDD FR1 RI reporting for both SA and NSA

6.4.3.2\_1.1 Test Purpose

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.

6.4.3.2\_1.2 Test applicability

This test applies to all types of NR UE release 15 and forward supporting 4 Rx antenna ports.

This test also applies to all types of EUTRA UE release 15 and forward supporting EN-DC and 4 Rx antenna ports.

6.4.3.2\_1.3 Minimum Conformance Requirements

The minimum performance requirement in Table 6.4.3.2\_1.3-2 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 ≥ ;

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 ≥ ;

For the parameters specified in Table 6.4.3.2\_1.3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.4.3.2\_1.3-2.

Table 6.4.3.2\_1.3-1: RI Test (TDD)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Test 1** | **Test 2** | **Test 3** | **Test 4** |
| Bandwidth | | | MHz | 40 | 40 | 40 | 40 |
| Subcarrier spacing | | | kHz | 30 | 30 | 30 | 30 |
| Duplex Mode | | |  | TDD | TDD | TDD | TDD |
| TDD Slot Configuration | | |  | FR1.30-1 | FR1.30-1 | FR1.30-1 | FR1.30-1 |
| SNR | | | dB | -2 | 16 | 16 | 22 |
| Propagation channel | | |  | TDLA30-5 | TDLA30-5 | TDLA30-5 | TDLA30-5 |
| Antenna configuration | | |  | ULA Low 2x4 | ULA Low 2x4 | ULA High 2x4 | ULA Low 4x4 |
| Beamforming Model | | |  | As defined in Annex B.4.1 | As defined in Annex B.4.1 | As defined in Annex B.4.1 | As defined in Annex B.4.1 |
| ZP CSI-RS configuration | 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 |
| Density (ρ) | |  | 1 | 1 | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 5, (4) | Row 5, (4) | Row 5, (4) | Row 5, (4) |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | (9) | (9) | (9) | (9) |
| CSI-RS  periodicity and offset | | slot | 10/1 | 10/1 | 10/1 | 10/1 |
| NZP CSI-RS for CSI acquisition | 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 |
| Density (ρ) | |  | 1 | 1 | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0) | |  | Row 3 (6) | Row 3 (6) | Row 3 (6) | Row 4 (0) |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | (13) | (13) | (13) | (13) |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 10/1 | 10/1 | 10/1 | 10/1 |
| CSI-IM configuration | CSI-IM resource Type | |  | Periodic | Periodic | Periodic | Periodic |
| CSI-IM RE pattern | |  | Pattern 0 | Pattern 0 | Pattern 0 | Pattern 0 |
| 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 |
| ReportConfigType | | |  | Periodic | Periodic | Periodic | Periodic |
| CQI-table | | |  | Table 2 | Table 2 | Table 2 | Table 2 |
| reportQuantity | | |  | cri-RI-PMI-CQI | cri-RI-PMI-CQI | cri-RI-PMI-CQI | cri-RI-PMI-CQI |
| timeRestrictionForChannelMeasurements | | |  | not configured | not configured | not configured | not configured |
| timeRestrictionForInterferenceMeasurements | | |  | not configured | not configured | not configured | not configured |
| cqi-FormatIndicator | | |  | Wideband | Wideband | Wideband | Wideband |
| pmi-FormatIndicator | | |  | Wideband | Wideband | Wideband | Wideband |
| Sub-band Size | | | RB | 16 | 16 | 16 | 16 |
| csi-ReportingBand | | |  | 1111111 | 1111111 | 1111111 | 1111111 |
| CSI-Report periodicity and offset | | | slot | 10/9 | 10/9 | 10/9 | 10/9 |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | typeI-SinglePanel | typeI-SinglePanel | typeI-SinglePanel |
| Codebook Mode |  | 1 | 1 | 1 | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | N/A | N/A | N/A | (2,1) |
| 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 | 11111111 |
| RI Restriction |  | N/A | N/A | N/A | 00000010 for fixed Rank 2 and 00001111 for follow RI |
| Physical channel for CSI report | | |  | PUCCH | PUCCH | PUCCH | PUCCH |
| CQI/RI/PMI delay | | | ms | 9.5 | 9.5 | 9.5 | 9.5 |
| Maximum number of HARQ transmission | | |  | 1 | 1 | 1 | 1 |
| RI Configuration | | |  | Fixed RI = 2 and follow RI | Fixed RI = 1 and follow RI | Fixed RI = 1 and follow RI | Fixed RI = 2 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\_1.3-2: Minimum requirement (TDD)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Test 1** | **Test 2** | **Test 3** | **Test 4** |
| **1 | N/A | 1.05 | 0.9 | N/A |
| **2 | 0.9 | N/A | N/A | 0.9 |

The normative reference for this requirement is TS 38.101-4 [2] clause 6.4.3.2.

6.4.3.2\_1.4 Test Description

6.4.3.2\_1.4.1 Initial conditions

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

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

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

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7 for TE diagram and section A.3.2.5 for UE diagram.

2. The parameter settings for the cell are set up according to Table 6.1.2-1 and Table 6.4.3.2\_1.3-1 as appropriate.

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

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR, *Connected without release On* and Test Mode ON for SA or EN-DC, DC bearer *MCG* and *SCG, Connected without release On* and Test Mode ON for NSA according to TS 38.508-1 [6] clause 4.5. Message contents are defined in clause 6.4.3.2\_1.4.3.

6.4.3.2\_1.4.2 Test procedure

1. Set the parameters of bandwidth, reference channel, the propagation condition, antenna configuration, antenna correlation, Codebook configuration, Beamforming Model, RI configuration and SNR according to Table 6.4.3.2\_1.3-1 as appropriate.

2. The SS shall send PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE reported CQI (wideband CQI), PMI and fixed RI as defined in Table 6.4.3.2\_1.3-1. The SS sends downlink MAC padding bits on the DL RMC. Measure theaccording to Annex G.3.3.

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

4. The SS shall transmit an RRC Connection Reconfiguration message to set codebookSubsetRestriction as for UE reported RI according to Table 6.4.3.2\_1.3-1.

5. The UE shall transmit RRC Connection Reconfiguration Complete message.

6. Propagation conditions are set according to Table 6.4.3.2\_1.3-1.

7. The SS shall send PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE reported CQI (wideband CQI), PMI and RI. The SS sends downlink MAC padding bits on the DL RMC. Measure according to Annex G.3.3.

If the ratio ( / ) satisfies the requirement in Table 6.4.3.2\_1.5-1, then pass the UE for this test and go to step 8. Otherwise, declare a FAIL verdict.

8. If all tests have not been done, then repeat the same procedure (steps 1 to 7) with test conditions according to the Table 6.4.3.2\_1.3-2 for the other Tests as appropriate. Otherwise, declare a PASS verdict.

6.4.3.2\_1.4.3 Message Contents

Message contents are according to TS 38.508-1 [6] clause 4.6 with the following exceptions:

Table 6.4.3.2\_1.4.3-1: CSI-RS-ResourceMapping for NZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 001000 |  | Test1, 2, 3 |
| row4 | 001 |  | Test4 |
| } |  |  |  |
| nrofPorts | p2 |  | Test1, 2, 3 |
| p4 |  | Test4 |
| firstOFDMSymbolInTimeDomain | 13 |  |  |
| } |  |  |  |

Table 6.4.3.2\_1.4.3-2: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| other | 000100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 9 |  |  |
| } |  |  |  |

Table 6.4.3.2\_1.4.3-3: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern |  |  |  |
| pattern0 SEQUENCE { |  |  |  |
| subcarrierLocation-p0 | s4 |  |  |
| symbolLocation-p0 | 9 |  |  |
| } |  |  |  |
| periodicityAndOffset | CSI-ResourcePeriodicityAndOffset |  |  |

Table 6.4.3.2\_1.4.3-4: *CSI-ResourcePeriodicityAndOffset*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-43 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset CHOICE { |  |  |  |
| slots10 | 1 |  |  |
| } |  |  |  |

Table 6.4.3.2\_1.4.3-5: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| two SEQUENCE { |  |  |  |
| twoTX-CodebookSubsetRestriction | 010000 |  | Fixed rank 2 |
| 000011 |  | Fixed rank 1 |
| 010011 |  | Following rank |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 11111111 |  |  |

Table 6.4.3.2\_1.4.3-6: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ReportConfig ::= SEQUENCE { |  |  |  |
| reportConfigType CHOICE { |  |  |  |
| periodic SEQUENCE { |  |  |  |
| reportSlotConfig CHOICE { | slot10 |  |  |
| slot10 | 9 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands7 | 1111111 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

6.4.3.2\_1.5 Test Requirements

Table 6.4.3.2\_1.5-1: Test Requirement (TDD)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Test 1** | **Test 2** | **Test 3** | **Test 4** |
| **1 | N/A | 1.04 | 0.89 | N/A |
| **2 | 0.89 | N/A | N/A | 0.89 |

# 7 Demodulation performance requirements (Radiated requirements)

## 7.1 General

For conformance testing involving FR2 test cases in this specification, the UE under test shall be pre-configured with UL Tx diversity schemes disabled to account for single polarization System Simulator (SS) in the test environment. The UE under test may transmit with dual polarization.

### 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 [3] with FDL\_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 antenna ports | PDSCH | All tests in Clause 7.2.2 |
| 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 | 1)Up to 16 DL carriers  2)Same numerology across carrier for data/control channel at a given time |
| PDSCH repetitions over multiple slots *(pdsch-RepetitionMultiSlots)* | FR2 TDD | PDSCH | Clause 7.2.2.2.2 |  |
| Alternative 64QAM MCS table for PDSCHNew 64QAM MCS table for PDSCH (*dl-64QAM-MCS-TableAlt*) | FR2 TDD | PDSCH | Clause 7.2.2.2.2 |  |
| 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 signaling

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 type | | 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 |
| Support of PT-RS with one antenna port for DL reception (*onePortsPTRS*) | FR2 TDD | PDSCH | Clause 7.2 |  |
| SDR | Clause 7.5.1  Clause 7.5A.1 |
| PCell operation on FR2 (*pCell-FR2*) | 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 Section 5.5A.1 of TS 38.101-2 [3]. CA\_N corresponds to NR CA configurations and bandwidth combination sets defined in Section 5.5A.2 of TS 38.101-2 [3]. CA\_AX corresponds to NR CA configurations and bandwidth combination sets defined in Clause 5.5A.3 of TS 38.101-2 [3]. | |

##### 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 Section 5.5A of TS 38.101-2 [3]. 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 Section 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 and FRCs used in the test. | | | |

#### 7.1.1.6 FFS

#### 7.1.1.7 Applicability of requirements for RedCap

The performance requirements in Table 7.1.1.7-1 shall apply for UEs which support optional feature *supportOfRedCap*.

Table 7.1.1.7-1: Requirements applicability for RedCap

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE capability | Test type | | Test list | Applicability notes |
| RedCap with 2RX | FR2 TDD | PDSCH | Clause 7.2.2.2.1 (Tests 1-1, 2-2, and 2-6) |  |
|  | PDCCH | Clause 7.3.2.2.1 (Test 1-2)  Clause 7.3.2.2.2 (Test 2-1) |  |
|  | PBCH | Clause 7.4.2.2 (Table 7.4.2.2-2 Tests 1 and 2)  Clause 7.4.2.2 (Table 7.4.2.2-3 Tests 1 and 2) |  |
|  | SDR | Clause 7.5.2 |  |

### 7.1.1\_1 Applicability of test requirements due to maximum achievable SNR

Table 7.1.1\_1-1,Table 7.1.1\_1.1-1a, Table 7.1.1\_1-1b and Table 7.1.1\_1.1-1c specify the current assumption of maximum testable SNRBB for indirect farfield (IFF), PC3 and PC1, Max device size ≤ 30 cm under fading conditions.

Table 7.1.1\_1-1: PC3 maximum testable SNRBB under fading conditions for modulations up to 64 QAM

|  |  |  |  |
| --- | --- | --- | --- |
| Operating Band / Frequency | Maximum testable SNRBB (dB) | | |
| CHBW 50 MHz | CHBW 100 MHz | CHBW 200 MHz |
| n257 mid | 30.6 | 27.5 | 24.4 |
| n258 mid | 30.6 | 27.5 | 24.4 |
| n259 mid | 20.4 | 17.2 | 14.1 |
| n260 mid | 24.4 | 21.2 | 18.2 |
| n261 mid | 30.6 | 27.5 | 24.4 |

Table 7.1.1\_1-1a: PC3 maximum testable SNRBB under fading conditions for 256QAM modulation for DEMOD scenarios

|  |  |  |  |
| --- | --- | --- | --- |
| Operating Band / Frequency | Maximum testable SNRBB (dB) | | |
| CHBW 50 MHz | CHBW 100 MHz | CHBW 200 MHz |
| n257 mid | 29.1 | 25.9 | 22.9 |
| n258 mid | 29.1 | 25.9 | 22.9 |
| n259 mid | 18.8 | 15.6 | 12.5 |
| n260 mid | 22.9 | 19.7 | 16.6 |
| n261 mid | 29.1 | 25.9 | 22.9 |

Table 7.1.1\_1-1b: PC1 maximum testable SNRBB under fading conditions for modulations up to 64 QAM

|  |  |  |  |
| --- | --- | --- | --- |
| Operating Band / Frequency | Maximum testable SNRBB (dB) | | |
| CHBW 50 MHz | CHBW 100 MHz | CHBW 200 MHz |
| n257 mid | 40.6 | 37.4 | 34.4 |
| n258 mid | 40.6 | 37.4 | 34.4 |
| n259 mid | FFS | FFS | FFS |
| n260 mid | 34.0 | 30.8 | 27.8 |
| n261 mid | 40.6 | 37.4 | 34.4 |

Table 7.1.1\_1-1c: PC1 maximum testable SNRBB under fading conditions for 256QAM modulation for DEMOD scenarios

|  |  |  |  |
| --- | --- | --- | --- |
| Operating Band / Frequency | Maximum testable SNRBB (dB) | | |
| CHBW 50 MHz | CHBW 100 MHz | CHBW 200 MHz |
| n257 mid | 39.0 | 35.9 | 32.9 |
| n258 mid | 39.0 | 35.9 | 32.9 |
| n259 mid | TBD | TBD | TBD |
| n260 mid | 32.4 | 29.3 | 26.3 |
| n261 mid | 39.0 | 35.9 | 32.9 |

Based on the current assumption of maximum testable SNRBB, the applicability of test points is defined in Table 7.1.1\_1-2 and Table 7.1.1\_1-2a for indirect farfield (IFF), PC3 and PC1, Max device size size ≤ 30 cm under fading conditions.

Table 7.1.1\_1-2: Testability of test requirements due to maximum achievable SNR per band for PC3 and for intra-band contiguous CA

Editor’s note: n259 and n260 test point applicability for > 200MHz Aggregated ChBW is in []

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Case | Test point | CHBW / MHz | Fading | SNR test requirement | Test Point Applicability | | | | |
| n257 | n258 | n259 | n260 | n261 |
| 7.2.2.2.1\_1 | 1-1 | 100 | Yes | 1.4 | x | x | x | x | x |
|  | 1-2 | 100 | Yes | 3.6 | x | x | x | x | x |
|  | 1-3 | 100 | Yes | 14.2 | x | x | x | x | x |
|  | 2-1 | 100 | Yes | 5.8 | x | x | x | x | x |
|  | 2-2 | 100 | Yes | 16.0 | x | x | x | x | x |
|  | 2-3 | 50 | Yes | 15.7 | x | x | x | x | x |
|  | 2-4 | 200 | Yes | 15.8 | x | x | - | x | x |
|  | 2-5 | 50 | Yes | 16 | x | x | x | x | x |
|  | 2-6 | 100 | Yes | 20.3 | x | x | - | x | x |
| 7.2.2.2.1\_2 | 3-1 | 100 | Yes | 20.7 | x | x | - | x | x |
| 7.2.2.2.1\_3 | 1-4 | 50 | Yes | 22.0 | x | x |  | x | x |
| 7.2.2.2.2\_1 | 1-1 | 100 | Yes | 0.7 | x | x | x | x | x |
| 7.2.2.2.3\_1 | 1-1 | 100 | Yes | 3.1 | x | x | x | x | x |
| 7.2A.2.1 | - | BWagg ≤ 300 | Yes | 12.0 | x | x | [x] | [x] | x |
|  | - | 300 < BWagg ≤ 400 | Yes | 12.0 | x | x | - | [x] | x |
|  | - | BWagg > 400 | Yes | 12.0 | TBD | TBD | - | TBD | TBD |
| 7.2A.2.2 | - | BWagg ≤ 300 | Yes | 12.0 | x | x | [x] | [x] | x |
|  | - | 300 < BWagg ≤ 400 | Yes | 12.0 | x | x | - | X | x |
|  | - | BWagg > 400 | Yes | 12.0 | TBD | TBD | - | TBD | TBD |
| 7.2A.2.3 | - | BWagg ≤ 300 | Yes | 12.0 | x | x | [x] | [x] | x |
|  | - | 300 < BWagg ≤ 400 | Yes | 12.0 | x | x | - | [x] | x |
|  | - | BWagg > 400 | Yes | 12.0 | TBD | TBD | - | TBD | TBD |
| 7.3.2.2.1 | 1-1 | 100 | Yes | 7.7 | x | x | x | x | x |
|  | 1-2 | 100 | Yes | 4.3 | x | x | x | x | x |
| 7.3.2.2.2 | 2-1 | 100 | Yes | 3.2 | x | x | x | x | x |
|  | 2-2 | 100 | Yes | 0.2 | x | x | x | x | x |
| 7.3.2.2.3 | 1-1 | 100 | Yes | 4.7 | x | x | x | x | x |
| 7.5.1 | - | 100 | No | NA | x | x | x | x | x |
|  | - | 200 | No | NA | x | x | x | x | x |
|  | - | 400 | No | NA | TBD | TBD | TBD | TBD | TBD |
| 7.5A.1 | - | BWagg ≤ 400 | No | NA | x | x | x | x | x |
|  | - | BWagg > 400 | No | NA | TBD | TBD | TBD | TBD | TBD |

Table 7.1.1\_1-2a: Testability of test requirements due to maximum achievable SNR per band for PC1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Case | Test point | CHBW / MHz | Fading | SNR test requirement | Test Point Applicability | | | | |
| n257 | n258 | n259 | n260 | n261 |
| 7.2.2.2.1\_1 | 1-1 | 100 | Yes | 1.4 | x | x | TBD | x | x |
|  | 1-2 | 100 | Yes | 3.6 | x | x | TBD | x | x |
|  | 1-3 | 100 | Yes | 14.2 | x | x | TBD | x | x |
|  | 2-1 | 100 | Yes | 5.8 | x | x | TBD | x | x |
|  | 2-2 | 100 | Yes | 16.0 | x | x | TBD | x | x |
|  | 2-3 | 50 | Yes | 15.7 | x | x | TBD | x | x |
|  | 2-4 | 200 | Yes | 15.8 | x | x | TBD | x | x |
|  | 2-5 | 50 | Yes | 16 | x | x | TBD | x | x |
|  | 2-6 | 100 | Yes | 20.3 | x | x | TBD | x | x |
| 7.2.2.2.1\_2 | 3-1 | 100 | Yes | 20.7 | x | x | TBD | x | x |
| 7.2.2.2.1\_3 | 1-4 | 50 | Yes | 22.0 | x | x | TBD | x | x |
| 7.2.2.2.2\_1 | 1-1 | 100 | Yes | TBD | TBD | TBD | TBD | TBD | TBD |
| 7.2.2.2.3\_1 | 1-1 | 100 | Yes | 3.1 | x | x | TBD | x | X |
| 7.2A.2.1 | 1,2 | BWagg ≤ 200 | Yes | 12.0 | x | x | TBD | x | x |
|  | 3,4 | BWagg > 200 | Yes | 12.0 | TBD | TBD | TBD | TBD | TBD |
| 7.2A.2.2 | 1,2 | BWagg ≤ 200 | Yes | 12.0 | x | x | TBD | x | x |
|  | 3,4 | BWagg > 200 | Yes | 12.0 | TBD | TBD | TBD | TBD | TBD |
| 7.3.2.2.1 | 1-1 | 100 | Yes | 7.7 | x | x | TBD | x | x |
|  | 1-2 | 100 | Yes | 4.3 | x | x | TBD | x | x |
| 7.3.2.2.2 | 2-1 | 100 | Yes | 3.2 | x | x | TBD | x | x |
|  | 2-2 | 100 | Yes | 0.2 | x | x | TBD | x | x |
| 7.3.2.2.3 | 1-1 | 100 | Yes | 4.7 | x | x | TBD | x | x |
| 7.5.1 | - | 100 | No | NA | x | x | TBD | x | x |
|  | - | 200 | No | NA | x | x | TBD | x | x |
|  | - | 400 | No | NA | TBD | TBD | TBD | TBD | TBD |
| 7.5A.1 | - | BWagg ≤ 200 | No | NA | x | x | TBD | x | x |
|  | - | BWagg > 200 | No | NA | TBD | TBD | TBD | TBD | TBD |

## 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 | | | Unit | Value |
| PDSCH transmission scheme | | |  | Transmission scheme 1 |
| PTRS *epre-Ratio* | | |  | 0 |
| Actual carrier configuration | Offset between Point A and the lowest usable subcarrier on this carrier (Note 2) | | RBs | 0 |
| 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 [3] for tested channel bandwidth and subcarrier spacing |
| Common serving cell parameters | Physical Cell ID | |  | 0 |
| SSB position in burst | |  | 1 |
| SSB periodicity | | ms | 20 |
| PDCCH configuration | Slots for PDCCH monitoring | |  | Each slot |
| 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 |
| DCI format | |  | 1\_1 |
| TCI state | |  | TCI state #1 |
| PDCCH & PDCCH DMRS Precoding configuration | |  | For number of Tx=1: No precoding;  For number of Tx>1: Single Panel Type I, Randomized precoder selection for every REG bundle and updated per slot with equal probability of each applicable i1/i2 combination or codebook  index, chosen from section 5.2.2.2.1 of TS 38.214 [12]. |
| Cross carrier scheduling | | |  | Not configured |
| CSI-RS for tracking | First subcarrier index in the PRB used for CSI-RS (*k0*) | |  | 0 for CSI-RS resource 1,2,3,4 |
| First OFDM symbol in the PRB used for CSI-RS (*l0*) | |  | 6 for CSI-RS resource 1 and 3 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 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = BWP size |
| QCL info | |  | TCI state #0 |
| NZP CSI-RS for CSI acquisition | First subcarrier index in the PRB used for CSI-RS (*k0*) | |  | 0 |
| First OFDM symbol in the PRB used for CSI-RS (*l0*) | |  | 12 |
| Number of CSI-RS ports (*X*) | |  | 2 |
| CDM Type | |  | FD-CDM2 |
| Density (*ρ*) | |  | 1 |
| CSI-RS periodicity | | Slots | 60 kHz SCS: 80  120 kHz SCS: 160 |
| CSI-RS offset | |  | 0 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = BWP size |
| QCL info | |  | TCI state #1 |
| ZP CSI-RS for CSI acquisition | First subcarrier index in the PRB used for CSI-RS (k0) | |  | 4 |
| First OFDM symbol in the PRB used for CSI-RS (*l0*) | |  | 12 |
| Number of CSI-RS ports (*X*) | |  | 4 |
| CDM Type | |  | FD-CDM2 |
| Density (*ρ*) | |  | 1 |
| CSI-RS periodicity | | Slots | 60 kHz SCS: 80  120 kHz SCS: 160 |
| CSI-RS offset | |  | 0 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = BWP size |
| CSI-RS for beam refinement | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resource 1,2 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 8 for CSI-RS resource 1  l0 = 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 |
| Density (ρ) | |  | 3 for CSI-RS resource 1,2 |
| CSI-RS periodicity | | Slots | 60 kHz SCS: 80 for CSI-RS resource 1,2  120 kHz SCS: 160 for CSI-RS resource 1,2 |
| CSI-RS offset | | Slots | 0 for CSI-RS resource 1,2 |
| Repetition | |  | ON |
| QCL info | |  | TCI state #1 |
| PDSCH DMRS configuration | Antenna ports indexes | |  | {1000} for Rank 1 tests {1000, 1001} for Rank 2 tests |
| Position of the first DMRS for PDSCH mapping type A | |  | 2 |
| Number of PDSCH DMRS CDM group(s) without data | |  | 1 |
| TCI state #0 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type D |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type D |
| PTRS configuration | Frequency density (*KPT-RS*) | |  | 2 |
| Time density (*LPT-RS*) | |  | 1 |
| Resource Element Offset | |  | 2 |
| Maximum number of code block groups for ACK/NACK feedback | | |  | 1 |
| Maximum number of HARQ transmission | | |  | 4 |
| HARQ ACK/NACK bundling | | |  | Multiplexed |
| Redundancy version coding sequence | | |  | {0,2,3,1} |
| PDSCH & PDSCH DMRS Precoding configuration | | |  | For number of Tx=1: No precoding;  For number of Tx>1: Single Panel Type I, Randomized precoder selection with Wideband size and updated per slot with equal probability of each applicable i1/i2 combination or codebook  index, chosen from section 5.2.2.2.1 of TS 38.214 [12]. |
| Symbols for all unused REs | | |  | OCNG in Annex A.5 |
| Physical signals, channels mapping and precoding | | |  | As specified in Annex B.4.1 |
| Note 1: UE assumes that the TCI state for the PDSCH is identical to the TCI state applied for the PDCCH transmission.  Note 2: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-2 [3] for tested channel bandwidth and subcarrier spacing. | | | | |

Table 7.2-2: 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 |

### 7.2.1 1RX requirements (Void)

### 7.2.2 2RX requirements

#### 7.2.2.1 FDD (Void)

#### 7.2.2.2 TDD

##### 7.2.2.2.1 2Rx TDD FR2 PDSCH mapping Type A performance

7.2.2.2.1\_0 Minimum conformance requirements

For PDSCH Type-A scheduling, the requirements are specified in Table 7.2.2.2.1\_0-3, 7.2.2.2.1\_0-4 and 7.2.2.2.1\_0-5, with the addition of the parameters in Table 7.2.2.2.1\_0-2 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 7.2.2.2.1\_0-1.

Table 7.2.2.2.1\_0-1: Tests purpose

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

Table 7.2.2.2.1\_0-2: 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 (*l0*) |  | 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 | | |
| PDSCH configuration | Mapping type |  | Type A | | |
| k0 |  | 0 | | | |
| Starting symbol (S) |  | 1 |
| Length (L) |  | Specific to each Reference channel as defined in A.3.2.2 |
| PDSCH aggregation factor |  | 1 |
| PRB bundling type |  | Static |
| PRB bundling size |  | WB for 1-1,  2 for other tests |
| Resource allocation type |  | Test 2-1: Type 1 with start RB = 30, LRBs = 6  Other tests: Type 0 |
| RBG size |  | Test 2-1: N/A  Other tests: Config2 |
| VRB-to-PRB mapping type |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 | | |
| Number of additional DMRS |  | 1 |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Number of HARQ Processes | |  | 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 | | |
| K1 value (PDSCH-to-HARQ-timing-indicator) | |  | As defined in Annex A.1.3 | | |

Table 7.2.2.2.1\_0-3: Minimum performance for Rank 1 (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | Bandwidth (MHz)/Subcarrier spacing (kHz) | **Modulation and code rate** | **TDD UL-DL pattern** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | |
| **Fraction of maximum throughput (%)** | **SNRBB (dB)** |
| 1-1 | R.PDSCH.5-1.1TDD | 100/120 | QPSK, 0.30 | FR2.120-1. A | 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.5-3.1TDD | 100/120 | 64QAM, 0.46 | FR2.120-1 | TDLA30-300 | 2x2 XPL Med | 70 | 12.4 |
| 1-4 | R.PDSCH.5-10.1 TDD | 50/120 | 256QAM  0.67 | FR2.120-1 | TDLD30-75 | 2x2 ULA Low | 70 | 20.2 |

Table 7.2.2.2.1\_0-4: Minimum performance for Rank 2 (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | Bandwidth (MHz)/Subcarrier spacing (kHz) | **Modulation and code rate** | **TDD UL-DL pattern** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | |
| **Fraction of maximum throughput (%)** | **SNRBB (dB)** |
| 2-1 | R.PDSCH.5-4.1 TDD | 100/120 | QPSK, 0.30 | FR2.120-2 | TDLA30-75 | 2x2 ULA Low | 70 | 4.1 |
| 2-2 | R.PDSCH.5-2.2 TDD | 100/120 | 16QAM, 0.48 | FR2.120-1 | TDLA30-300 | 2x2 ULA Low | 70 | 14.4 |
| 2-3 | R.PDSCH.5-5.2 TDD | 50/120 | 16QAM,0.48 | FR2.120-2 | TDLA30-75 | 2x2 ULA Low | 70 | 14.0 |
| 2-4 | R.PDSCH.5-2.3 TDD | 200/120 | 16QAM, 0.48 | FR2.120-1 | 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 | FR2.120-2 | TDLA30-75 | 2x2 ULA Low | 70 | 18.6 |

Table 7.2.2.2.1\_0-5: Minimum performance for Rank 2 (FRC) for Enhanced Type X Receiver

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test num.** | **Reference channel** | Bandwidth (MHz)/Subcarrier spacing (kHz) | **Modulation and code rate** | **TDD UL-DL pattern** | **Propagation condition** | **Correlation matrix and antenna configuration** | **Reference value** | |
| **Fraction of maximum throughput (%)** | **SNRBB (dB)** |
| 3-1 | R.PDSCH.5-5.1TDD | 100/120 | 16QAM, 0.48 | FR2.120-2 | TDLA30-75 | 2x2 ULA Medium | 70 | 19.0 |

The normative reference for this requirement is TS 38.101-4 [5] clause 7.2.2.2.1.

###### 7.2.2.2.1\_1 2Rx TDD FR2 PDSCH mapping Type A performance - 2x2 MIMO with baseline receiver for SA and NSA

7.2.2.2.1\_1.1 Test Purpose

Verify the PDSCH mapping Type A normal performance with different channel models, MCSs and number of MIMO layers.

7.2.2.2.1\_1.2 Test Applicability

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

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

7.2.2.2.1\_1.3 Test Description

7.2.2.2.1\_1.3.1 Initial Conditions

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

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.2-1 of TS 38.521-2 [8].

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

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

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

Only sub tests shall be tested which are testable according to Table 7.1.1\_1-2.

For EN-DC within FR2 operation, setup the LTE radiated link according to Annex D:

1. Connection between SS, the faders, AWGN noise source and the UE is shown in TS 38.508-1 [6] Annex A, Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 7.2-1 and Table 7.2.2.2.1.0-2 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-2 [8].

4. Propagation conditions for NR cell are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On for NSA* according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 7.2.2.2.1\_1.3.3.

7.2.2.2.1\_1.3.2 Test Procedure

1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.0.If no direction found, mark the test as inconclusive.

2. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 7.2.2.2.1\_1.4-1 and 7.2.2.2.1\_1.4-2.. The SS sends downlink MAC padding bits on the DL RMC.

3. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 7.2.2.2.1\_1.4-1 and 7.2.2.2.1\_1.4-2 as appropriate.

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

5. Repeat steps from 1 to 4 for each subtest in Tables 7.2.2.2.1\_1.4-1 and 7.2.2.2.1\_1.4-2 as appropriate.

7.2.2.2.1\_1.3.3 Message Contents

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

7.2.2.2.1\_1.3.3\_1 Message exceptions for SA

Table 7.2.2.2.1\_1.3.3\_1-1: SchedulingRequestResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-157 | | | |
| Information Element | Value/remark | Comment | Condition |
| SchedulingRequestResourceConfig ::= SEQUENCE { |  |  |  |
| periodicityAndOffset CHOICE { |  |  |  |
| sl80 | 7 | Test point 2-1, 2-3, 2-6 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.2.2.2.1\_1.3.3\_1-2: CSI-RS-ResourceMapping for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6] Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| firstOFDMSymbolInTimeDomain | 3 | l0 = 3 for CSI-RS resource 1 and 3 | TRS, Test 1-1, 1-2 |
|  | 7 | l0 = 7 for CSI-RS resource 2 and 4 | TRS, Test 1-1, 1-2 |
| nrofPorts | p1 | 1 for CSI-RS resource 1,2,3,4 | TRS |
| } |  |  |  |

Table 7.2.2.2.1\_1.3.3\_1-3: CSI-ResourcePeriodicityAndOffset for TRS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6] Table 5.4.2.3-10 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| Slots160 | 82 | Periodicity 160 slots and offset 82 for CSI-RS resource 1 and 2 | Test 1-2 |
| Slots160 | 83 | Periodicity 160 slots and offset 83 for CSI-RS resource 3 and 4 | Test 1-2 |
| } |  |  |  |

Table 7.2.2.2.1\_1.3.3\_1-4: PDCCH *Search Space*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6] Table 4.6.3-162 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel1 | n0 |  |  |
| aggregationLevel2 | n0 |  |  |
| aggregationLevel4 | n1 |  | Test 2-3 |
| aggregationLevel8 | n1 | AL8 | Other than test 2-3 |
| aggregationLevel16 | n0 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.2.2.2.1\_1.3.3\_1-5: DMRS-DownlinkConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6] Table 4.6.3-50 | | | |
| Information Element | Value/remark | Comment | Condition |
| DMRS-DownlinkConfig ::= SEQUENCE { |  |  |  |
| dmrs-Type | Type 1 |  |  |
| dmrs-AdditionalPosition | pos1 |  |  |
| maxLength | len1 |  |  |
| } |  |  |  |

Table 7.2.2.2.1\_1.3.3\_1-6: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6] Table 4.6.3-100 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| vrb-ToPRB-Interleaver | Not present |  |  |
| resourceAllocation | resourceAllocationType0 |  |  |
| pdsch-AggregationFactor | Not present |  |  |
| prb-BundlingType CHOICE { |  |  |  |
| staticBundling SEQUENCE { |  |  |  |
| bundleSize | Not present | PRB Bundling size of 2 | Other than test 1-1 |
|  | Wideband |  | Test 1-1 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.2.2.2.1\_1.3.3\_1-7: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6] Table 4.6.3-102 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | Set according to the test id |  | 8 for Test 1-1, 1-3, 2-2, 2-4  10 for Test 2-1, 2-3, 2-5, 2-6, 3-1  16 for Test 1-2 |
| } |  |  |  |

7.2.2.2.1\_1.3.3\_2 Message exceptions for NSA

Same as 7.2.2.2.1\_1.3.3\_1.

7.2.2.2.1\_1.4 Test Requirements

Tables 7.2.2.2.1\_1.4-1 and 7.2.2.2.1\_1.4-2 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2 for each throughput test shall meet or exceed the specified value in Tables 7.2.2.2.1\_1.4-1 and 7.2.2.2.1\_1.4-2 for the specified SNR including test tolerances for all throughput tests.

Table 7.2.2.2.1\_1.4-1: Test Requirement for Rank 1 (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz)/Subcarrier spacing (kHz) | Modulation and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNRBB (dB) |
| 1-1 | R.PDSCH.5-1.1TDD | 100/120 | QPSK, 0.30 | FR2.120-1 A | TDLC60-300 | 2x2 ULA Low | 70 | 1.4 |
| 1-2 | R.PDSCH.5-2.1TDD | 100/120 | 16QAM, 0.48 | FR2.120-1 | TDLA30-300 | 2x2 ULA Low | 30 | 3.6 |
| 1-3 | R.PDSCH.5-3.1TDD | 100/120 | 64QAM, 0.46 | FR2.120-1 | TDLA30-300 | 2x2 XPL Medium | 70 | 14.2 |

Table 7.2.2.2.1\_1.4-2: Test Requirement for Rank 2 (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz)/Subcarrier spacing (kHz) | Modulation and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNRBB (dB) |
| 2-1 | R.PDSCH.5-4.1TDD | 100/120 | QPSK, 0.30 | FR2.120-2 | TDLA30-75 | 2x2 ULA Low | 70 | 5.8 |
| 2-2 | R.PDSCH.5-2.2TDD | 100/120 | 16QAM, 0.48 | FR2.120-1 | TDLA30-300 | 2x2 ULA Low | 70 | 16.0 |
| 2-3 | R.PDSCH.5-5.2TDD | 50/120 | 16QAM,0.48 | FR2.120-2 | TDLA30-75 | 2x2 ULA Low | 70 | 15.7 |
| 2-4 | R.PDSCH.5-2.3TDD | 200/120 | 16QAM, 0.48 | FR2.120-1 | TDLA30-300 | 2x2 ULA Low | 70 | 15.8 |
| 2-5 | R.PDSCH.4-1.1TDD | 50/60 | 16QAM, 0.48 | FR2.60-1 | TDLA30-75 | 2x2 ULA Low | 70 | 16 |
| 2-6 | R.PDSCH.5-6.1TDD | 100/120 | 64QAM, 0.43 | FR2.120-2 | TDLA30-75 | 2x2 ULA Low | 70 | 20.3 |

###### 7.2.2.2.1\_2 2Rx TDD FR2 PDSCH mapping Type A performance - 2x2 MIMO with enhanced type 1 receiver for SA and NSA

7.2.2.2.1\_2.1 Test Purpose

Verify the PDSCH mapping Type A normal performance with different channel models, MCSs and number of MIMO layers.

7.2.2.2.1\_2.2 Test Applicability

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

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

7.2.2.2.1\_2.3 Test Description

Same test description as in clause 7.2.2.2.1\_1.3 with following exception:

- Table 7.2.2.2.1\_2.4-1 instead of Tables 7.2.2.2.1\_1.4-1 and 7.2.2.2.1\_1.4-2

7.2.2.2.1\_2.3.1 Message contents

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

7.2.2.2.1\_2.3.1\_1 Message exceptions for SA

Same as 7.2.2.2.1\_1.3.3\_1 with following exceptions:

Table 7.2.2.2.1\_2.3.1\_1-1: SchedulingRequestResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-157 | | | |
| Information Element | Value/remark | Comment | Condition |
| SchedulingRequestResourceConfig ::= SEQUENCE { |  |  |  |
| periodicityAndOffset CHOICE { |  |  |  |
| Sl80 | 7 |  | Test 3-1 |
| } |  |  |  |
| } |  |  |  |

7.2.2.2.1\_2.3.1\_2 Message exceptions for NSA

Same as 7.2.2.2.1\_2.3.1\_1.

7.2.2.2.1\_2.4 Test Requirements

Table 7.2.2.2.1\_2.4-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2 for each throughput test shall meet or exceed the specified value in Table 7.2.2.2.1\_2.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 7.2.2.2.1\_2.4-1: Test Requirement for Rank 2 (FRC) for Enhanced Type 1 Receiver

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz)/Subcarrier spacing (kHz) | Modulation and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNRBB (dB) |
| 3-1 | R.PDSCH.5-5.1TDD | 100/120 | 16QAM, 0.48 | FR2.120-2 | TDLA30-75 | 2x2 ULA Med | 70 | 20.7 |

###### 7.2.2.2.1\_3 2Rx TDD FR2 PDSCH mapping Type A performance - 2x2 MIMO with 256QAM for SA and NSA (Rel-16 and forward)

7.2.2.2.1\_3.1 Test Purpose

Verify the PDSCH mapping Type A normal performance with different channel models, MCSs and number of MIMO layers.

7.2.2.2.1\_3.2 Test Applicability

This test applies to all types of NR UE release 16 and forward supporting 256QAM for PDSCH.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and NR 256QAM for PDSCH.

7.2.2.2.1\_3.3 Test Description

Same test description as in clause 7.2.2.2.1\_1.3 with following exception:

- Table 7.2.2.2.1\_3.4-1 instead of Table 7.2.2.2.1\_1.4-1

7.2.2.2.1\_3.3.1 Message contents

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

7.2.2.2.1\_3.3.1\_1 Message exceptions for SA

Same as 7.2.2.2.1\_1.3.3\_1 with following exceptions:

Table 7.2.2.2.1\_3.3.1\_1-1: Void

Table 7.2.2.2.1\_3.3.1\_1-2: *SearchSpace*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 Table 4.6.3-162 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel1 | n0 |  |  |
| aggregationLevel2 | n0 |  |  |
| aggregationLevel4 | n1 | AL4 | Test 1-4 |
| aggregationLevel8 | n0 |  |  |
| aggregationLevel16 | n0 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.2.2.2.1\_3.3.1\_1-3: PDSCH-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 Table 5.4.2.0-26 with condition DEMOD\_FR2 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| mcs-Table | qam256 |  | Test 1-4 |
| } |  |  |  |

Table 7.2.2.2.1\_3.3.1\_1-4: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 Table 5.4.2.0-25 with condition DEMOD\_FR2 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | 8 |  | Test 1-4 |
| } |  |  |  |

7.2.2.2.1\_3.3.1\_2 Message exceptions for NSA

Same as 7.2.2.2.1\_3.3.1\_1.

7.2.2.2.1\_3.4 Test Requirements

Table 7.2.2.2.1.0-2 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2 for each throughput test shall meet or exceed the specified value in Table 7.2.2.2.1\_3.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 7.2.2.2.1\_3.4-1: Test Requirement for Rank 1 (FRC) for 256QAM

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz)/Subcarrier spacing (kHz) | Modulation and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNRBB (dB) |
| 1-4 | R.PDSCH.5-10.1 TDD | 50/120 | 256QAM  0.67 | FR2.120-1 | TDLD30-75 | 2x2 ULA Low | 70 | 22.0 |

##### 7.2.2.2.2 2Rx TDD FR2 PDSCH repetitions over multiple slots

7.2.2.2.2\_0 Minimum conformance requirements

For PDSCH with slot aggregation, the requirements are specified in Table 7.2.2.2.2\_0-3, additional parameters in Table 7.2.2.2.2\_0-2 and the downlink physical channel setup according to Annex C.5.1.

The test purpose is specified in Table 7.2.2.2.2\_0-1.

Table 7.2.2.2.2\_0-1: Test purpose

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

Table 7.2.2.2.2\_0-2: Test Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
| *k0* |  | 0 |
| Starting symbol (S) |  | 1 |
| Length (L) |  | 13 |
| PDSCH aggregation factor |  | 2 |
| PRB bundling type |  | Static |
| PRB bundling size |  | 2 |
| Resource allocation type |  | Type 0 |
| RBG size |  | Config2 |
| VRB-to-PRB mapping type |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size |  | N/A |
| PDSCH DMRS configuration | DMRS Type |  | Type 1 |
| Number of additional DMRS |  | 1 |
| Maximum number of OFDM symbols for DL front loaded DMRS |  | 1 |
| Number of HARQ Processes | |  | 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 feedback is generated for PDSCH on slot i, where mod(i,4) = 1, where i is the slot index per frame; i = {0,...,79} | | | |

Table 7.2.2.2.2\_0-3: Minimum performance for Rank 1 (FRC)

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target BLER | SNR (dB) |
| 1-1 | R.PDSCH. 5-11.1 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. | | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5] clause 7.2.2.2.2.

###### 7.2.2.2.2\_1 2Rx TDD FR2 PDSCH repetitions over multiple slots - 2x2 MIMO with baseline receiver for SA and NSA

7.2.2.2.2\_1.1 Test Purpose

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

7.2.2.2.2\_1.2 Test Applicability

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

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

7.2.2.2.2\_1.3 Test Description

7.2.2.2.2\_1.3.1 Initial Conditions

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

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.2-1 of TS 38.521-2 [8].

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

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

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

Only sub tests shall be tested which are testable according to Table 7.1.1\_1-2.

For EN-DC within FR2 operation, setup the LTE radiated link according to Annex D:

1. Connection between SS, the faders, AWGN noise source and the UE is shown in TS 38.508-1 [6] Annex A, Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 7.2-1 and Table 7.2.2.2.2.0-2 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-2 [8].

4. Propagation conditions for NR cell are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On for NSA* according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 7.2.2.2.2\_1.3.3.

7.2.2.2.2\_1.3.2 Test Procedure

1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.0.If no direction found, mark the test as inconclusive.

2. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 7.2.2.2.2\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC. The UE may expect that the TB is repeated with same symbol allocation among each of the *pdsch-AggregationFactor* consecutive slots.

3. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 7.2.2.2.2\_1.4-1 as appropriate.

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

7.2.2.2.2\_1.3.3 Message Contents

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

7.2.2.2.2\_1.3.3\_1 Message exceptions for SA

Table 7.2.2.2.2\_1.3.3\_1-1: SchedulingRequestResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-157 | | | |
| Information Element | Value/remark | Comment | Condition |
| SchedulingRequestResourceConfig ::= SEQUENCE { |  |  |  |
| periodicityAndOffset CHOICE { |  |  |  |
| sl80 | 7 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.2.2.2.2\_1.3.3\_1-2: *PDSCH-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6] Table 4.6.3-100 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-Config ::= SEQUENCE { |  |  |  |
| pdsch-AggregationFactor | 2 |  |  |
| } |  |  |  |

Table 7.2.2.2.2\_1.3.3\_1-3: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6] Table 4.6.3-102 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | 4 |  |  |
| } |  |  |  |

7.2.2.2.2\_1.3.3\_2 Message exceptions for NSA

Same as 7.2.2.2.2\_1.3.3\_1.

7.2.2.2.2\_1.4 Test Requirements

Table 7.2.2.2.2\_1.4-1 defines the primary level settings.

The target BLER percentage for the downlink reference measurement channels specified in Annex A.3.2.2 for each BLER test shall meet or exceed the specified value in Table 7.2.2.2.2\_1.4-1 for the specified SNR including test tolerances for all BLER tests.

Table 7.2.2.2.2\_1.4-1: Test Requirement for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation and code rate | TDD UL-DL pattern | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Target BLER | SNR (dB) |
| 1-1 | R.PDSCH. 5-11.1 TDD | 100 / 120 | 16QAM,  0.37 | FR2.120-2 | TDLA30-75 | 2x2 ULA Low | 1% (Note 1) | 0.7 |
| Note 1: BLER is defined as residual BLER; i.e. ratio of incorrectly received transport blocks / sent transport blocks, independently of the number HARQ transmission(s) for each transport block. | | | | | | | | |

##### 7.2.2.2.3 2Rx TDD FR2 PDSCH Mapping Type B

7.2.2.2.3\_0 Minimum conformance requirements

The performance requirements are specified in Table 7.2.2.2.3.0-3, with the addition of test parameters in Table 7.2.2.2. 3.0-2 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 7.2.2.2.3.0-1.

Table 7.2.2.2.3.0-1: Test purpose

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

Table 7.2.2.2.3.0-2: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| PDCCH configuration | Number of PDCCH candidates and aggregation levels |  | 1/AL8 |
| PDSCH configuration | Mapping type |  | Type B |
| k0 |  | 0 |
| Starting symbol (S) |  | 1 |
| 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 |
| 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 7.2.2.2.3.0-3: Minimum performance for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation  condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH. 5-1.2 TDD | 100 / 120 | QPSK, 0.30 | FR2.120-1 | TDLA30-75 | 2x2, ULA Low | 70 | 1.3 |

The normative reference for this requirement is TS 38.101-4 [5] clause 7.2.2.2.3.

###### 7.2.2.2.3\_1 2Rx TDD FR2 PDSCH mapping Type B performance - 2x2 MIMO with baseline receiver for SA and NSA

7.2.2.2.3\_1.1 Test Purpose

Verify the PDSCH mapping Type B performance under 2 receive antenna conditions.

7.2.2.2.3\_1.2 Test Applicability

This test applies to all types of NR UE release 16 and forward supporting PDSCH mapping type B.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and PDSCH mapping type B.

7.2.2.2.3\_1.3 Test Description

7.2.2.2.3\_1.3.1 Initial Conditions

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

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.2-1 of TS 38.521-2 [8].

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

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

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

Only sub tests shall be tested which are testable according to Table 7.1.1\_1-2.

For EN-DC within FR2 operation, setup the LTE radiated link according to Annex D:

1. Connection between SS, the faders, AWGN noise source and the UE is shown in TS 38.508-1 [6] Annex A, Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 7.2-1 and Table 7.2.2.2.3.0-2 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-2 [8].

4. Propagation conditions for NR cell are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On for NSA* according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 7.2.2.2.3\_1.3.3.

7.2.2.2.3\_1.3.2 Test Procedure

1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.0.If no direction found, mark the test as inconclusive.

2. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Tables 7.2.2.2.3\_1.4-1. The SS sends downlink MAC padding bits on the DL RMC.

3. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Tables 7.2.2.2.3\_1.4-1 as appropriate.

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

7.2.2.2.3\_1.3.3 Message Contents

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

7.2.2.2.3\_1.3.3\_1 Message exceptions for SA

Table 7.2.2.2.3\_1.3.3\_1-3: PDSCH-ServingCellConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6] Table 4.6.3-102 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-ServingCellConfig ::= SEQUENCE { |  |  |  |
| nrofHARQ-ProcessesForPDSCH | 8 |  |  |
| } |  |  |  |

Table 7.2.2.2.3\_1.3.3\_1-4: PDSCH-TimeDomainResourceAllocationList

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-103 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-TimeDomainResourceAllocationList::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF { | 2 entry |  |  |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  |  |  |
| K0 | Not present |  |  |
| mappingType | typeB |  |  |
| startSymbolAndLength | 15 | Start symbol(S)=1, Length(L)=2 |  |
| } |  |  |  |
| } |  |  |  |

7.2.2.2.3\_1.3.3\_2 Message exceptions for NSA

Same as 7.2.2.2.3\_1.3.3\_1.

7.2.2.2.3\_1.4 Test Requirements

Table 7.2.2.2.3\_1.4-1 defines the primary level settings.

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A.3.2 for each throughput test shall meet or exceed the specified value in Table 7.2.2.2.3\_1.4-1 for the specified SNR including test tolerances for all throughput tests.

Table 7.2.2.2.3\_1.4-1: Test Requirement for Rank 1

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Modulation format and code rate | TDD UL-DL pattern | Propagation  condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 1-1 | R.PDSCH. 5-1.2 TDD | 100 / 120 | QPSK, 0.30 | FR2.120-1 | TDLA30-75 | 2x2, ULA Low | 70 | 3.1 |

## 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.2.0 Minimum conformance requirements

For CA with different numbers of DL component carriers, the requirements are defined in Table 7.2A.2.0-3-3 based on the single carrier requirements for different bandwidth specified in Table 7.2A.2.0-2, with the parameters in Table 7.2A.2.0-1 and the downlink physical channel setup according to Annex C.2.2. The performance requirements specified in this sub-clause do not apply for UE single carrier test.

Table 7.2A.2.0-1: Test parameters for CA

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Duplex mode | |  | TDD |
| Active DL BWP index | |  | 1 |
| PDSCH configuration | Mapping type |  | Type A |
| k0 |  | 0 |
| Starting symbol (S) |  | 1 |
| 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 |
| Number of HARQ Processes | |  | 8 |
| TDD UL-DL pattern | |  | 120kHz SCS: FR2.120-1 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | |  | As defined in Annex A.1.3 |

Table 7.2A.2.0-2: Single carrier performance for TDD 120 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 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.2.0-3: 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\_0-2 |
| Note 1: The applicability of requirements for different CA duplex modes, SCSs, CA configurations and bandwidth combination sets is defined in 7.1.1.5. | | |

The normative reference for this requirement is TS 38.101-4 [5] clause 7.2A.2.1

#### 7.2A.2.1 2Rx TDD FR2 CA requirements for normal PDSCH Demodulation Performance for both SA and NSA (2DLCA)

7.2A.2.1.1 Test Purpose

Verify the PDSCH mapping Type A normal performance with different channel models, MCSs and number of MIMO layers.

7.2A.2.1.2 Test Applicability

This test applies to all types of NR UE release 15 and forward that support NR 2DL CA.

7.2A.2.1.3 Test Description

7.2A.2.1.3.1 Initial Conditions

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

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.3.5-1 of 38.521-2.

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

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

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

CA capability to be tested: Any one of the supported CA capability as per the selection criteria specified in Table 7.1.1.5.2-2.

CA Bandwidth combination: Largest aggregated bandwidth as per Table 7.2A.2.1.3.1-1

For EN-DC within FR2 operation, setup the LTE radiated link according to Annex D:

Table 7.2A.2.1.3.1-1: Test point selection for CA UE demodulation tests

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Tests | CA capability where the tests apply | CA configuration from the selected CA capability where the tests apply | CA Bandwidth combination to be tested in priority order | PCell CC configuration |
| Test 1 in Section 7.2A.2.0-3 | CA\_C, CA\_N, CA\_AX | Table 7.1.1.5.2-2 | Largest aggregated CA bandwidth combination | Any of CCs |

1. Connection between SS, the faders, AWGN noise source and the UE is shown in TS 38.508-1 [6] Annex A, Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 7.2-1, 7.2A.2.0-1 and Table 7.2A.2.0-2 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-2 [8].

4. Propagation conditions for NR cell are set according to Annex B.0.

6. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On for NSA* according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 7.2A.2.1.3.3.

7.2A.2.1.3.2 Test Procedure

1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.0. If no direction found, mark the test as inconclusive.

2. Configure SCC(s) according to Annex C.0, C.1 and C.2 for all downlink physical channels.

3. The SS shall configure SCC(s) as per TS 38.508-1 [6] clause 5.5.1. Message contents are defined in clause 7.2 A.2.1.1.3.3.

4. SS activates SCC(s) by sending the activation MAC-CE (Refer TS 38.321 [24], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[25], clause9.3).

5. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to Table 7.2A.2.1.4-1 on each NR CC. The SS sends downlink MAC padding bits on the DL RMC.

6. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 7.2A.2.1.4-1 on each NR CC

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

7.2A.2.1.3.3 Message Contents

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

7.2A.2.1.4 Test Requirements

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.2 for each throughput test per component carrier shall meet or exceed the specified value as per Table 7.2A.2.1.4\_1.4-1 for the specified SNR including test tolerances.

Table 7.2A.2.1.4-1: Single carrier performance for TDD 120 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 50 | R.PDSCH.5-9.1 TDD | 16QAM, 0.33 | TDLA30-75 | 2x2, ULA Low | 70 | 12.1 |
| 100 | R.PDSCH.5-9.2 TDD | 16QAM, 0.33 | TDLA30-75 | 2x2, ULA Low | 70 | 11.9 |
| 200 | R.PDSCH.5-9.3 TDD | 16QAM, 0.33 | TDLA30-75 | 2x2, ULA Low | 70 | 12.0 |
| 400 | R.PDSCH.5-9.4 TDD | 16QAM, 0.33 | TDLA30-75 | 2x2, ULA Low | 70 | 12.0 |

#### 7.2A.2.2 2Rx TDD FR2 CA requirements for normal PDSCH Demodulation Performance for both SA and NSA (3DLCA)

7.2A.2.2.1 Test Purpose

Same as 7.2A.2.1.1

7.2A.2.2.2 Test Applicability

This test applies to all types of NR UE release 15 and forward that support NR 3DL CA.

7.2A.2.2.3 Test Description

Same as 7.2A.2.1.3

7.2A.2.2.3.2 Test Procedure

Same as 7.2A.2.1.3.2

7.2A.2.2.3.3 Message Contents

Same as 7.2A.2.1.3.3

7.2A.2.2.4 Test Requirements

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.2 for each throughput test per component carrier shall meet or exceed the specified value as per Table 7.2A.2.2.4\_1.4-1 for the specified SNR including test tolerances.

Table 7.2A.2.2.4-1: Single carrier performance for TDD 120 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 50 | R.PDSCH.5-9.1 TDD | 16QAM, 0.33 | TDLA30-75 | 2x2, ULA Low | 70 | 12.1 |
| 100 | R.PDSCH.5-9.2 TDD | 16QAM, 0.33 | TDLA30-75 | 2x2, ULA Low | 70 | 11.9 |
| 200 | R.PDSCH.5-9.3 TDD | 16QAM, 0.33 | TDLA30-75 | 2x2, ULA Low | 70 | 12.0 |
| 400 | R.PDSCH.5-9.4 TDD | 16QAM, 0.33 | TDLA30-75 | 2x2, ULA Low | 70 | 12.0 |

#### 7.2A.2.3 2Rx TDD FR2 CA requirements for normal PDSCH Demodulation Performance for both SA and NSA (4DLCA)

7.2A.2.3.1 Test Purpose

Same as 7.2A.2.1.1

7.2A.2.3.2 Test Applicability

This test applies to all types of NR UE release 15 and forward that support NR 4DL CA.

7.2A.2.3.3 Test Description

Same as 7.2A.2.1.3

7.2A.2.3.3.2 Test Procedure

Same as 7.2A.2.1.3.2

7.2A.2.3.3.3 Message Contents

Same as 7.2A.2.1.3.3

7.2A.2.3.4 Test Requirements

The fraction of maximum throughput percentage for the downlink reference measurement channels specified in Annex A 3.2.2 for each throughput test per component carrier shall meet or exceed the specified value as per Table 7.2A.2.3.4\_1.4-1 for the specified SNR including test tolerances.

Table 7.2A.2.3.4-1: Single carrier performance for TDD 120 kHz SCS for CA configurations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Bandwidth (MHz) | Reference channel | Modulation format and code rate | Propagation condition | Correlation matrix and antenna configuration | Reference value | |
| Fraction of maximum throughput (%) | SNR (dB) |
| 50 | R.PDSCH.5-9.1 TDD | 16QAM, 0.33 | TDLA30-75 | 2x2, ULA Low | 70 | 12.1 |
| 100 | R.PDSCH.5-9.2 TDD | 16QAM, 0.33 | TDLA30-75 | 2x2, ULA Low | 70 | 11.9 |
| 200 | R.PDSCH.5-9.3 TDD | 16QAM, 0.33 | TDLA30-75 | 2x2, ULA Low | 70 | 12.0 |
| 400 | R.PDSCH.5-9.4 TDD | 16QAM, 0.33 | TDLA30-75 | 2x2, ULA Low | 70 | 12.0 |

## 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 | Parameter |
| Carrier configuration | Offset between Point A and the lowest usable subcarrier on this carrier (Note 1) | |  | 0 |
| DL BWP configuration #1 | Cyclic prefix | |  | Normal |
| Common serving cell parameters | Physical Cell ID | |  | 0 |
| SSB position in burst | |  | 1 |
| SSB periodicity | | ms | 20 |
| PDCCH configuration | Slots for PDCCH monitoring | |  | Each slot |
| Number of PDCCH candidates | |  | 1 |
| Frequency domain resource allocation for CORESET | |  | Start from RB = 0 with contiguous RB allocation |
| TCI state | |  | TCI state #1 |
| CSI-RS for tracking | First subcarrier index in the PRB used for CSI-RS (k0) | |  | 0 |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | CSI-RS resource 1: 4 CSI-RS resource 2: 8 CSI-RS resource 3: 4 CSI-RS resource 4: 8 |
| Number of CSI-RS ports (X) | |  | 1 |
| CDM Type | |  | No CDM |
| Density (ρ) | |  | 3 |
| CSI-RS periodicity | | Slots | 160 |
| CSI-RS offset | | Slots | 80 for CSI-RS resource 1 and 2  81 for CSI-RS resource 3 and 4 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = BWP size |
| QCL info | |  | TCI state #0 |
| NZP CSI-RS for beam management | First subcarrier index in the PRB used for CSI-RS (k0) | |  | 0 |
| First OFDM symbol in the PRB used for CSI-RS (l0) | |  | CSI-RS resource 1: 8  CSI-RS resource 2: 9 |
| Number of CSI-RS ports (X) | |  | 1 |
| CDM Type | |  | No CDM |
| Density (ρ) | |  | 3 |
| CSI-RS periodicity | | Slots | 120 kHz SCS: 160 for CSI-RS resource 1,2 |
| CSI-RS offset | | Slots | 0 for CSI-RS resource 1,2 |
| Repetition | |  | ON |
| QCL info | |  | TCI state #1 |
| PDCCH & PDCCH DMRS Precoding configuration | | |  | For number of Tx=1: No precoding;  For number of Tx>1: Single Panel Type I, Randomized precoder selection for every REG bundle and updated per slot with equal probability of each applicablei1/i2 combination or codebook  index, chosen from section 5.2.2.2.1 of TS 38.214 [12] |
| TCI state #0 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type D |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type D |
| Physical signals, channels mapping and precoding | | |  | As specified in Annex B.4.1 |
| Symbols for all unused REs | | |  | OP.1 FDD as defined in Annex A.5.1.1  OP.1 TDD as defined in Annex A.5.2.1 |
| The number of slots between PDSCH and corresponding HARQ-ACK information | | |  | Specific to each TDD UL-DL pattern and as defined in Annex A.1.3. |
| Note 1: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-2 [3] 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

##### 7.3.2.2.1 2Rx TDD FR2 PDCCH 1 Tx antenna performance for both SA and NSA

7.3.2.2.1.1 Test Purpose

This test verifies the demodulation performance of PDCCH for a single-antenna port with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 7.3.2.2.1.3-1.

7.3.2.2.1.2 Test Applicability

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

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

7.3.2.2.1.3 Minimum conformance requirements

For the parameters specified in Table 7.3.2.2.1.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 7.3.2.2.1.3-2. The downlink physical setup is in accordance with Annex C.2.2.

Table 7.3.2.2.1.3-1: Test Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | 1 Tx Antenna | 2 Tx Antenna |
| TDD UL-DL pattern |  | FR2.120-1 | |
| CCE to REG mapping type |  | Interleaved | |
| REG bundle size |  | 2 for test 1-1  6 for test 1-2 | 2 |
| Interleaver size |  | 3 for test 1-1  2 for test 1-2 | 3 |
| Shift index |  | 0 | |

Table 7.3.2.2.1.3-2: Minimum performance requirements with 120 kHz SCS for 1Tx antenna

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNRBB (dB) |
| 1-1 | 100 MHz | 60 | 1 | 2 CCE | R.PDCCH.5-1.1 TDD | TDLA30-75 | 1x2 Low | 1 | 6.0 |
| 1-2 | 100 MHz | 60 | 1 | 4 CCE | R.PDCCH.5-1.2 TDD | TDLA30-300 | 1x2 Low | 1 | 2.6 |

The normative reference for this requirement is TS 38.101-4 [5] clause 7.3.2.2.1.

7.3.2.2.1.4 Test Description

7.3.2.2.1.4.1 Initial Conditions

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

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.2-1 of TS 38.521-2 [8].

Configurations of PDCCH before measurement are specified in Annex C.

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

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

Only sub tests shall be tested which are testable according to Table 7.1.1\_1-2.

For EN-DC within FR2 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 7.3-1 and Table 7.3.2.2.1.3-1 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-2 [8].

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 7.3.2.2.1.4.3.

7.3.2.2.1.4.2 Test procedure

1. Set the UE in a direction found using one of the test procedures defined in Annex H. If no direction found, mark the test as inconclusive.

2. SS transmits PDCCH with DCI format as specified in PDCCH Reference Channel for C\_RNTI to transmit the DL RMC according to Table 7.3.2.2.1.4.4-1. The details of PDCCH are specified in Table 7.3.2.2.1.3-1 and Table 7.3.2.2.1.3-2. The details of PDSCH are specified in Table A.3.3.2.5-3. The SS sends downlink MAC padding bits on the DL RMC.

3. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 7.3.2.2.1.4.4-1 as appropriate.

4. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 7.3.2.2.1.4.4-1, pass the UE. Otherwise fail the UE.

5. Repeat steps from 1 to 4 for each subtest in Table 7.3.2.2.1.4.4-1 as appropriate.

7.3.2.2.1.4.3 Message contents

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

7.3.2.2.1.4.3.1 Message exceptions for SA

Table 7.3.2.2.1.4.3.1-1: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| frequencyDomainResources | 11111111 11000000 00000000 00000000 00000000 00000 | CORESET to use the least significant 60 RBs of the BWP |  |
| cce-REG-MappingType CHOICE { |  |  |  |
| Interleaved SEQUENCE { | Null |  |  |
| reg-BundleSize | n2 |  | 2 for test 1-1 |
|  | n6 |  | 6 for test 1-2 |
| interleaverSize | n3 |  | 3 for test 1-1 |
| } | n2 |  | 2 for test 1-2 |
| } |  |  |  |
| } |  |  |  |

Table 7.3.2.2.1.4.3.1-2: PDCCH Search Space

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel2 | n1 | AL2 | Test 1-1 |
| aggregationLevel4 | n1 | AL4 | Test 1-2 |
| } |  |  |  |
| } |  |  |  |

7.3.2.2.1.4.3.2 Message exceptions for NSA

Same as 7.3.2.2.1.4.3.1.

7.3.2.2.1.4.4 Test requirement

Table 7.3.2.2.1.4.4-1 defines the primary level settings.

For the parameters specified in Table 7.3.2.2.1.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 7.3.2.2.1.4.4-1.

Table 7.3.2.2.1.4.4-1: Test requirements with 120 kHz SCS for 1Tx antenna

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNRBB (dB) |
| 1-1 | 100 MHz | 60 | 1 | 2 CCE | R.PDCCH.5-1.1 TDD | TDLA30-75 | 1x2 Low | 1 | 7.7 |
| 1-2 | 100 MHz | 60 | 1 | 4 CCE | R.PDCCH.5-1.2 TDD | TDLA30-300 | 1x2 Low | 1 | 4.3 |

##### 7.3.2.2.2 2Rx TDD FR2 PDCCH 2 Tx antenna performance for both SA and NSA

7.3.2.2.2.1 Test Purpose

This test verifies the demodulation performance of PDCCH for two-antenna port with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 7.3.2.2.2.3-1.

7.3.2.2.2.2 Test Applicability

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

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

7.3.2.2.2.3 Minimum conformance requirements

For the parameters specified in Table 7.3.2.2.2.3-1, the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 7.3.2.2.2.3-2. The downlink physical setup is in accordance with Annex C.2.2.

Table 7.3.2.2.2.3-1: Test Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | 1 Tx Antenna | 2 Tx Antenna |
| TDD UL-DL pattern |  | FR2.120-1 | |
| CCE to REG mapping type |  | Interleaved | |
| REG bundle size |  | 2 for test 1-1  6 for test 1-2 | 2 |
| Interleaver size |  | 3 for test 1-1  2 for test 1-2 | 3 |
| Shift index |  | 0 | |

Table 7.3.2.2.2.3-2: Minimum performance requirements with 120 kHz SCS for 2Tx Antenna

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **Bandwidth** | **CORESET RB** | **CORESET duration** | **Aggregation level** | **Reference Channel** | **Propagation Condition** | **Antenna configuration and correlation Matrix** | **Reference value** | |
| **Pm-dsg (%)** | **SNRBB (dB)** |
| 2-1 | 100 MHz | 60 | 1 | 8 CCE | R.PDCCH.5-1.3 TDD | TDLA30-75 | 2x2 Low | 1 | 1.4 |
| 2-2 | 100 MHz | 60 | 2 | 16 CCE | R.PDCCH.5-2.1 TDD | TDLA30-75 | 2x2 Low | 1 | -1.6 |

The normative reference for this requirement is TS 38.101-4 [5] clause 7.3.2.2.2.

7.3.2.2.2.4 Test Description

7.3.2.2.2.4.1 Initial Conditions

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

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.2-1 of TS 38.521-2 [8].

Configurations of PDCCH before measurement are specified in Annex C.

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

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

Only sub tests shall be tested which are testable according to Table 7.1.1\_1-2.

For EN-DC within FR2 operation, setup the LTE link according to Annex D:

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 7.3-1 and Table 7.3.2.2.2.3-1 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, C.3.1 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-2 [8].

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 7.3.2.2.1.4.3.

7.3.2.2.2.4.2 Test procedure

1. Set the UE in a direction found using one of the test procedures defined in Annex H If no direction found, mark the test as inconclusive.

2. SS transmits PDCCH with DCI format as specified in PDCCH Reference Channel for C\_RNTI to transmit the DL RMC according to Table 7.3.2.2.2.4.4-1. The details of PDCCH are specified in Table 7.3.2.2.2.3-1 and Table 7.3.2.2.2.3-2. The details of PDSCH are specified in Table A.3.3.2.5-3. The SS sends downlink MAC padding bits on the DL RMC.

3. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 7.3.2.2.2.4.4-1 as appropriate.

4. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 7.3.2.2.2.4.4-1, pass the UE. Otherwise fail the UE.

5. Repeat steps from 1 to 4 for each subtest in Table 7.3.2.2.2.4.4-1 as appropriate.

7.3.2.2.2.4.3 Message contents

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

7.3.2.2.2.4.3.1 Message exceptions for SA

Table 7.3.2.2.2.4.3.1-1: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| frequencyDomainResources | 11111111 11000000 00000000 00000000 00000000 00000 | CORESET to use the least significant 60 RBs of the BWP |  |
| Duration | 2 | SearchSpace  Duration of 2  symbols | Test 2-2 |
| cce-REG-MappingType CHOICE { |  |  |  |
| Interleaved SEQUENCE { | Null |  |  |
| reg-BundleSize | n2 |  |  |
| interleaverSize | n3 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.3.2.2.2.4.3.1-2: PDSCH-TimeDomainResourceAllocationList

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-27 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDSCH-TimeDomainResourceAllocationList ::= SEQUENCE(SIZE(1..maxNrofDL-Allocations)) OF PDSCH-TimeDomainResourceAllocation { | 2 entries |  | Test 2-2 |
| PDSCH-TimeDomainResourceAllocation[1] SEQUENCE { |  | entry 1 |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 53 | Start symbol(S)=2, Length(L)=12 | Test 2-2 |
| } |  |  |  |
| PDSCH-TimeDomainResourceAllocation[2] SEQUENCE { |  | entry 2 |  |
| K0 | Not present |  |  |
| mappingType | typeA |  |  |
| startSymbolAndLength | 100 | Start symbol(S)=2, Length(L)=8 | Test 2-2 |
| } |  |  |  |
| } |  |  |  |

Table 7.3.2.2.2.4.3.1-3: PDCCH Search Space

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel8 | n1 | AL8 | Test 2-1 |
| aggregationLevel16 | n1 | AL16 | Test 2-2 |
| } |  |  |  |
| } |  |  |  |

7.3.2.2.2.4.3.2 Message exceptions for NSA

Same as 7.3.2.2.2.4.3.1.

7.3.2.2.2.4.4 Test requirement

Table 7.3.2.2.2.4.4-1 defines the primary level settings.

For the parameters specified in Table 7.3.2.2.2.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 7.3.2.2.2.4.4-1.

Table 7.3.2.2.2.4.4-1: Test requirements with 120 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Test number** | **Bandwidth** | **CORESET RB** | **CORESET duration** | **Aggregation level** | **Reference Channel** | **Propagation Condition** | **Antenna configuration and correlation Matrix** | **Reference value** | |
| **Pm-dsg (%)** | **SNRBB (dB)** |
| 2-1 | 100 MHz | 60 | 1 | 8 CCE | R.PDCCH.5-1.3 TDD | TDLA30-75 | 2x2 Low | 1 | 3.2 |
| 2-2 | 100 MHz | 60 | 2 | 16 CCE | R.PDCCH.5-2.1 TDD | TDLA30-75 | 2x2 Low | 1 | 0.2 |

##### 7.3.2.2.3 2Rx TDD FR2 PDCCH 1 Tx antenna performance for power saving

7.3.2.2.3.1 Test Purpose

This test verifies the demodulation performance of PDCCH under 2 receive antenna conditions and with a given SNR for which the average probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg), shall be below the specified value in Table 7.3.2.2.3.3-2 after receipt wake-up indication in the *DCI format 2\_6* PDCCH in DRX off state. The downlink physical setup is in accordance with Annex C.2.1.

7.3.2.2.3.2 Test applicability

This test applies to all types of NR UE release 16 and forward supporting Long DRX Cycle and DRX adaptation.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and Long DRX Cycle and DRX adaptation.

7.3.2.2.3.3 Minimum conformance requirements

During the test the UE shall monitor the *DCI format 2\_6* PDCCH in DRX off state and decide whether to receive the following PDCCH in DRX on period.

The parameters specified in Table 7.3.2.2.3.3-1 are valid for normal PDCCH in DRX on period and PDCCH in DRX off period.

Table 7.3.2.2.3.3-1: Test Parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | 1 Tx Antenna |
| TDD UL-DL pattern | |  | FR2.120-1 |
| CCE to REG mapping type | |  | Interleaved |
| REG bundle size | |  | 6 |
| Interleaver size | |  | 2 |
| Shift index | |  | 0 |
|  | |  |  |
| DRX cycle | | ms | 10 |
| *ps-WakeUp-r16* | |  | absent |
| Wake-up indication bit in DCI format 2\_6 | |  | 1 |
| PDCCH DCI format 2\_6 configuration | PS-offset |  | (TminimumTimeGap+1)//0.125 |
| Number of PDCCH candidates |  | 1 |
| Frequency domain resource allocation for CORESET |  | Start from RB = 0 with contiguous RB allocation |
| TCI state |  | TCI state #1 |
| PDCCH configuration | Slots for PDCCH monitoring |  | Each slot during DRX-on period |
|  | |  |  |
| Note: TminimumTimeGap­ is signalled as a part of *drx-Adaptation-r16*UE capability. | | | |

For the parameters specified in Table 7.3.2.2.3.3-2, the average probability of a missed downlink scheduling grant (Pm-dsg) observed on PDCCH during DRX on shall be below the specified value in Table 7.3.2.2.3.3-2. The downlink physical setup is in accordance with Annex C.5.1.

Table 7.3.2.2.3.3-2: Minimum performance requirements with 120 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNRBB (dB) |
| 3-1 | 100 | 60 | 1 | 4 | R.PDCCH. 5-1.2 TDD | TDLA30-300 | 1x2 Low | 1 | 3.0 |
| 8 | R.PDCCH. 5-1.4 TDD |

The normative reference for this requirement is TS 38.101-4 [5] clause 7.3.2.2.3.

7.3.2.2.3.4 Test description

7.3.2.2.3.4.1 Initial conditions

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

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

Configurations of DRX, DCP, PDCCH before measurement are specified in 7.3.2.2.3.4.3.1 and Annex C.

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

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

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

1. Connect the SS, the faders and AWGN noise source to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.

2. The parameter settings for the cell are set up according to Table 7.3-1 and Table 7.3.2.2.3.3-1as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2 and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-2 [8].

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

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without Release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 7.3.2.2.3.4.3.

7.3.2.2.3.4.2 Test procedure

1. SS transmits PDCCH with DCI format2\_6 as specified in PDCCH Reference Channel for C\_RNTI within DRX off state. The Wake-up indication bit in PDCCH is set to 1.

2. Set the UE in a direction found using one of the test procedures defined in Annex H. If no direction found, mark the test as inconclusive.

3. SS transmits PDCCH with DCI format1\_1 as specified in PDCCH Reference Channel R.PDCCH. 5-1.2 TDD for C\_RNTI to transmit the DL RMC according to Table 7.3.2.2.3.4.4-1. The details of PDCCH are specified in Table 7.3.2.2.3.3-1 and Table 7.3.2.2.3.3-2. The details of PDSCH are specified in Table A.3.3.2.5-3. The SS sends downlink MAC padding bits on the DL RMC.

4. Set the parameters of the propagation condition, antenna configuration, the correlation matrix and the SNR according to Table 7.3.2.2.3.4.4-1 as appropriate.

5. Measure the Pm-dsg for a duration sufficient to achieve statistical significance according to Annex G clause G.1.5. Count the number of NACKs, ACKs and statDTXs on the UL PUCCH during each subtest interval. Pm-dsg is the ratio (statDTX)/(NACK+ACK+statDTX). If Pm-dsg is less than the value specified in table 7.3.2.2.3.4.4-1, pass the UE. Otherwise fail the UE.

6. Repeat steps from 2 to 5 for each subtest in Table 7.3.2.2.3.4.4-1 as appropriate.

7.3.2.2.3.4.3 Message contents

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

7.3.2.2.3.4.3.1 Message exceptions for SA

Table 7.3.2.2.3.4.3.1-1: DRX-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [4],Table 4.6.3-56 | | | |
| Information Element | Value/remark | Comment | Condition |
| DRX-Config ::= SEQUENCE { |  |  |  |
| drx-onDurationTimer CHOICE { |  |  |  |
| milliSeconds | ms5 |  |  |
| } |  |  |  |
| drx-InactivityTimer | ms0 |  |  |
| drx-HARQ-RTT-TimerDL | 0 |  |  |
| drx-HARQ-RTT-TimerUL | 0 |  |  |
| drx-RetransmissionTimerDL | sl1 |  |  |
| drx-RetransmissionTimerUL | sl1 |  |  |
| drx-LongCycleStartOffset CHOICE { |  |  |  |
| ms10 | 0 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.3.2.2.3.4.3.1-2: DCP-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-106 | | | |
| Information Element | Value/remark | Comment | Condition |
| dcp-Config-r16 CHOICE { |  |  |  |
| setup SEQUENCE { |  |  |  |
| ps-Offset-r16 | 40 |  |  |
| sizeDCI-2-6-r16 | 2 |  |  |
| ps-PositionDCI-2-6-r16 | 0 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.3.2.2.3.4.3.1-3: PDCCH-Config

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6],Table 4.6.3-95 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCCH-Config::= SEQUENCE { |  |  |  |
| controlResourceSetToAddModList SEQUENCE(SEQUENCE(SIZE (1..3)) OF ControlResourceSet ::= SEQUENCE { | 1 entry |  |  |
| ControlResourceSet[1] | ControlResourceSet |  |  |
| } |  |  |  |
| searchSpacesToAddModList  SEQUENCE(SIZE (1..10)) OF SearchSpace ::= SEQUENCE { | 2 entry |  |  |
| SearchSpace[1] | SearchSpace1 |  |  |
| SearchSpace[2] | SearchSpace2 |  |  |
| } |  |  |  |
| searchSpacesToAddModListExt-r16 SEQUENCE(SIZE (1..10)) OF SearchSpace { | 2 entry |  |  |
| searchSpaceExt-r16[1] | SearchSpaceExt1 |  |  |
| searchSpaceExt-r16[2] | SearchSpaceExt2 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.3.2.2.3.4.3.1-4: PDCCH-ControlResourceSet

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| frequencyDomainResources | 11111111 11000000 00000000 00000000 00000000 00000 | CORESET to use the least significant 60 RBs of the BWP |  |
| cce-REG-MappingType CHOICE { |  |  |  |
| Interleaved SEQUENCE { | Null |  |  |
| reg-BundleSize | n6 |  | 2 |
| interleaverSize | n2 |  | 3 |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 7.3.2.2.3.4.3.1-5: Void

Table 7.3.2.2.3.4.3.1-6: PDCCH-SearchSpace1

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| searchSpaceId | 2 | SearchSpaceId with condition USS | USS |
| controlResourceSetId | 1 | ControlResourceSetId |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel4 | n1 | AL4 |  |
| } |  |  |  |
| } |  |  |  |

Table 7.3.2.2.3.4.3.1-6a: PDCCH-SearchSpace2

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| searchSpaceId | 4 | SearchSpaceId with condition USS | USS |
| controlResourceSetId | 1 | ControlResourceSetId |  |
| monitoringSlotPeriodicityAndOffset CHOICE { |  |  |  |
| sl1 | NULL |  |  |
| } |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel4 | n1 | AL4 |  |
| } |  |  |  |
| searchSpaceType | Not present |  |  |
| } |  |  |  |

Table 7.3.2.2.3.4.3.1-7: PDCCH-SearchSpaceExt1

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7a | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpaceExt-r16 ::= SEQUENCE { |  |  |  |
| controlResourceSetId-r16 | 1 |  |  |
| } |  |  |  |

Table 7.3.2.2.3.4.3.1-7a: PDCCH-SearchSpaceExt2

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.0-7a | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpaceExt-r16 ::= SEQUENCE { |  |  |  |
| controlResourceSetId-r16 | 1 |  |  |
| searchSpaceType-r16 SEQUENCE { |  |  |  |
| common SEQUENCE { |  |  |  |
| dci-Format2-6-r16 SEQUENCE { | NULL |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

7.3.2.2.3.4.3.2 Message exceptions for NSA

Same as 7.3.2.2.3.4.3.1.

7.3.2.2.3.4.4 Test requirement

Table 7.3.2.2.3.4.4-1 defines the primary level settings.

For the parameters specified in Table 5.3-1 the average probability of a missed downlink scheduling grant (Pm-dsg) shall be below the specified value in Table 7.3.2.2.3.4.4-1.

Table 7.3.2.2.3.4.4-1: Minimum performance with 120 kHz SCS

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) | CORESET RB | CORESET duration | Aggregation level | Reference Channel | Propagation Condition | Antenna configuration and correlation Matrix | Reference value | |
| Pm-dsg (%) | SNRBB (dB) |
| 3-1 | 100 | 60 | 1 | 4 | R.PDCCH. 5-1.2 TDD | TDLA30-300 | 1x2 Low | 1 | 4.7 |
| 8 | R.PDCCH. 5-1.4 TDD |

## 7.4 PBCH demodulation requirements

TS 38.101-4 shall specify the PBCH performance requirements and has recommended that these requirements do not need to be tested.

## 7.5 Sustained downlink data rate provided by lower layers

### 7.5.1 FR2 Sustained downlink data rate performance for single carrier

7.5.1.1 Test Purpose

The purpose of the test is to verify that the Layer 1 and Layer 2 correctly process in a sustained manner the received packets corresponding to the maximum data rate indicated by UE capabilities*.* The sustained downlink data rate shall be verified in terms of the success rate of delivered PDCP SDU(s) by Layer 2. The test case below specifies the RF conditions and the required success rate of delivered TB by Layer 1 to meet the sustained data rate requirement.

7.5.1.2 Test Applicability

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

7.5.1.3 Minimum conformance requirements

The requirements in this clause are applicable to the FR2 single carrier case.

The requirements and procedure defined below apply using operating band instead of CA configuration, and bandwidth instead of bandwidth combination.

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 7.5.1.3-3 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 7.5.1.3-4 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.



where

J is the number of aggregated component carriers in CA bandwidth combination

TBSj 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 7.5.1.3-1

µj 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%\*NDL\_correct\_rx/ (NDL\_newtx + NDL\_retx), where NDL\_newtx is the number of newly transmitted DL transport blocks, NDL\_retx is the number of retransmitted DL transport blocks, and NDL\_correct\_rx is the number of correctly received DL transport blocks.

The test parameters are specified in Table 7.5.1.3-1.

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 7.5.1.3-1: Test parameters for FR2 TDD

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Value |
| PDSCH transmission scheme | | |  | Transmission scheme 1 |
| PTRS epre-Ratio | | |  | 0 |
| Channel bandwidth | | | MHz | Channel bandwidth from selected CA bandwidth combination |
| Common serving cell parameters | Physical Cell ID | |  | 0 |
| SSB position in burst | |  | First SSB in Slot #0 |
| SSB periodicity | | ms | 20 |
| First DMRS position for Type A PDSCH mapping | |  | 2 |
| Cross carrier scheduling | | |  | Not configured |
| Active DL BWP index | | |  | 1 |
| Actual carrier configuration | Offset between Point A and the lowest usable subcarrier on this carrier (Note 3) | | RBs | 0 |
| Subcarrier spacing | | kHz | 60 or 120 |
| DL BWP configuration #1 | RB Offset | |  | 0 |
| 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 |
| PDCCH configuration | Slots for PDCCH monitoring | |  | Each slot |
| Symbols with PDCCH | |  | Symbols #0 |
| Number of PRBs in CORESET | |  | Table 7.5A.1-2 |
| Number of PDCCH candidates and aggregation levels | |  | 2/AL2 for 120 kHz / 50 MHz  2/AL4 for 60 kHz / 50 MHz, 120 kHz / 100 MHz  2/AL8 for other greater combinations |
| CCE-to-REG mapping type | |  | Non-interleaved |
| DCI format | |  | 1-1 |
| TCI State | |  | TCI state #1 |
| PDCCH &PDCCH DMRS Precoding configuration | |  | For number of Tx=1: No precoding;  For number of Tx>1: Single Panel Type I, Randomized precoder selection for every REG bundle and updated per slot with equal probability of precoder index 0 and 2 |
| PDSCH configuration | Mapping type | |  | Type A |
| k0 | |  | 0 |
| PDSCH aggregation factor | |  | 1 |
| PRB bundling type | |  | Static |
| PRB bundling size | |  | wideband |
| Resource allocation type | |  | Type 0 |
| RBG size | |  | Config2 |
| VRB-to-PRB mapping type | |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size | |  | N/A |
| Starting symbol (S) | |  | 1 |
| Length (L) | |  | 13 |
| PDSCH DMRS configuration | DMRS Type | |  | Type 1 |
| Number of additional DMRS | |  | 1 |
| Length | |  | 1 |
| Antenna ports indexes | |  | {1000} for 1 Layer CCs {1000, 1001} for 2 Layers CCs |
| Number of PDSCH DMRS CDM group(s) without data | |  | 1 |
| PTRS configuration | Frequency density (*KPT-RS*) | |  | 2 |
| Time density (*LPT-RS*) | |  | 1 |
| CSI-RS for tracking | Subcarrier indexes in the PRB used for CSI-RS | |  | k0 = 3 for CSI-RS resource 1,2,3,4 |
| OFDM symbols in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resource 1 and 3  l0 = 10 for CSI-RS resource 2 and 4 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 |
| CDM Type | |  | 'No CDM' for CSI-RS resource 1,2,3,4 |
| Density (ρ) | |  | 3 for CSI-RS resource 1,2,3,4 |
| CSI-RS periodicity | | Slots | 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 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = ceil(BWP size/4)\*4 |
| QCL info | |  | TCI state #0 |
| NZP CSI-RS for CSI acquisition | Subcarrier indexes in the PRB used for CSI-RS | |  | k0 = 4 |
| OFDM symbols in the PRB used for CSI-RS | |  | l0 = 13 |
| Number of CSI-RS ports (X) | |  | Same as number of transmit antenna |
| CDM Type | |  | 'FD-CDM2' |
| Density (ρ) | |  | 1 |
| CSI-RS periodicity | | Slots | 60 kHz SCS: 80  120 kHz SCS: 160 |
| CSI-RS offset | |  | 0 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = ceil(BWP size/4)\*4 |
| QCL info | |  | TCI state #1 |
| ZP CSI-RS for CSI acquisition | Subcarrier indexes in the PRB used for CSI-RS | |  | k0 = 0 |
| OFDM symbols in the PRB used for CSI-RS | |  | l0 = 12 |
| Number of CSI-RS ports (X) | |  | 4 |
| CDM Type | |  | 'FD-CDM2' |
| Density (ρ) | |  | 1 |
| CSI-RS periodicity | | Slots | 60 kHz SCS: 80  120 kHz SCS: 160 |
| CSI-RS offset | |  | 0 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = ceil(BWP size/4)\*4 |
| CSI-RS for beam refinement | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resource 1,2 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 8 for CSI-RS resource 1  l0 = 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 |
| Density (ρ) | |  | 3 for CSI-RS resource 1,2 |
| CSI-RS periodicity | | Slots | 60 kHz SCS: 80 for CSI-RS resource 1,2  120 kHz SCS: 160 for CSI-RS resource 1,2 |
| CSI-RS offset | | Slots | 0 for CSI-RS resource 1,2 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = ceil(BWP size/4)\*4 |
| Repetition | |  | ON |
| QCL info | |  | TCI state #1 |
| TCI state #0 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type D |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type D |
| Maximum number of code block groups for ACK/NACK feedback | | |  | 1 |
| Number of HARQ Processes | | |  | 10 for FR2.60-1 and 8 for FR2.120-1 |
| K1 value | | |  | Specific to each UL-DL pattern |
| Maximum number of HARQ transmission | | |  | 4 |
| HARQ ACK/NACK bundling | | |  | Multiplexed |
| Redundancy version 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 | | |  | For number of Tx=1: No precoding;  For number of Tx>1: Single Panel Type I, Precoder index 0 with Wideband granularity and updated per slot for Rank 2 |
| Symbols for all unused REs | | |  | OP.1 FDD as defined in Annex A.5.1.1  OP.1 TDD as defined in Annex A.5.2.1 |
| Propagation condition | | |  | Static propagation condition  No external noise sources are applied |
| Antenna configuration | 1 layer CCs | |  | 1x2 or 1x4 |
| 2 layers CCs | |  | 2x2 or 2x4 |
| Physical signals, channels 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 7.5.1.3-2: 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 7.5.1.3-3: 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 7.5.1.3-4: SNR required to achieve 85% of peak throughput

|  |  |  |
| --- | --- | --- |
| MCS Index (Note 1) | SNRBB(dB) for maximum number of PDSCH MIMO Layers = 1 | SNRBB(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]. | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 7.5.1.

7.5.1.4 Test description

7.5.1.4.1 Initial conditions

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

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

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

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

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 4.3.1.1.

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram (without fader and AWGN) and clause A.3.2.2 for UE diagram.

2. The parameter settings for the NR cell are initially set up according to Table 7.5.1.3-1 as appropriate.

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

4. Propagation conditions for the NR cell are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR with *Connected without release On, Test Loop Function On with UE Test Loop Mode A with UL\_PDCP\_SDU\_SIZE = 0* according to TS 38.508-1 [6] clause 4.5.4. Message content are defined in clause 7.5.1.4.3.

6. SS shall transmit UECapabilityEnquiry message.

7. The UE shall transmit UECapabilityInformation message.

8. Using the UE capabilities advertised in the *UE-CapabilityRAT-Container* of the type *UE-NR-Capability,* and the procedure outlined in 7.5.1.3 determine one set of parameters that would provide the largest data rate.

9. Setup up the NR cell using these parameters for the test.

10. Configure the TBsize, DL RMC, UL RMC, PDCP size from Annex A.3.2\_1 and Annex A.2.2 for UL as appropriate.

7.5.1.4.2 Test procedure

1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.0. If no direction found, mark the test as inconclusive.

2. SS configures T-reordering timer to be infinity.

3. SS sends a PDCP reestablishment via RRC Reconfiguration message requesting for PDCP Status Report.

4. SS sets the counters NDL\_newtx NDL\_retx to 0.

5. For each new DL HARQ transmission the SS generates sufficient PDCP SDUs (max PDCP SDU size and minimum number of consecutive PDCP SDUs) to fill up the TB in accordance with Annex A.3.2\_1. The SS ciphers the PDCP SDUs, concatenates the resultant PDCP PDUs to form an RLC PDU and then a MAC PDU. The SS transmits the MAC PDU. The SS increments then NDL\_newtx by one

6. If PHY requests a DL HARQ retransmission, the SS performs a HARQ retransmission and increments NDL\_retx by one.

7. Steps 5 to 6 are repeated at every TTI for at least 300 frames and the SS waits for 300ms to let any HARQ retransmissions and RLC retransmissions to finish.

8. SS sends a PDCP reestablishment via RRC Reconfiguration message requesting for PDCP Status Report.

9. The SS calculates the TB success rate as A = 100%\* NDL\_correct\_rx / (NDL\_newtx + NDL\_retx).

10. SS computes the PDCP SDU loss by looking into the FMC and Bitmap field in the PDCP Status Report. PDCP SDU loss B = COUNT reported in the Bitmap field of PDCP Stata Report.

11. The UE passes the test if A ≥ 85% TB success rates and B = 0.

Note 1: In case of RLC PDU retransmission, the number of new required PDCP SDUs is as many as to fill the rest of TB.

7.5.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2 with the following exceptions

Table 7.5.1.4.3-0: CLOSE UE TEST LOOP (in the preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.509 clause 6.3.1 | | | |
| Information Element | | Value/remark | Comment | Condition |
| Protocol discriminator | | 1 1 1 1 |  |  |
| Skip indicator | | 0 0 0 0 |  |  |
| Message type | | 1 0 0 0 0 0 0 0 |  |  |
| UE test loop mode | | 0 0 0 0 0 0 0 0 | UE test loop mode A |  |
| UE test loop mode A LB setup | |  |  |
| Length of UE test loop mode A LB setup list in bytes | | 0 0 0 0 0 0 1 1 | Length of one LB setup DRB (3 bytes) |
| LB setup DRB | | 0 0 0 0 0 0 0 0,  0 0 0 0 0 0 0 0,  0 0 Q5 Q4 Q3 Q2 Q1 Q0 | UL PDCP SDU size = 0  Q5 = 1 (for NR Data Radio Bearers)  Q4..Q0 = Data Radio Bearer identity number -1 for the radio bearer. See 38.509 clause 6.3.1 |
| UE test loop mode B LB setup | | Not present |  |

Table 7.5.1.4.3-1: RadioBearerConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3-132 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF SEQUENCE { | 1 entry |  | DRB1 |
| cnAssociation CHOICE { |  |  |  |
| sdap-Config | SDAP-Config |  |  |
| } |  |  |  |
| drb-Identity | DRB-Identity using condition DRB1 |  |  |
| reestablishPDCP | true |  | DRB1 AND Re-establish\_PDCP |
| pdcp-Config | PDCP-Config |  |  |
| } |  |  |  |

Table 7.5.1.4.3-2: *PDCP-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-99 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCP-Config ::= SEQUENCE { |  |  |  |
| drb SEQUENCE { |  |  |  |
| discardTimer | infinity |  |  |
| pdcp-SN-Size-UL | len18bits |  |  |
| pdcp-SN-Size-DL | len18bits |  |  |
| headerCompression CHOICE { |  |  |  |
| notUsed | Null |  |  |
| } |  |  |  |
| integrityProtection | Not present |  |  |
| statusReportRequired | true |  |  |
| outOfOrderDelivery | Not present |  |  |
| } |  |  |  |
| t-Reordering | Not present |  |  |
| } |  |  |  |

Table 7.5.1.4.3-3: PDCCH *Search Space*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.3-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel1 | n0 |  |  |
| aggregationLevel2 | n2 | 1 for UL, 1 for DL | BW 50 MHz SCS 120 kHz |
| aggregationLevel4 | n2 | 1 for UL, 1 for DL | (BW 50 MHz SCS 60 kHz) OR (BW 100 MHz SCS 120 kHz) |
| aggregationLevel8 | n2 | 1 for UL, 1 for DL | (BW 100 MHz SCS 60 kHz) OR (BW 200 MHz SCS 120 kHz) OR (BW 400 MHz SCS 120 kHz) |
| aggregationLevel16 | n0 |  |  |
| } |  |  |  |
| } |  |  |  |

7.5.1.5 Test requirement

The TB success rate of greater than 85% with no PDCP SDU loss shall be sustained during at least 300 frames.

### 7.5.2 FR2 Sustained downlink data rate performance for RedCap

7.5.2.1 Test Purpose

The purpose of the test is to verify that the Layer 1 and Layer 2 correctly process in a sustained manner the received packets corresponding to the maximum data rate indicated by UE 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.

7.5.2.2 Test Applicability

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

7.5.2.3 Minimum conformance requirements

Same as in Clause 7.5.1.3 except that the MIMO layers are configured to 2 for UE supporting 2 MIMO layers and 1 for UE supporting 1 MIMO layers for all operating bands. Antenna configuration is 1x1 for UE supporting 1 layer and 2x2 for UE supporting 2 layers.

7.5.2.4 Test description

7.5.2.4.1 Initial conditions

Same as in Clause 7.5.1.4.1.

7.5.2.4.2 Test procedure

Same as in Clause 7.5.1.4.2.

7.5.2.4.3 Message contents

Same as in Clause 7.5.1.4.3.

7.5.2.5 Test requirement

Same as in Clause 7.5.1.5.

### 7.5A.1 FR2 Sustained downlink data rate performance for carrier aggregation

#### 7.5A.1.1 FR2 SDR performance for CA (2DL CA)

7.5A.1.1.1 Test Purpose

The purpose of the test is to verify that the Layer 1 and Layer 2 correctly process in a sustained manner the received packets corresponding to the maximum data rate indicated by UE capabilities*.* The sustained downlink data rate shall be verified in terms of the success rate of delivered PDCP SDU(s) by Layer 2. The test case below specifies the RF conditions and the required success rate of delivered TB by Layer 1 to meet the sustained data rate requirement.

7.5A.1.1.2 Test Applicability

This test applies to all types of NR UE release 15 and forward supporting 2DLCA.

7.5A.1.1.3 Minimum conformance requirements

Same as 7.5.1.3

7.5A.1.1.4 Test description

7.5A.1.1.4.1 Initial conditions

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1 for TE diagram (without fader and AWGN) and clause A.3.2.2 for UE diagram.

2. The parameter settings for the NR cell are initially set up according to Table 7.5.1.3-1 as appropriate.

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

4. Propagation conditions for the NR cell(s) as applicable are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR with *Connected without release On, Test Loop Function On with UE Test Loop Mode A with UL\_PDCP\_SDU\_SIZE = 0* according to TS 38.508-1 [6] clause 4.5.4. Message content are defined in clause 7.5.1.4.3.

6. Configure SCC(s) as applicable according to Annex C.0, C.1 and C.2 for all downlink physical channels.

7. The SS shall configure SCC(s) as applicable as per TS 38.508-1 [6] clause 5.5.1.

8. SS activates SCC(s) as applicable by sending the activation MAC-CE (Refer TS 38.321 [18], clauses 5.9, 6.1.3.10). Wait for at least 1 second (Refer TS 38.133[19], clause9.3).

9. SS shall transmit UECapabilityEnquiry message.

10. The UE shall transmit UECapabilityInformation message.

11. Using the UE capabilities advertised in the *UE-CapabilityRAT-Container* of the type *UE-NR-Capability,* and the procedure outlined in 7.5.1.3 determine one set of parameters that would provide the largest data rate.

12. Setup up the NR cells using these parameters for the test.

13. Configure the TBsize, DL RMC, UL RMC, PDCP size from Annex A.3.2\_1 and Annex A.2.2 for UL as appropriate.

7.5A.1.1.4.2 Test procedure

1. SS configures T-reordering timer to be infinity.

2. SS sends a PDCP reestablishment via RRC Reconfiguration message requesting for PDCP Status Report.

3. SS sets the counters NDL\_newtx NDL\_retx to 0.

4. For each new DL HARQ transmission the SS generates sufficient PDCP SDUs (max PDCP SDU size and minimum number of consecutive PDCP SDUs) to fill up the TB on both PCC and SCC(s) as applicable in accordance with Annex A.3.2\_1. The SS ciphers the PDCP SDUs, concatenates the resultant PDCP PDUs to form an RLC PDU and then a MAC PDU. The SS transmits the MAC PDU. The SS increments then NDL\_newtx by one

5. If PHY requests a DL HARQ retransmission, the SS performs a HARQ retransmission and increments NDL\_retx by one.

6. Steps 5 to 6 are repeated at every TTI for at least 300 frames and the SS waits for 300ms to let any HARQ retransmissions and RLC retransmissions to finish.

7. SS sends a PDCP reestablishment via RRC Reconfiguration message requesting for PDCP Status Report.

8. The SS calculates the TB success rate as A = 100%\* NDL\_correct\_rx / (NDL\_newtx + NDL\_retx).

10. SS computes the PDCP SDU loss by looking into the FMC and Bitmap field in the PDCP Status Report. PDCP SDU loss B = COUNT reported in the Bitmap field of PDCP Stata Report.

11. The UE passes the test if A ≥ 85% TB success rates and B = 0.

Note 1: In case of RLC PDU retransmission, the number of new required PDCP SDUs is as many as to fill the rest of TB.

7.5A.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2 with the following exceptions

Table 7.5A.1.1.4.3-0: CLOSE UE TEST LOOP (in the preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.509 clause 6.3.1 | | | |
| Information Element | | Value/remark | Comment | Condition |
| Protocol discriminator | | 1 1 1 1 |  |  |
| Skip indicator | | 0 0 0 0 |  |  |
| Message type | | 1 0 0 0 0 0 0 0 |  |  |
| UE test loop mode | | 0 0 0 0 0 0 0 0 | UE test loop mode A |  |
| UE test loop mode A LB setup | |  |  |
| Length of UE test loop mode A LB setup list in bytes | | 0 0 0 0 0 0 1 1 | Length of one LB setup DRB (3 bytes) |
| LB setup DRB | | 0 0 0 0 0 0 0 0,  0 0 0 0 0 0 0 0,  0 0 Q5 Q4 Q3 Q2 Q1 Q0 | UL PDCP SDU size = 0  Q5 = 1 (for NR Data Radio Bearers)  Q4..Q0 = Data Radio Bearer identity number -1 for the radio bearer. See 38.509 clause 6.3.1 |
| UE test loop mode B LB setup | | Not present |  |

Table 7.5A.1.1.4.3-1: RadioBearerConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3-132 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF SEQUENCE { | 1 entry |  | DRB1 |
| cnAssociation CHOICE { |  |  |  |
| sdap-Config | SDAP-Config |  |  |
| } |  |  |  |
| drb-Identity | DRB-Identity using condition DRB1 |  |  |
| reestablishPDCP | true |  | DRB1 AND Re-establish\_PDCP |
| pdcp-Config | PDCP-Config |  |  |
| } |  |  |  |

Table 7.5A.1.1.4.3-2: *PDCP-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-99 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCP-Config ::= SEQUENCE { |  |  |  |
| drb SEQUENCE { |  |  |  |
| discardTimer | infinity |  |  |
| pdcp-SN-Size-UL | len18bits |  |  |
| pdcp-SN-Size-DL | len18bits |  |  |
| headerCompression CHOICE { |  |  |  |
| notUsed | Null |  |  |
| } |  |  |  |
| integrityProtection | Not present |  |  |
| statusReportRequired | true |  |  |
| outOfOrderDelivery | Not present |  |  |
| } |  |  |  |
| t-Reordering | Not present |  |  |
| } |  |  |  |

Table 7.5A.1.1.4.3-3: PDCCH *Search Space*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.3-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel1 | n0 |  |  |
| aggregationLevel2 | n2 | 1 for UL, 1 for DL | BW 50 MHz SCS 120 kHz |
| aggregationLevel4 | n2 | 1 for UL, 1 for DL | (BW 50 MHz SCS 60 kHz) OR (BW 100 MHz SCS 120 kHz) |
| aggregationLevel8 | n2 | 1 for UL, 1 for DL | (BW 100 MHz SCS 60 kHz) OR (BW 200 MHz SCS 120 kHz) OR (BW 400 MHz SCS 120 kHz) |
| aggregationLevel16 | n0 |  |  |
| } |  |  |  |
| } |  |  |  |

7.5A.1.1.5 Test requirement

The TB success rate of greater than 85% with no PDCP SDU loss shall be sustained during at least 300 frames on each CC.

#### 7.5A.1.2 FR2 SDR performance for CA (3DL CA)

Editor’s Note: MU analysis is complete for upto 400MHz Aggregated Channel BW

7.5A.1.2.1 Test Purpose

Same as in clause 7.5A.1.2.1

7.5A.1.2.2 Test Applicability

This test applies to all types of NR UE release 15 and forward supporting 3DLCA.

7.5A.1.2.3 Minimum conformance requirements

Same as in 7.5.1.3

7.5A.1.2.4 Test description

Same as in clause 7.5A.1.1.4

7.5A.1.2.5 Test requirement

The TB success rate of greater than 85% with no PDCP SDU loss shall be sustained during at least 300 frames on each CC.

#### 7.5A.1.3 FR2 SDR performance for CA (4DL CA)

Editor’s Note: MU analysis is complete for upto 400MHz Aggregated Channel BW 7.5A.1.3.1 Test Purpose

Same as in clause 7.5A.1.3.1

7.5A.1.3.2 Test Applicability

This test applies to all types of NR UE release 15 and forward supporting 4DLCA.

7.5A.1.3.3 Minimum conformance requirements

Same as in 7.5.1.3

7.5A.1.3.4 Test description

Same as in clause 7.5A.1.1.4

7.5A.1.3.5 Test requirement

The TB success rate of greater than 85% with no PDCP SDU loss shall be sustained during at least 300 frames on each CC.

#### 7.5A.1.4 FR2 SDR performance for CA (5DL CA)

Editor’s Note: MU analysis is complete for upto 400MHz Aggregated Channel BW

7.5A.1.4.1 Test Purpose

Same as in clause 7.5A.1.3.1

7.5A.1.4.2 Test Applicability

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

7.5A.1.4.3 Minimum conformance requirements

Same as in 7.5.1.3

7.5A.1.4.4 Test description

Same as in clause 7.5A.1.1.4

7.5A.1.4.5 Test requirement

The TB success rate of greater than 85% with no PDCP SDU loss shall be sustained during at least 300 frames on each CC.

#### 7.5A.1.5 FR2 SDR performance for CA (6DL CA)

Editor’s Note: MU analysis is complete for upto 400MHz Aggregated Channel BW

7.5A.1.5.1 Test Purpose

Same as in clause 7.5A.1.3.1

7.5A.1.5.2 Test Applicability

This test applies to all types of NR UE release 15 and forward supporting 6DLCA.

7.5A.1.5.3 Minimum conformance requirements

Same as in 7.5.1.3

7.5A.1.5.4 Test description

Same as in clause 7.5A.1.1.4

7.5A.1.5.5 Test requirement

The TB success rate of greater than 85% with no PDCP SDU loss shall be sustained during at least 300 frames on each CC.

#### 7.5A.1.6 FR2 SDR performance for CA (7DL CA)

Editor’s Note: MU analysis is complete for upto 400MHz Aggregated Channel BW

7.5A.1.6.1 Test Purpose

Same as in clause 7.5A.1.3.1

7.5A.1.6.2 Test Applicability

This test applies to all types of NR UE release 15 and forward supporting 7DLCA.

7.5A.1.6.3 Minimum conformance requirements

Same as in 7.5.1.3

7.5A.1.6.4 Test description

Same as in clause 7.5A.1.1.4

7.5A.1.6.5 Test requirement

The TB success rate of greater than 85% with no PDCP SDU loss shall be sustained during at least 300 frames on each CC.

#### 7.5A.1.7 FR2 SDR performance for CA (8DL CA)

Editor’s Note: MU analysis is complete for upto 400MHz Aggregated Channel BW

7.5A.1.7.1 Test Purpose

Same as in clause 7.5A.1.3.1

7.5A.1.7.2 Test Applicability

This test applies to all types of NR UE release 15 and forward supporting 8DLCA.

7.5A.1.7.3 Minimum conformance requirements

Same as in 7.5.1.3

7.5A.1.7.4 Test description

Same as in clause 7.5A.1.1.4

7.5A.1.7.5 Test requirement

The TB success rate of greater than 85% with no PDCP SDU loss shall be sustained during at least 300 frames on each CC.

# 8 CSI reporting requirements (Radiated requirements)

## 8.1 General

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

For conformance testing involving FR2 test cases in this specification, the UE under test shall be pre-configured with UL Tx diversity schemes disabled to account for single polarization System Simulator (SS) in the test environment. The UE under test may transmit with dual polarization.

### 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 [3] with FDL\_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 antenna | CQI | All tests in Clause 8.2.2 |
| 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 (*pdsch-256QAM-FR2*) | FR2 TDD | CQI | Clause 8.2.2.2.2.1\_1 (Tests 3 and 4) | The test coverage can be considered fulfilled without executing of Test 1 and 2 from Clause 8.2.2.2.2.1 if UE passes Test 3 and 4 from Clause 8.2.2.2.2.1\_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-LayersPDSCH)* | 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 PDSCH MIMO layers capability |
| RI | Clause 8.4.2.2 |
| Support of 1 port PTRS (*onePortsPTRS*) | FR2 TDD | CQI | Clause 8.2 |  |
| PMI | Clause 8.3 |
| 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 clause 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 clause 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 component 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.

#### 8.1.1.6 Applicability of requirements for RedCap

The performance requirements in Table 8.1.1.6-1 shall apply for UEs which support optional feature *supportOfRedCap*.

Table 8.1.1.6-1: Requirements applicability for RedCap

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE capability | Test type | | Test list | Applicability notes |
| RedCap with 2RX | FR2 TDD | CQI | Clause 8.2.2.2.1.1 (Tests 1 and 2)  Clause 8.2.2.2.2.1 (Test 1) |  |
|  |  | PMI | Clause 8.3.2.2.1 (Tests 2) |  |
|  |  | RI | Clause 8.4.2.2 (Test 2) |  |

### 8.1.1\_1 Applicability of test requirements due to maximum achievable SNR

The current assumption of maximum testable SNRBB for PC3, Max device size ≤ 30 cm under fading conditions is specified in Tables 7.1.1\_1-1 and 7.1.1\_1-1a.

The current assumption of maximum testable SNRBB for indirect far field (IFF), PC3, Max device size ≤ 30 cm without fading conditions is specified in Tables 8.1.1\_1-0 and 8.1.1\_1-1.

Table 8.1.1\_1-0: Current assumption of maximum testable SNRBB under fading for modulations up to 256 QAM for CSI scenarios

|  |  |  |  |
| --- | --- | --- | --- |
| Operating Band / Frequency | Maximum testable SNRBB (dB) | | |
| CHBW 50 MHz | CHBW 100 MHz | CHBW 200 MHz |
| n257 mid | 26.3 | 23.2 | 20.1 |
| n258 mid | 26.3 | 23.2 | 20.1 |
| n259 mid | 16.0 | 12.8 | 9.6 |
| n260 mid | 20.1 | 16.9 | 13.8 |
| n261 mid | 26.3 | 23.2 | 20.1 |

Table 8.1.1\_1-1: Current assumption of maximum testable SNRBB without fading for modulations up to 256 QAM

|  |  |  |  |
| --- | --- | --- | --- |
| Operating Band / Frequency | Maximum testable SNRBB (dB) | | |
| CHBW 50 MHz | CHBW 100 MHz | CHBW 200 MHz |
| n257 mid | 28.7 | 25.5 | 22.5 |
| n258 mid | 28.7 | 25.5 | 22.5 |
| n259 mid | 18.4 | 15.2 | 12.1 |
| n260 mid | 22.5 | 19.3 | 16.3 |
| n261 mid | 28.7 | 25.5 | 22.5 |

Based on the current assumption of maximum testable SNRBB, the applicability of test points is defined in Table 8.1.1\_1-2 for indirect far field (IFF), PC3, Max device size ≤ 30 cm under fading conditions.

Table 8.1.1\_1-2: Testability of test requirements due to maximum achievable SNR per band

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Test Case | | Test point | | CHBW / MHz | | Fading | | SNR test requirement | | Test Point Applicability | | | | | | | | | |
| n257 | | n258 | | n259 | | n260 | | n261 | |
| 8.2.2.2.1.1 | | 1 | | 100 | | No | | 9 | | x | | x | | x | | x | | x | |
|  | | 2 | | 100 | | No | | 15 | | x | | x | | x | | x | | x | |
| 8.2.2.2.2.1 | | 1 | | 100 | | Yes | | 7 | | x | | x | | x | | x | | x | |
|  | | 2 | | 100 | | Yes | | 13 | | x | | x | | x | | x | | x | |
| 8.2.2.2.2.1\_1 | | 3 | | 50 | | Yes | | 8 | | x | | x | | x | | x | | x | |
|  | | 4 | | 50 | | Yes | | 21 | | x | | x | | TBD | | TBD | | x | |
| 8.2A.3.1.1 | | 1 | | BWagg ≤ 200 | | No | | 10 | | x | | x | | x | | x | | x | |
| BWagg > 200 | | No | | 10 | | TBD | | TBD | | TBD | | TBD | | TBD | |
| 8.2A.3.1.2 | | 1 | | BWagg ≤ 200 | | No | | 12 | | x | | x | | x | | x | | x | |
| BWagg > 200 | | No | | 12 | | TBD | | TBD | | TBD | | TBD | | TBD | |
| 8.2A.3.1.3 | | 1 | | BWagg ≤ 200 | | No | | 12 | | x | | x | | x | | x | | x | |
| BWagg > 200 | | No | | 12 | | TBD | | TBD | | TBD | | TBD | | TBD | |
| 8.4.2.2.1 | | 1 | | 100 | | Yes | | 0 | | x | | x | | X | | x | | x | |
|  | | 2 | | 100 | | Yes | | 16 | | x | | x | | x | | x | | x | |
|  | | 3 | | 100 | | Yes | | 16 | | x | | x | | x | | x | | x | |

### 8.1.2 Common test parameters

Parameters specified in Table 8.1.2-1 are applied for all test cases in this section unless otherwise stated.

Table 8.1.2-1: Test parameters for CSI test cases

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Value** |
| PDSCH transmission scheme | | |  | Transmission scheme 1 |
| Duplex Mode | | |  | TDD |
| PTRS *epre-Ratio* | | |  | 0 |
| Actual carrier configuration | Offset between Point A and the lowest usable subcarrier on this carrier (Note 3) | | RBs | 0 |
| Subcarrier spacing | | kHz | 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 [3] for tested channel bandwidth and subcarrier spacing |
| Active DL BWP index | | |  | 1 |
| Common serving cell parameters | Physical Cell ID | |  | 0 |
| SSB position in burst | |  | First SSB in Slot #0 |
| SSB periodicity | | ms | 20 |
| PDCCH configuration | Slots for PDCCH monitoring | |  | Each slot |
| Symbols with PDCCH | |  | 0,1 |
| Number of PDCCH candidates and aggregation levels | |  | 1/AL8 |
| DCI format | |  | 1\_1 |
| 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  Static propagation conditions:  Single Panel Type I, Random precoder chosen from precoder index 0 and 2, selection updated per slot |
| Cross carrier scheduling | | |  | Not configured |
| 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 |
| DMRS ports indexes | |  | {1000} for Rank1  {1000,1001} for Rank2 |
| Maximum number of OFDM symbols for DL front loaded DMRS | |  | 1 |
| Number of PDSCH DMRS CDM group(s) without data | |  | 2 |
| PTRS configuration | Frequency density (*KPT-RS*) | |  | 2 |
| Time density (*LPT-RS*) | |  | 1 |
| Resource Element Offset | |  | 2 |
| CSI-RS for tracking | First subcarrier index in the PRB used for CSI-RS (*k0*) | |  | 0 for CSI-RS resource 1,2,3,4 |
| First OFDM symbol in the PRB used for CSI-RS (*l0*) | |  | 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 periodicity | | slot | 120kHz SCS: 160 for CSI-RS resource 1,2,3,4 |
| CSI-RS offset | | slot | 120 kHz SCS:  80 for CSI-RS resource 1 and 2  81 for CSI-RS resource 3 and 4 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = BWP size |
| QCL info | |  | TCI state #0 |
| NZP CSI-RS for CSI acquisition | Frequency Occupation | |  | Start PRB 0  Number of PRB = BWP size |
| QCL info | |  | TCI state #1 |
| ZP CSI-RS for CSI acquisition | Frequency Occupation | |  | Start PRB 0  Number of PRB = BWP size |
| CSI-RS for beam refinement | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resource 1,2 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 8 for CSI-RS resource 1  l0 = 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 |
| Density (ρ) | |  | 3 for CSI-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 1,2 |
| Repetition | |  | ON |
| QCL info | |  | TCI state #1 |
| TCI state #0 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type D |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | CSI-RS resource 1 from 'CSI-RS for tracking' configuration |
| QCL Type |  | Type D |
| Number of HARQ Processes | | |  | 8 |
| HARQ ACK/NACK bundling | | |  | Multiplexed |
| Redundancy version coding sequence | | |  | {0,2,3,1} |
| K1 value (PDSCH-to-HARQ-timing-indicator) | | |  | For FR2.120-1:  3 if mod (i.5) = 0,  6 if mod(i,5) = 2  For FR2.120-2:  11 if mod(i,8) = 0,  7]if mod(i,8) = 4,  6]if mod(i,8) = 5,  where i is slot index per radio fame with values 0-79. |
| Symbols for unused REs | | |  | OCNG as specified in A.5 |
| Physical signals, channels mapping and precoding | | |  | As specified in Annex B.4.1 |
| Note 1: PDSCH is not scheduled on slots containing CSI-RS or 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.  Note 3: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-2 [3] for tested channel bandwidth and subcarrier spacing. | | | | |

## 8.2 Reporting of Channel Quality Indicator (CQI)

### 8.2.1 1RX requirements

TBD

### 8.2.2 2RX requirements

#### 8.2.2.1 FDD

TBD

#### 8.2.2.2 TDD

##### 8.2.2.2.1 CQI reporting under AWGN conditions

###### 8.2.2.2.1.1 2Rx TDD FR2 periodic wideband CQI reporting under AWGN performance for both SA and NSA

8.2.2.2.1.1.1 Test Purpose

The purpose of this test is to verify the variance of the wideband CQI reports is within the limits defined and a PDSCH BLER of 10% falls between the transport format based median CQI-1 and median CQI or the transport format based median CQI and median CQI +1.

8.2.2.2.1.1.2 Test Applicability

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

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

8.2.2.2.1.1.3 Minimum requirement for periodic CQI reporting

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.

For the parameters specified in Table 8.2.2.2.1.1.3-1, 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 8.2.2.2.1.1.3-1 Test parameters

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Test 1** | | **Test 2** | |
| Bandwidth | | | MHz | 100 | | | |
| Subcarrier spacing | | | kHz | 120 | | | |
| Duplex Mode | | |  | TDD | | | |
| TDD Slot Configuration | | |  | FR2.120-2 Annex A.1.3 | | | |
| SNRBB | | | dB | 8 | 9 | 14 | 15 |
| Propagation channel | | |  | AWGN | | | |
| Antenna configuration | | |  | 2×2 with static channel specified in Annex B.1 | | | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | *Periodic* | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | *FD-CDM2* | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | 8 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) | |  | 13 | | | |
| CSI-RS  periodicity and offset | | slot | 8/1 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | *Periodic* | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | *fd-CDM2* | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | 6 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) | |  | 13 | | | |
| NZP CSI-RS-timeConfig  periodicity and offset | | slot | 8/1 | | | |
| CSI-IM configuration | CSI-IM resource Type | |  | Periodic | | | |
| CSI-IM RE pattern | |  | 1 | | | |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) | |  | (8, 13) | | | |
| CSI-IM timeConfig  periodicity and offset | | slot | 8/1 | | | |
| ReportConfigType | | |  | *Periodic* | | | |
| CQI-table | | |  | Table 1 | | | |
| reportQuantity | | |  | *cri-RI-PMI-CQI* | | | |
| timeRestrictionForChannelMeasurements | | |  | *Not configured* | | | |
| timeRestrictionForInterferenceMeasurements | | |  | *Not configured* | | | |
| cqi-FormatIndicator | | |  | *Wideband* | | | |
| pmi-FormatIndicator | | |  | *Wideband* | | | |
| Sub-band Size | | | RB | 8 | | | |
| csi-ReportingBand | | |  | 111111111 | | | |
| CSI-Report periodicity and offset | | | slot | 8/3 | | | |
| aperiodicTriggeringOffset | | |  | *Not configured* | | | |
| Codebook configuration | | Codebook Type |  | *typeI-SinglePanel* | | | |
| Codebook Mode |  | 1 | | | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | *Not configured* | | | |
| CodebookSubsetRestriction |  | 010000 | | | |
| RI Restriction |  | N/A | | | |
| Physical channel for CSI report | | |  | PUCCH | | | |
| CQI/RI/PMI delay | | | ms | 8.375 | | | |
| Maximum number of HARQ transmission | | |  | 1 | | | |
| Measurement channel | | |  | As specified in Table A.4-1, TBS.1-2 | | | |

The normative reference for this requirement is TS 38.101-4 [5] clause 8.2.2.2.1.1.

8.2.2.2.1.1.4 Test Description

8.2.2.2.1.1.4.1 Initial Conditions

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

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.2-1 of TS 38.521-2 [8].

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

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

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

Only sub tests shall be tested which are testable according to Table 7.1.1\_1-2.

For EN-DC within FR2 operation, setup the LTE radiated link according to Annex D:

1. Connection between SS, AWGN noise source and the UE antenna is shown in TS 38.508-1 [6] Annex A, Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 8.1.2-1 and Table 8.2.2.2.1.1.3-1 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, C.3.1, and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-2 [8].

4. Propagation conditions for NR cell are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On for NSA* according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 8.2.2.2.1.1.4.3.

8.2.2.2.1.1.4.2 Test Procedure

1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.0. If no direction found mark the test as inconclusive.

2. Set the parameters of bandwidth, SCS, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 8.2.2.2.1.1.3-1.

3. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 2000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 1 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.

4. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as wideband Median CQI value.

5. If Median CQI is not equal to 1 or 15 and 1800 or more of the wideband CQI values are in the range (Median CQI - 1) ≤ Median CQI ≤ ( Median CQI + 1) then continue with step 6, otherwise go to step 9.

6. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data until the number of filtered ACK+NACK responses reaches 1000.

For the filtered ACK and NACK responses if the ratio (NACK / ACK + NACK) ≤ 0.1 then go to step 7, otherwise go to step 8.

7. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI+1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 8 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) > 0.1

then pass the UE for this test and go to step 10, otherwise go to step 9.

8. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the wideband median-CQI-1 value and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH, transmitted by the SS, record and filter the ACK, NACK and statDTX responses as in step 6 until 1000 filtered ACK+NACK responses are gathered.

If the ratio (NACK /ACK + NACK) ≤ 0.1

then pass the UE for this test and go to step 10, otherwise go to step 9.

9. If both SNR points of the test have not been tested, then repeat the same procedure (steps 1 to 8) for the other SNR point as appropriate. Otherwise fail the UE.

10. Repeat step 1 to 9 for Test2.

8.2.2.2.1.1.4.3 Message Contents

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

8.2.2.2.1.1.4.3\_1 Message exceptions for SA

Table 8.2.2.2.1.1.4.3\_1-1: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ReportConfig ::= SEQUENCE { |  |  |  |
| reportConfigType CHOICE { |  | Periodic |  |
| periodic SEQUENCE { |  |  |  |
| reportSlotConfig | CSI-ReportPeriodicityAndOffset | 8/1 |  |
| } |  |  |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE{ |  |  |  |
| Subbands9 | 111111111 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 8.2.2.2.1.1.4.3\_1-2: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| CodebookConfig ::= SEQUENCE { |  |  |  |
| codebookType CHOICE { |  |  |  |
| type1 SEQUENCE { |  |  |  |
| subType CHOICE { |  |  |  |
| typeI-SinglePanel SEQUENCE { |  |  |  |
| nrOfAntennaPorts CHOICE { |  |  |  |
| Two SEQUENCE { |  |  |  |
| twoTX-codebookSubsetRestriction | 010000 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 8.2.2.2.1.1.4.3\_1-3: SchedulingRequestResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-157 | | | |
| Information Element | Value/remark | Comment | Condition |
| SchedulingRequestResourceConfig ::= SEQUENCE { |  |  |  |
| periodicityAndOffset CHOICE { |  |  |  |
| Sl80 | 7 |  |  |
| } |  |  |  |
| } |  |  |  |

8.2.2.2.1.1.4.3\_2 Message exceptions for NSA

Same as 8.2.2.2.1.1.4.3\_1.

8.2.2.2.1.1.5 Test Requirements

The pass/fail decision is as specified in the test procedure in clause 8.2.2.2.1.1.4.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

##### 8.2.2.2.2 CQI reporting under fading conditions

###### 8.2.2.2.2.1 2Rx TDD FR2 aperiodic wideband CQI reporting under fading performance for both SA and NSA

8.2.2.2.2.1.1 Test Purpose

To verify the variance of the wideband CQI reports is within the limits defined, that the ratio of the throughput is within the limits defined and that the average PDSCH BLER is greater than or equal to 1% for the indicated transport format.

8.2.2.2.2.1.2 Test Applicability

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

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

8.2.2.2.2.1.3 Minimum requirement for aperiodic CQI reporting

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 8.2.2.2.2.1.3-1 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 8.2.2.2.2.1.3-2;

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 8.2.2.2.2.1.3-2;

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 8.2.2.2.2.1.3-1: Test parameters

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Test 1** | | **Test 2** | |
| Bandwidth | | | MHz | 100 | | | |
| Subcarrier spacing | | | kHz | 120 | | | |
| Duplex Mode | | |  | TDD | | | |
| TDD Slot Configuration | | |  | FR2.120-2 Annex A.1.3 | | | |
| SNRBB | | | dB | 6 | 7 | 12 | 13 |
| Propagation channel | | |  | TDLA30-35 | | | |
| Antenna configuration | | |  | 2×2  ULA High | | | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | *Periodic* | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | *FD-CDM2* | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | 8 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) | |  | 13 | | | |
| CSI-RS  interval and offset | | slot | 8/1 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | *Aperiodic* | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | *fd-CDM2* | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | 6 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) | |  | 13 | | | |
| NZP CSI-RS-timeConfig  interval and offset | | slot | Not configured | | | |
| aperiodicTriggeringOffset | |  | 0 | | | |
| CSI-IM configuration | CSI-IM resource Type | |  | Aperiodic | | | |
| CSI-IM RE pattern | |  | 1 | | | |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) | |  | (8, 13) | | | |
| CSI-IM timeConfig  interval and offset | | slot | Not configured | | | |
| ReportConfigType | | |  | *Aperiodic* | | | |
| CQI-table | | |  | Table 1 | | | |
| reportQuantity | | |  | *cri-RI-PMI-CQI* | | | |
| timeRestrictionForChannelMeasurements | | |  | *Not configured* | | | |
| timeRestrictionForInterferenceMeasurements | | |  | *Not configured* | | | |
| cqi-FormatIndicator | | |  | *Wideband* | | | |
| pmi-FormatIndicator | | |  | *Wideband* | | | |
| Sub-band Size | | | RB | 8 | | | |
| csi-ReportingBand | | |  | 111111111 | | | |
| CSI-Report periodicity and offset | | | slot | Not configured | | | |
| Aperiodic Report Slot Offset | | |  | 6 | | | |
| CSI request | | |  | 1 in slots i, where mod(i, 8) = 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 configuration | | Codebook Type |  | *typeI-SinglePanel* | | | |
| Codebook Mode |  | 1 | | | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | *Not configured* | | | |
| CodebookSubsetRestriction |  | 000001 | | | |
| RI Restriction |  | N/A | | | |
| Physical channel for CSI report | | |  | PUSCH | | | |
| CQI/RI/PMI delay | | | ms | 1.375 | | | |
| Maximum number of HARQ transmission | | |  | 1 | | | |
| Measurement channel | | |  | As specified in Table A.4-1, TBS.1-1 | | | |

Table 8.2.2.2.2.1.3-2 Minimum requirements

|  |  |  |
| --- | --- | --- |
|  | Test 1 | Test 2 |
| ** [%] | 2 | 2 |
| ** | 1.05 | 1.05 |

The normative reference for this requirement is TS 38.101-4 [5] clause 8.2.2.2.2.1.

8.2.2.2.2.1.4 Test Description

8.2.2.2.2.1.4.1 Initial Conditions

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

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.2-1 of TS 38.521-2 [8].

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

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

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

Only sub tests shall be tested which are testable according to Table 7.1.1\_1-2.

For EN-DC within FR2 operation, setup the LTE radiated link according to Annex D:

1. Connection between SS, the faders, AWGN noise source and the UE antenna is shown in TS 38.508-1 [6] Annex A, Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 8.1.2-1 and Table 8.2.2.2.2.1.3-1 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, C.3.1, and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-2 [8].

4. Propagation conditions for NR cell are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On for NSA* according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 8.2.2.2.2.1.4.3.

8.2.2.2.2.1.4.2 Test Procedure

1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.0. If no direction found mark the test as inconclusive.

2. Set the parameters of bandwidth, reference Channel, the propagation condition, antenna configuration and the SNR according to Table 8.2.2.2.2.1.5-1.

3. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to CQI value 2 and keep it regardless of the wideband CQI value sent by the UE. The SS sends downlink MAC padding bits on the DL RMC. Continue transmission of the PDSCH until 6000 wideband CQI reports have been gathered. In this process the SS collects wideband CQI reports every 1 ms and also cases where UE transmits nothing in its CQI timing are also counted as wideband CQI reports.

4. Set up a relative frequency distribution for the reported wideband CQI-values, Calculate the median value (wideband Median CQI is the wideband CQI that is at or crosses 50% distribution from the lower wideband CQI side). This CQI-value is declared as Median CQI value.

5. If Median CQI value is not equal to 1 or 15 and 120 (**%) or more of the wideband CQI values are outside the range (Median CQI - 1) ≤ Median CQI ≤ (Median CQI + 1) then continue with step 6, otherwise go to step 8.

6. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the Median CQI value from step 4 and shall not react to the UE’s wideband CQI reports. The SS sends downlink MAC padding bits on the DL RMC. Measure the average throughput according to Annex G.3.3 and G.3.4. Declare the throughput as .

7. The SS shall transmit PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE’s reported wideband CQI value. The SS sends downlink MAC padding bits on the DL RMC. For any PDSCH transmitted by the SS, record the associated ACK, NACK and statDTX responses. The responses are then filtered as follows: for the sequence of responses for each HARQ process, discard all the statDTX responses. Continue to gather data until the number of filtered ACK+NACK responses reaches 1000. Record the BLER (NACK / ACK + NACK) and measure the average throughput according to Annex G.3.3 and G.3.4. Declare the throughput as t.

If the recorded BLER ≥ 0.01 and t /  ≥ then pass the UE for this test and go to step 9.

8. If both SNR points of the test have not been tested, then repeat the same procedure (steps 2 to 7) for the other SNR point as appropriate. Otherwise fail the UE.

9. Repeat step 2 to 8, with test conditions according to the table 8.2.2.2.2.1.5-1, for Test2 as appropriate.

8.2.2.2.2.1.4.3 Message Contents

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

8.2.2.2.2.1.4.3\_1 Message exceptions for SA

Table 8.2.2.2.2.1.4.3\_1-1: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ReportConfig ::= SEQUENCE { |  |  |  |
| reportConfigType CHOICE { |  | Aperiodic |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 6 |  |  |
| } |  |  |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE{ |  |  |  |
| Subbands9 | 111111111 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 8.2.2.2.2.1.4.3\_1-2: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| CodebookConfig ::= SEQUENCE { |  |  |  |
| codebookType CHOICE { |  |  |  |
| type1 SEQUENCE { |  |  |  |
| subType CHOICE { |  |  |  |
| typeI-SinglePanel SEQUENCE { |  |  |  |
| nrOfAntennaPorts CHOICE { |  |  |  |
| Two SEQUENCE { |  |  |  |
| twoTX-codebookSubsetRestriction | 000001 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 8.2.2.2.2.1.4.3\_1-3: SchedulingRequestResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-157 | | | |
| Information Element | Value/remark | Comment | Condition |
| SchedulingRequestResourceConfig ::= SEQUENCE { |  |  |  |
| periodicityAndOffset CHOICE { |  |  |  |
| Sl80 | 7 |  |  |
| } |  |  |  |
| } |  |  |  |

8.2.2.2.2.1.4.3\_2 Message exceptions for NSA

Same as in 8.2.2.2.2.1.4.3\_1.

8.2.2.2.2.1.5 Test Requirements

Table 8.2.2.2.2.1.5-1 Test parameters

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Test 1** | | **Test 2** | |
| Bandwidth | | | MHz | 100 | | | |
| Subcarrier spacing | | | kHz | 120 | | | |
| Duplex Mode | | |  | TDD | | | |
| TDD Slot Configuration | | |  | FR2.120-2 Annex A.1.3 | | | |
| SNRBB | | | dB | 6+TT | 7+TT | 12+TT | 13+TT |
| Propagation channel | | |  | TDLA30-35 | | | |
| Antenna configuration | | |  | 2×2  ULA High | | | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | *Periodic* | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | *FD-CDM2* | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | 8 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) | |  | 13 | | | |
| CSI-RS  interval and offset | | slot | 8/1 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | *Aperiodic* | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | *fd-CDM2* | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | 6 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) | |  | 13 | | | |
| NZP CSI-RS-timeConfig  interval and offset | | slot | Not configured | | | |
| aperiodicTriggeringOffset | |  | 0 | | | |
| CSI-IM configuration | CSI-IM resource Type | |  | Aperiodic | | | |
| CSI-IM RE pattern | |  | 1 | | | |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) | |  | (8, 13) | | | |
| CSI-IM timeConfig  interval and offset | | slot | Not configured | | | |
| ReportConfigType | | |  | *Aperiodic* | | | |
| CQI-table | | |  | Table 1 | | | |
| reportQuantity | | |  | *cri-RI-PMI-CQI* | | | |
| timeRestrictionForChannelMeasurements | | |  | *Not configured* | | | |
| timeRestrictionForInterferenceMeasurements | | |  | *Not configured* | | | |
| cqi-FormatIndicator | | |  | *Wideband* | | | |
| pmi-FormatIndicator | | |  | *Wideband* | | | |
| Sub-band Size | | | RB | 8 | | | |
| csi-ReportingBand | | |  | 111111111 | | | |
| CSI-Report periodicity and offset | | | slot | Not configured | | | |
| Aperiodic Report Slot Offset | | |  | 6 | | | |
| CSI request | | |  | 1 in slots i, where mod(i, 8) = 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 configuration | | Codebook Type |  | *typeI-SinglePanel* | | | |
| Codebook Mode |  | 1 | | | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | *Not configured* | | | |
| CodebookSubsetRestriction |  | 000001 | | | |
| RI Restriction |  | N/A | | | |
| Physical channel for CSI report | | |  | PUSCH | | | |
| CQI/RI/PMI delay | | | ms | 1.375 | | | |
| Maximum number of HARQ transmission | | |  | 1 | | | |
| Measurement channel | | |  | As specified in Table A.4-1, TBS.1-1 | | | |
| Note 1: TT = 0dB | | | | | | | |

Table 8.2.2.2.2.1.5-2 Test requirements

|  |  |  |
| --- | --- | --- |
|  | **Test 1** | **Test 2** |
| ** [%] | 2 | 2 |
| ** | 1.05 - TT | 1.05 - TT |
| Note 1: TT = 0.01 | | |

###### 8.2.2.2.2.1\_1 2Rx TDD FR2 aperiodic CQI wideband reporting under fading performance for both SA and NSA – 256QAM (Rel-16 and forward)

Editor's note: This clause is incomplete. The following aspects are either missing or not yet determined:

- Test point applicability is TBD for all bands in Table 8.1.1\_1-2.

8.2.2.2.2.1\_1.1 Test Purpose

To verify the variance of the wideband CQI reports is within the limits defined, that the ratio of the throughput is within the limits defined and that the average PDSCH BLER is greater than or equal to 1% for the indicated transport format.

8.2.2.2.2.1\_1.2 Test Applicability

This test applies to all types of NR UE release 16 and forward supporting DL 256QAM.

This test also applies to all types of EUTRA UE release 16 and forward supporting EN-DC and NR DL 256QAM.

8.2.2.2.2.1\_1.3 Minimum requirement for aperiodic CQI reporting

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\_1.3-1 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\_1.3-2;

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\_1.3-2;

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 8.2.2.2.2.1\_1.3-1: Test parameters

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Test 3** | | **Test 4** | |
| Bandwidth | | | MHz | 50 | | | |
| Subcarrier spacing | | | kHz | 120 | | | |
| Duplex Mode | | |  | TDD | | | |
| TDD Slot Configuration | | |  | FR2.120-2 Annex A.1.3 | | | |
| SNRBB | | | dB | 7 | 8 | 20 | 21 |
| Propagation channel | | |  | TDLA30-35 | | | |
| Antenna configuration | | |  | 2×2  ULA High | | | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | *Periodic* | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | *FD-CDM2* | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | 8 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) | |  | 13 | | | |
| CSI-RS  interval and offset | | slot | 8/1 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | *Aperiodic* | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | *fd-CDM2* | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | 6 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) | |  | 13 | | | |
| NZP CSI-RS-timeConfig  interval and offset | | slot | Not configured | | | |
| aperiodicTriggeringOffset | |  | 0 | | | |
| CSI-IM configuration | CSI-IM resource Type | |  | Aperiodic | | | |
| CSI-IM RE pattern | |  | 1 | | | |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) | |  | (8, 13) | | | |
| CSI-IM timeConfig  interval and offset | | slot | Not configured | | | |
| ReportConfigType | | |  | *Aperiodic* | | | |
| CQI-table | | |  | Table 2 | | | |
| reportQuantity | | |  | *cri-RI-PMI-CQI* | | | |
| timeRestrictionForChannelMeasurements | | |  | *Not configured* | | | |
| timeRestrictionForInterferenceMeasurements | | |  | *Not configured* | | | |
| cqi-FormatIndicator | | |  | *Wideband* | | | |
| pmi-FormatIndicator | | |  | *Wideband* | | | |
| Sub-band Size | | | RB | 8 | | | |
| csi-ReportingBand | | |  | 1111 | | | |
| CSI-Report periodicity and offset | | | slot | Not configured | | | |
| Aperiodic Report Slot Offset | | |  | 6 | | | |
| CSI request | | |  | 1 in slots i, where mod(i, 8) = 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 configuration | | Codebook Type |  | *typeI-SinglePanel* | | | |
| Codebook Mode |  | 1 | | | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | *Not configured* | | | |
| CodebookSubsetRestriction |  | 000001 | | | |
| RI Restriction |  | N/A | | | |
| Physical channel for CSI report | | |  | PUSCH | | | |
| CQI/RI/PMI delay | | | ms | 1.375 | | | |
| Maximum number of HARQ transmission | | |  | 1 | | | |
| Measurement channel | | |  | As specified in Table A.4-2, TBS.2-7 | | | |

Table 8.2.2.2.2.1\_1.3-2 Minimum requirements

|  |  |  |
| --- | --- | --- |
|  | Test 3 | Test 4 |
| ** [%] | 2 | 2 |
| ** | 1.05 | 1.05 |

The normative reference for this requirement is TS 38.101-4 [5] clause 8.2.2.2.2.1.

8.2.2.2.2.1\_1.4 Test Description

Same test description as in clause 8.2.2.2.2.1.4 with the following exception:

- Table 8.2.2.2.2.1\_1.3-1 instead of 8.2.2.2.2.1.3-1

- Table 8.2.2.2.2.1\_1.4.1- instead of 8.2.2.2.2.1.4.3\_1-1

- Table 8.2.2.2.2.1\_1.5-1 instead of 8.2.2.2.2.1.5-1

- In test procedures, Test 3 and Test 4 are configured and tested.

Table 8.2.2.2.2.1\_1.4.1-1: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ReportConfig ::= SEQUENCE { |  |  |  |
| reportConfigType CHOICE { |  | Aperiodic |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 6 |  |  |
| } |  |  |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE{ |  |  |  |
| Subbands4 | 1111 |  |  |
| } |  |  |  |
| } |  |  |  |
| cqi-Table | table2 |  | Test 3 and 4 |
| } |  |  |  |

8.2.2.2.2.1\_1.5 Test Requirements

Table 8.2.2.2.2.1\_1.5-1 Test parameters

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Test 3** | | **Test 4** | |
| Bandwidth | | | MHz | 50 | | | |
| Subcarrier spacing | | | kHz | 120 | | | |
| Duplex Mode | | |  | TDD | | | |
| TDD Slot Configuration | | |  | FR2.120-2 Annex A.1.3 | | | |
| SNRBB | | | dB | 7+TT | 8+TT | 20+TT | 21+TT |
| Propagation channel | | |  | TDLA30-35 | | | |
| Antenna configuration | | |  | 2×2  ULA High | | | |
| Beamforming Model | | |  | As specified in Annex B.4.1 | | | |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | *Periodic* | | | |
| Number of CSI-RS ports (*X*) | |  | 4 | | | |
| CDM Type | |  | *FD-CDM2* | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | 8 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) | |  | 13 | | | |
| CSI-RS  interval and offset | | slot | 8/1 | | | |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | *Aperiodic* | | | |
| Number of CSI-RS ports (*X*) | |  | 2 | | | |
| CDM Type | |  | *fd-CDM2* | | | |
| Density (ρ) | |  | 1 | | | |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | 6 | | | |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) | |  | 13 | | | |
| NZP CSI-RS-timeConfig  interval and offset | | slot | Not configured | | | |
| aperiodicTriggeringOffset | |  | 0 | | | |
| CSI-IM configuration | CSI-IM resource Type | |  | Aperiodic | | | |
| CSI-IM RE pattern | |  | 1 | | | |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) | |  | (8, 13) | | | |
| CSI-IM timeConfig  interval and offset | | slot | Not configured | | | |
| ReportConfigType | | |  | *Aperiodic* | | | |
| CQI-table | | |  | Table 2 | | | |
| reportQuantity | | |  | *cri-RI-PMI-CQI* | | | |
| timeRestrictionForChannelMeasurements | | |  | *Not configured* | | | |
| timeRestrictionForInterferenceMeasurements | | |  | *Not configured* | | | |
| cqi-FormatIndicator | | |  | *Wideband* | | | |
| pmi-FormatIndicator | | |  | *Wideband* | | | |
| Sub-band Size | | | RB | 8 | | | |
| csi-ReportingBand | | |  | 1111 | | | |
| CSI-Report periodicity and offset | | | slot | Not configured | | | |
| Aperiodic Report Slot Offset | | |  | 6 | | | |
| CSI request | | |  | 1 in slots i, where mod(i, 8) = 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 configuration | | Codebook Type |  | *typeI-SinglePanel* | | | |
| Codebook Mode |  | 1 | | | |
| (CodebookConfig-N1,CodebookConfig-N2) |  | *Not configured* | | | |
| CodebookSubsetRestriction |  | 000001 | | | |
| RI Restriction |  | N/A | | | |
| Physical channel for CSI report | | |  | PUSCH | | | |
| CQI/RI/PMI delay | | | ms | 1.375 | | | |
| Maximum number of HARQ transmission | | |  | 1 | | | |
| Measurement channel | | |  | As specified in Table A.4-2, TBS.2-7 | | | |
| Note 1: TT = 0dB | | | | | | | |

Table 8.2.2.2.2.1\_1.5-2 Test requirements

|  |  |  |
| --- | --- | --- |
|  | **Test 3** | **Test 4** |
| ** [%] | 2 | 2 |
| ** | 1.05 - TT | 1.05 - TT |
| Note 1: TT = 0.01 | | |

## 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.3.1.0 Minimum requirement for periodic CQI reporting

For the CA CQI reporting test defined in Table 8.2A.3.1.0-4, the test requirements and the test parameters are defined as below.

For each CC, the test parameters are specified in Table 8.2A.3.1.0-1.

For CA with 2 DL CC, for the SNR configuration specified in Table 8.2A.3.1.0-2, 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 CQIPCell – wideband CQISCell ≥ 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.3.1.0-3, 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 CQIPCell – wideband CQISCell1 ≥ 2

wideband CQISCell1 – wideband CQISCell2, 3… ≥ 2

for more than 90% of the time.

Table 8.2A.3.1.0-1: CA CQI reporting test parameters for each CC

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Subcarrier spacing | | kHz | 120 |
| Duplex Mode | |  | TDD |
| TDD Slot Configuration | |  | FR2.120-2 Annex A.1.3 |
| Propagation channel | |  | AWGN |
| Antenna configuration | |  | 1×2 with static channel specified in Annex B.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | 8 |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | 13 |
| CSI-RS periodicity and offset | slot | 8/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 1 |
| CDM Type |  | No CDM |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | 6 |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | 13 |
| NZP CSI-RS-timeConfig  periodicity and offset | slot | 8/1 |
| CSI-IM configuration | CSI-IM resource Type |  | Periodic |
| CSI-IM RE pattern |  | 1 |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) |  | (8, 13) |
| CSI-IM timeConfig  periodicity and offset | slot | 8/1 |
| ReportConfigType | |  | Periodic |
| CQI-table | |  | Table 1 |
| reportQuantity | |  | cri-RI-PMI-CQI (Note 1) |
| Codebook configuration | |  | Not configured |
| timeRestrictionForChannelMeasurements | |  | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | Not configured |
| cqi-FormatIndicator | |  | Wideband |
| pmi-FormatIndicator | |  | Wideband |
| Sub-band Size | | RB | 8 for 50MHz, 100MHz,  16 for 200MHz,  32 for 400MHz |
| csi-ReportingBand | |  | 111111111 |
| CSI-Report periodicity and offset | | slot | 8/3 |
| aperiodicTriggeringOffset | |  | Not configured |
| Physical channel for CSI report | |  | PUCCH |
| CQI/RI/PMI delay | | ms | 8.375 |
| Maximum number of HARQ transmission | |  | 1 |
| Measurement channel | |  | Derived as per section 5.1.3.2 of TS 38.214 [12] |
| Note 1: The bit width of PMI for UCI on PUCCH in a case 1-port CSI-RS is configured as channel measurement resource is given in TS 38.212 [10], section 6.3.1.1.2. | | | |

Table 8.2A.3.1.0-2: SNR configurations for 2 DL CA

|  |  |  |
| --- | --- | --- |
| Parameter | PCell | SCell |
| SNR (dB) | 10.0 | 4.0 |

Table 8.2A.3.1.0-3: SNR configurations for 3 or more DL CA

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

Table 8.2A.3.1.0-4: 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 configurations and bandwidth combination sets is defined in 8.1.1.5.1. | |

The normative reference for this requirement is TS 38.101-4 [5], clause 8.2A.3.1.1.

##### 8.2A.3.1.1 2Rx CQI reporting accuracy under AWGN conditions for CA (2DL CA)

Editor's note: The following aspects are either missing or not yet determined:

- Test point applicability is TBD for all bands and BWagg > 200 MHz in Table 8.1.1\_1-2.

8.2A.3.1.1.1 Test Purpose

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.3.1.1.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 2DL CA.

8.2A.3.1.1.3 Test description

8.2A.3.1.1.3.1 Initial conditions

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

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.2-1 of TS 38.521-2 [8].

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

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

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

For EN-DC within FR2 operation, setup the LTE link according to Annex D

CA capability to be tested: test any one of the supported CA capabilities with largest aggregated CA bandwidth combination, as specified in 8.1.1.5.1.

CA configuration to be tested: For the selected CA capability, test any one of the supported CA configurations with largest aggregated CA bandwidth combination, as specified in 8.1.1.5.1.

1. Connection between SS, the AWGN noise source and the UE is shown in TS 38.508-1 [6] Annex A, Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 8.1.2-1, and Table 8.2A.3.1.0-1 to Table 6.2A.3.1.0-3 as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-2 [8].

4. Propagation conditions are set according to Annex B.1.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On* for NSA according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 8.2A.3.1.1.3.3.

8.2A.3.1.1.1.3.2 Test Procedure

1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.0. If no direction found, mark the test as inconclusive.

2. Set the parameters of bandwidth, reference channel, propagation condition, antenna configuration and SNR configuration according to Table 8.2A.3.1.0-1 to Table 8.2A.3.1.0-4 as appropriate.

3. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.

4. The SS shall start gathering CQI reports, and will continue gathering CQI reports until 2000 wideband CQI reports have been gathered for each PCC and SCC. For each CSI report calculate the respective difference CQIP-S = wideband CQIPCell – wideband CQISCell.

5. If more than 1800 values of CQIP-S are ≥ 2 pass the UE. Otherwise fail the UE.

8.2A.3.1.1.1.3.3 Message contents

8.2A.2.1.1.1.3.3\_1 Message exceptions for SA

Table 8.2A.2.1.1.1.3.3\_1-1: CSI-RS-ResourceMapping

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-2 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| row2 | 0000 0010 0000 | K0= 6, row2 |  |
| } |  |  |  |
| density CHOICE { |  |  |  |
| one | NULL |  |  |
| } |  |  |  |
| } |  |  |  |

Table 8.2A.2.1.1.1.3.3\_1-2: NZP CSI-ResourcePeriodicityAndOffset

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-2a | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slot8 | 3 |  |  |
| } |  |  |  |

Table 8.2A.2.1.1.1.3.3\_1-3: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-6 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-IM-Resource ::= SEQUENCE { |  |  |  |
| periodicityAndOffset SEQUENCE { |  |  |  |
| slot8 | 1 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 6.2A.2.1.1.1.3.3\_1-4: CSI-ReportConfig

|  |  |  |
| --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.4-12 | | |
| Information Element | Value/remark | Condition |
| CSI-ReportConfig ::= SEQUENCE { |  |  |
| subbandSize | 8 | For 50MHz and 100MHz CHBW. |
|  | 16 | For 200MHz CHBW. |
|  | 32 | For 400MHz CHBW. |
| } |  |  |

8.2A.2.1.1.1.3.3\_2 Message exceptions for NSA

Same as specified in 8.2A.2.1.1.1.3.3\_2.

8.2A.3.1.1.1.3.4 Test Requirements

The pass fail decision is as specified in the test procedure in clause 8.2A.3.1.1.1.3.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

##### 8.2A.3.1.2 2Rx CQI reporting accuracy under AWGN conditions for CA (3DL CA)

Editor's note: The following aspects are either missing or not yet determined:

- Test point applicability is TBD for all bands and BWagg > 200 MHz in Table 8.1.1\_1-2.

8.2A.3.1.2.1 Test Purpose

Same with 8.2A.3.1.1.1.

8.2A.3.1.2.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 3DL CA.

8.2A.3.1.2.3 Test description

8.2A.3.1.2.3.1 Initial conditions

Same with 8.2A.3.1.1.3.1.

8.2A.3.1.1.2.3.2 Test Procedure

1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.0. If no direction found, mark the test as inconclusive.

2. Set the parameters of bandwidth, reference channel, propagation condition, antenna configuration and SNR configuration according to Table 8.2A.3.1.0-1 to Table 8.2A.3.1.0-4 as appropriate.

3. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.

4. The SS shall start gathering CQI reports, and will continue gathering CQI reports until 2000 wideband CQI reports have been gathered for each PCC and SCCs. For each CSI report calculate the respective difference CQIP-S1 = wideband CQIPCell – wideband CQISCell1 and the respective difference CQIS1-S2 = wideband CQISCell1 – wideband CQISCell2.

5. If more than 1800 values of CQIP-S1 are ≥ 2 and more than 1800 values of CQI S1-S2 are ≥ 2, pass the UE. Otherwise fail the UE.

8.2A.3.1.1.2.3.3 Message contents

Same with 8.2A.3.1.1.1.3.3.

8.2A.3.1.1.2.3.4 Test Requirements

The pass fail decision is as specified in the test procedure in clause 8.2A.3.1.1.2.3.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

##### 8.2A.3.1.3 2Rx CQI reporting accuracy under AWGN conditions for CA (4DL CA)

Editor's note: The following aspects are either missing or not yet determined:

- Test point applicability is TBD for all bands and BWagg > 200 MHz in Table 8.1.1\_1-2.

8.2A.3.1.3.1 Test Purpose

Same with 8.2A.3.1.1.1.

8.2A.3.1.3.2 Test applicability

This test applies to all types of NR UE release 15 and forward that supports 4DL CA.

8.2A.3.1.3.3 Test description

8.2A.3.1.3.3.1 Initial conditions

Same with 8.2A.3.1.1.3.1.

8.2A.3.1.1.3.3.2 Test Procedure

1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.0. If no direction found, mark the test as inconclusive.

2. Set the parameters of bandwidth, reference channel, propagation condition, antenna configuration and SNR configuration according to Table 8.2A.3.1.0-1 to Table 8.2A.3.1.0-4 as appropriate.

3. SS transmits PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC on both PCC and SCC. The SS sends downlink MAC padding bits on the DL RMC.

4. The SS shall start gathering CQI reports, and will continue gathering CQI reports until 2000 wideband CQI reports have been gathered for each PCC and SCCs. For each CSI report calculate the respective difference CQIP-S1 = wideband CQIPCell – wideband CQISCell1, the respective difference CQIS1-S2 = wideband CQISCell1 – wideband CQISCell2 and the respective difference CQIS1-S3 = wideband CQISCell1 – wideband CQISCell3.

5. If more than 1800 values of CQIP-S1 are ≥ 2, more than 1800 values of CQI S1-S2 are ≥ 2 and more than 1800 values of CQI S1-S3 are ≥ 2, pass the UE. Otherwise fail the UE.

8.2A.3.1.1.3.3.3 Message contents

Same with 8.2A.3.1.1.1.3.3.

8.2A.3.1.1.3.3.4 Test Requirements

The pass fail decision is as specified in the test procedure in clause 8.2A.3.1.1.3.3.2.

There are no parameters in the test setup or measurement process whose variation impacts the results so there are no applicable test tolerances for this test.

## 8.3 Reporting of Precoding Matrix Indicator (PMI)

### 8.3.0 General

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 scheme 1 with 2TX and higher layer parameter *codebookType* set to 'typeI-SinglePanel' are specified in terms of the ratio



In the definition of *γ*, for 2TX PMI requirements, is 90 % of the maximum throughput obtained at  using the precoders configured according to the UE reports, and is the throughput measured at with random precoding.

### 8.3.1 1RX requirements (Void)

### 8.3.2 2RX requirements

#### 8.3.2.1 FDD

TBD

#### 8.3.2.2 TDD

##### 8.3.2.2.1 2Rx TDD FR2 Single PMI with 2TX TypeI-SinglePanel codebook for both SA and NSA

8.3.2.2.1.1 Test purpose

The purpose of this test is to test the accuracy of the Precoding Matrix Indicator (PMI) reporting such that the system throughput is maximized based on the precoders configured according to the UE reports.

8.3.2.2.1.2 Test applicability

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

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

8.3.2.2.1.3 Minimum conformance requirements

For the parameters specified in Table 8.3.2.2.1.3-1, and using the downlink physical channels specified in Annex C.5.1, the minimum requirements are specified in Table 8.3.2.2.1.3-2.

Table 8.3.2.2.1.3-1: Test parameters (single layer)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | Unit | Test 1 | Test 2 |
| Bandwidth | | MHz | 100 | 100 |
| Subcarrier spacing | | kHz | 120 | 120 |
| TDD DL-UL configuration | |  | FR2.120-2 as specified in Annex A.1.3 | FR2.120-1 as specified in Annex A.1.3 |
| Propagation channel | |  | TDLA30-35 | TDLA30-35 |
| Antenna configuration | |  | 2 x 2 ULA Low | 2 x 2 ULA Low |
| Beamforming Model | |  | As specified in Annex B.4.1 | As specified in Annex B.4.1 |
| ZP CSI-RS configuration | CSI-RS resource Type |  | Periodic | Periodic |
| Number of CSI-RS ports (*X*) |  | 4 | 4 |
| CDM Type |  | FD-CDM2 | FD-CDM2 |
| Density (ρ) |  | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 4, (8,-) | Row 4, (8,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (13,-) | (13,-) |
| CSI-RS  interval and offset | slot | 8/1 | 5/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Aperiodic | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 2 | 2 |
| CDM Type |  | FD-CDM2 | FD-CDM2 |
| Density (ρ) |  | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) |  | Row 3, (6,-) | Row 3, (6,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (13,-) | (13,-) |
| CSI-RS  interval and offset | slot | Not configured | Not configured |
| aperiodicTriggeringOffset |  | 0 | 0 |
| CSI-IM configuration | CSI-IM resource Type |  | Aperiodic | Aperiodic |
| CSI-IM RE pattern |  | Pattern 1 | Pattern 1 |
| CSI-IM Resource Mapping  (kCSI-IM,lCSI-IM) |  | (8,13) | (8,13) |
| CSI-IM timeConfig  interval and offset | slot | Not configured | Not configured |
| ReportConfigType | |  | Aperiodic | Aperiodic |
| CQI-table | |  | Table 1 | Table 1 |
| reportQuantity | |  | cri-RI-PMI-CQI | cri-RI-PMI-CQI |
| timeRestrictionForChannelMeasurements | |  | Not configured | Not configured |
| timeRestrictionForInterferenceMeasurements | |  | Not configured | Not configured |
| cqi-FormatIndicator | |  | Wideband | Wideband |
| pmi-FormatIndicator | |  | Wideband | Wideband |
| Sub-band Size | | RB | 8 | 8 |
| csi-ReportingBand | |  | 111111111 | 111111111 |
| CSI-Report interval and offset | | slot | Not configured | Not configured |
| Aperiodic Report 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 | |  | 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 configuration | Codebook Type |  | typeI-SinglePanel | typeI-SinglePanel |
| Codebook Mode |  | 1 | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | N/A | N/A |
| CodebookSubsetRestriction |  | 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 of HARQ transmission | |  | 4 | 4 |
| Measurement channel | |  | 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 8.3.2.2.1.3-2: Minimum requirement

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Test 1** | **Test 2** |
| ** | 1.05 | 1.05 |

8.3.2.2.1.4 Test description

8.3.2.2.1.4.1 Initial conditions

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

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.2-1 of TS 38.521-2 [8].

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

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

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

For EN-DC within FR2 operation, setup the LTE radiated link according to Annex D:

1. Connection between SS, the faders, AWGN noise source and the UE antenna is shown in TS 38.508-1 [6] Annex A, Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 8.1.2-1 and Table 8.3.2.2.1.3-1 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-2 [8].

4. Propagation conditions for NR cell are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On for NSA* according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 8.3.2.2.1.4.3.

8.3.2.2.1.4.2 Test procedure

1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.0.If no direction found, mark the test as inconclusive.

2. Set the parameters of bandwidth, the propagation condition, antenna configuration and measurement channel according to Table 8.3.2.2.1.3-1 as appropriate.

3. The SS shall transmit PDSCH via PDCCH DCI format [1\_1] for C\_RNTI to transmit the DL RMC with precoding matrix according to PMI report from the UE. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission with an UL RMC for CP-OFDM QPSK with 5 RBs allocated according to A.2.2.6 of TS 38.521-1 [21] to carry the PUSCH CQI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. No transport block is sent in parallel to the CQI feedback. Establish and  according to Annex G.3.2.

4. Set SNR to . The SS shall transmit PDSCH with randomly selected precoding matrix from codebook (Table 5.2.2.2.1-1 in TS 38.214 [12]) every slot regardless of PMI reports from the UE. Note that each precoding matrix shall be selected in equal probabilities. The SS sends downlink MAC padding bits on the DL RMC. SS schedules the UL transmission to carry the PUSCH CSI feedback via PDCCH DCI format [0\_1] with aperiodic CSI request triggered. Measure according to Annex G.3.3.

5. Calculate . If the ratio ≥ which is specified in table 8.3.2.2.1.5-1, then the test is pass. Otherwise, the test is fail.

6. Repeat steps from 3 to 5 for each subtest in Table 8.3.2.2.1.3-1 as appropriate.

8.3.2.2.1.4.3 Message contents

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

8.3.2.2.1.4.3\_1 Message exceptions for SA

Table 8.3.2.2.1.4.3\_1-1: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | Aperiodic |  | CSI-RS for CSI Acquisition |
| Periodic |  | CSI-RS for Tracking or  Beam Refinement |
| } |  |  |  |

Table 8.3.2.2.1.4.3\_1-2: CSI-RS-ResourceMapping for NZP-CSI-RS for Tracking

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| row1 | 0001 |  |  |
| } |  |  |  |
| nrofPorts | p1 | 1 for CSI-RS resource 1,2,3,4 |  |
| firstOFDMSymbolInTimeDomain | 4 | l0 = 4 for CSI-RS resource 1 and 3 |  |
| 8 | l0 = 8 for CSI-RS resource 2 and 4 |  |
| } |  |  |  |

Table 8.3.2.2.1.4.3\_1-3: CSI-RS-ResourceMapping for NZP-CSI-RS for Acquisition

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| row3 | 001000 |  |  |
| } |  |  |  |
| nrofPorts | p2 |  |  |
| firstOFDMSymbolInTimeDomain | 13 |  |  |
| } |  |  |  |

Table 8.3.2.2.1.4.3\_1-4: CSI-RS-ResourceMapping for NZP-CSI-RS for Beam Refinement

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| row1 | 0001 |  |  |
| } |  |  |  |
| nrofPorts | p1 |  |  |
| firstOFDMSymbolInTimeDomain | 8 | l0 = 8 for CSI-RS resource 1 |  |
| 9 | l0 = 9 for CSI-RS resource 2 |  |
| } |  |  |  |

Table 8.3.2.2.1.4.3\_1-5: CSI-RS-ResourceMapping for ZP-CSI-RS

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-45 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-RS-ResourceMapping ::= SEQUENCE { |  |  |  |
| frequencyDomainAllocation CHOICE { |  |  |  |
| row4 | 100 |  |  |
| } |  |  |  |
| nrofPorts | p4 |  |  |
| firstOFDMSymbolInTimeDomain | 13 |  |  |
| } |  |  |  |

Table 8.3.2.2.1.4.3\_1-6: ZP CSI-ResourcePeriodicityAndOffset

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: Table 4.6.3-43 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourcePeriodicityAndOffset ::= CHOICE { |  |  |  |
| slots8 | 1 |  | Test 1 |
| slots5 | 1 |  | Test 2 |
| } |  |  |  |

Table 8.3.2.2.1.4.3\_1-7: CSI-IM-Resource

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-34 | | | |
| Information Element | Value/remark | Comment | Condition |
| csi-IM-ResourceElementPattern CHOICE { |  |  |  |
| pattern1 SEQUENCE { |  |  |  |
| subcarrierLocation-p1 | s8 |  |  |
| symbolLocation-p1 | 13 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 8.3.2.2.1.4.3\_1-8: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| CodebookConfig ::= SEQUENCE { |  |  |  |
| codebookType CHOICE { |  |  |  |
| type1 SEQUENCE { |  |  |  |
| subType CHOICE { |  |  |  |
| typeI-SinglePanel SEQUENCE { |  |  |  |
| nrOfAntennaPorts CHOICE { |  |  |  |
| Two SEQUENCE { |  |  |  |
| twoTX-codebookSubsetRestriction | 001111 |  |  |
| } |  |  |  |
| } |  |  |  |
| TypeI-SinglePanel-ri-Restriction | 11111111 |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 8.3.2.2.1.4.3\_1-9: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ReportConfig ::= SEQUENCE { |  |  |  |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 6 |  | Test 1 |
| 8 |  | Test 2 |
| } |  |  |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands9 | 111111111 |  |  |
| } |  |  |  |
| } |  |  |  |
| subbandSize | value2 |  |  |
| } |  |  |  |

8.3.2.2.1.4.3\_2 Message exceptions for NSA

Same as 8.3.2.2.1.4.3\_1.

8.3.2.2.1.5 Test requirement

Table 8.3.2.2.1.5-1: Test requirement (TDD)

|  |  |  |
| --- | --- | --- |
| Parameter | Test 1 | Test 2 |
| ** | 1.04 | 1.04 |

## 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

##### 8.4.2.2.1 2Rx TDD FR2 RI reporting for both SA and NSA

-8.4.2.2.1.1 Test Purpose

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.

8.4.2.2.1.2 Test Applicability

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

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

8.4.2.2.1.3 Minimum requirement

The minimum performance requirement in Table 8.4.2.2.1.3-2 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 ≥ ;

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 ≥ ;

For the parameters specified in Table 8.4.2.2.1.3-1, and using the downlink physical channels specified in Annex C.2.2, the minimum requirements are specified in Table 8.4.2.2.1.3-2.

Table 8.4.2.2.1.3-1: RI Test (TDD)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Parameter | | | Unit | Test 1 | Test 2 | Test 3 |
| Bandwidth | | | MHz | 100 | 100 | 100 |
| Subcarrier spacing | | | kHz | 120 | 120 | 120 |
| Duplex Mode | | |  | TDD | TDD | TDD |
| TDD Slot Configuration | | |  | FR2.120-2 | FR2.120-2 | FR2.120-2 |
| SNR | | | dB | 0 | 16 | 16 |
| Propagation channel | | |  | TDLA30-35 | TDLA30-35 | TDLA30-35 |
| Antenna configuration | | |  | 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 |
| ZP CSI-RS configuration | CSI-RS resource Type | |  | Periodic | Periodic | Periodic |
| Number of CSI-RS ports (*X*) | |  | 4 | 4 | 4 |
| CDM Type | |  | FD-CDM2 | FD-CDM2 | FD-CDM2 |
| Density (ρ) | |  | 1 | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 4, (8,-) | Row 4, (8,-) | Row 4, (8,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) | |  | (13,-) | (13,-) | (13,-) |
| CSI-RS  interval and offset | | slot | 8/1 | 8/1 | 8/1 |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type | |  | Aperiodic | Aperiodic | Aperiodic |
| Number of CSI-RS ports (*X*) | |  | 2 | 2 | 2 |
| CDM Type | |  | FD-CDM2 | FD-CDM2 | FD-CDM2 |
| Density (ρ) | |  | 1 | 1 | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1 ) | |  | Row 3 (6,-) | Row 3 (6,-) | Row 3 (6,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) | |  | (13,-) | (13,-) | (13,-) |
| NZP CSI-RS-timeConfig  interval and offset | | slot | Not configured | Not configured | Not configured |
| aperiodicTriggeringOffset | |  | 0 | 0 | 0 |
| CSI-IM configuration | CSI-IM resource Type | |  | Aperiodic | Aperiodic | Aperiodic |
| CSI-IM RE pattern | |  | Pattern 1 | Pattern 1 | Pattern 1 |
| 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 |
| ReportConfigType | | |  | Aperiodic | Aperiodic | Aperiodic |
| CQI-table | | |  | Table 1 | Table 1 | Table 1 |
| reportQuantity | | |  | cri-RI-PMI-CQI | cri-RI-PMI-CQI | cri-RI-PMI-CQI |
| timeRestrictionForChannelMeasurements | | |  | not configured | not configured | not configured |
| timeRestrictionForInterferenceMeasurements | | |  | not configured | not configured | not configured |
| 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 Report Slot Offset | | |  | 6 | 6 | 6 |
| CSI request | | |  | 1 in slots i, where mod(i, 8) = 1, otherwise it is equal to 0 | 1 in slots i, where mod(i, 8) = 1, otherwise it is equal to 0 | 1 in slots i, where mod(i, 8) = 1, otherwise it is equal to 0 |
| reportTriggerSize | | |  | 1 | 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 | One State with one Associated Report Configuration  Associated Report Configuration contains pointers to NZP CSI-RS and CSI-IM |
| Codebook configuration | | Codebook Type |  | typeI-SinglePanel | typeI-SinglePanel | typeI-SinglePanel |
| Codebook Mode |  | 1 | 1 | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | N/A | N/A | N/A |
| 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. TBS.1-1 is used for Rank 1 case. TBS.1-2 is used for Rank 2 case. | | | | | | |

Table 8.4.2.2.1.3-2: Minimum requirement (TDD)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Test 1 | Test 2 | Test 3 |
| **1 | N/A | 1.05 | 1.05 |
| **2 | 1.0 | N/A | N/A |

The normative reference for this requirement is TS 38.101-4 [5] clause 8.4.2.2.

8.4.2.2.1.4 Test Description

8.4.2.2.1.4.1 Initial Conditions

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

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in Table 5.2-1 of TS 38.521-2 [8].

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

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

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

Only sub tests shall be tested which are testable according to Table 7.1.1\_1-2.

For EN-DC within FR2 operation, setup the LTE radiated link according to Annex D:

1. Connection between SS, the faders, AWGN noise source and the UE antenna is shown in TS 38.508-1 [6] Annex A, Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 8.1.2-1 and Table 8.4.2.2.1.3-1 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-2 [8].

4. Propagation conditions for NR cell are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity NR for SA with *Connected without release On, Test Mode On* or EN-DC, DC bearer *MCG* and *SCG, Connected without release On, Test Mode On for NSA* according to TS 38.508-1 [6] clause 4.5. Message content are defined in clause 8.4.2.2.1.4.3.

8.4.2.2.1.4.2 Test Procedure

1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.0. If no direction found mark the test as inconclusive.

2. Set the parameters of bandwidth, reference channel, the propagation condition, antenna configuration, antenna correlation, Codebook configuration, Beamforming Model, RI configuration and SNR according to Table 8.4.2.2.1.3-1 as appropriate. Measure theaccording to Annex G.3.3.

3. The SS shall send PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE reported CQI (wideband CQI), PMI and fixed RI as defined in Table 8.4.2.2.1.3-1. The SS sends downlink MAC padding bits on the DL RMC.

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

5. The SS shall transmit an RRC Connection Reconfiguration message to set codebookSubsetRestriction as for UE reported RI according to Table 8.4.2.2.1.3-1.

6. The UE shall transmit RRC Connection Reconfiguration Complete message.

7. Propagation conditions are set according to Table 8.4.2.2.1.3-1.

8. The SS shall send PDSCH via PDCCH DCI format 1\_1 for C\_RNTI to transmit the DL RMC according to the UE reported CQI (wideband CQI), PMI and RI. The SS sends downlink MAC padding bits on the DL RMC. Measure according to Annex G.3.3.  
If the ratio ( / ) satisfies the requirement in Table 8.4.2.2.1.5-1, then pass the UE for this test and go to step 9. Otherwise, declare a FAIL verdict.

9. If all tests have not been done, then repeat the same procedure (steps 1 to 8) with test conditions according to the Table 8.4.2.2.1.3-2 for the other Tests as appropriate. Otherwise, declare a PASS verdict.

8.4.2.2.1.4.3 Message Contents

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

8.4.2.2.1.4.3\_1 Message exceptions for SA

Table 8.4.2.2.1.4.3\_1-1: SchedulingRequestResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-157 | | | |
| Information Element | Value/remark | Comment | Condition |
| SchedulingRequestResourceConfig ::= SEQUENCE { |  |  |  |
| periodicityAndOffset CHOICE { |  |  |  |
| Sl80 | 7 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 8.4.2.2.1.4.3\_1-2: CSI-ResourceConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-41 | | | |
| Information Element | Value/remark | Comment | Condition |
| CSI-ResourceConfig ::= SEQUENCE { |  |  |  |
| resourceType | Aperiodic |  | CSI-RS for CSI Acquisition,  CSI-IM-Resource |
| Periodic |  | CSI-RS for Tracking or  Beam Refinement |
| } |  |  |  |

Table 8.4.2.2.1.4.3\_1-3: *CodebookConfig*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.2, Table 4.6.3-25 | | | |
| Information Element | Value/remark | Comment | Condition |
| nrOfAntennaPorts CHOICE { |  |  |  |
| Two SEQUENCE { |  |  |  |
| twoTX-CodebookSubsetRestriction | 010000 | Fixed rank 2 | Test 1 |
| 000011 | Fixed rank 1 | Test 2, Test 3 |
| 010011 | Following rank | Test 1, Test 2, Test 3 |
| } |  |  |  |
| } |  |  |  |
| typeI-SinglePanel-ri-Restriction | 11111111 | Non restriction |  |

Table 8.4.2.2.1.4.3\_1-4: CSI-ReportConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3, Table 4.6.3-39 | | | |
| Information Element | Value/remark | Comment | Condition |
| reportConfigType CHOICE { |  |  |  |
| aperiodic SEQUENCE { |  |  |  |
| reportSlotOffsetList | 6 |  |  |
| } |  |  |  |
| reportFreqConfiguration SEQUENCE { |  |  |  |
| csi-ReportingBand CHOICE { |  |  |  |
| subbands9 | 111111111 |  |  |
| } |  |  |  |
| } |  |  |  |
| subbandSize | value2 |  |  |
| } |  |  |  |

8.4.2.2.1.4.3\_2 Message exceptions for NSA

Same as 8.4.2.2.1.4.3\_1.

8.4.2.2.1.5 Test Requirements

Table 8.4.2.2.1.5-1: Test Requirement (TDD)

|  |  |  |  |
| --- | --- | --- | --- |
|  | Test 1 | Test 2 | Test 3 |
| **1 | N/A | 1.04 | 1.04 |
| **2 | 0.99 | 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.

For conformance testing involving FR2 test cases in this specification, the UE under test shall be pre-configured with UL Tx diversity schemes disabled to account for single polarization System Simulator (SS) in the test environment. The UE under test may transmit with dual polarization.

### 9.1.1 Applicability of requirements

The following applicability rules are specified for demodulation performance requirements for interworking:

- For UEs supporting NR/5GC, EN-DC and NE-DC,

- The performance requirements specified in Clause 5 will be verified only for NR/5GC 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 NR/5GC except for the sustained downlink data rate test specified in Clause 7.5.

- The sustained downlink data rate tests specified in Clauses 5.5, 5.5A and 7.5 for NR/5GC and in Clause 9.4B for EN-DC and NE-DC 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.

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

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 subclause 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 36.521-1 [16]. The physical channel setup with downlink power allocation is according to Annex C.3.2 of TS 36.521-1 [16].

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 TxNote 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)** | **Downlink power allocation (dB)** | | |
|  |  | **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 36.521-1 [16]. The physical channel setup with downlink power allocation is according to Annex C.3.2 of TS 36.521-1 [16].

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 TxNote 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 setup** | **Bandwidth (MHz)** | **Downlink power allocation (dB)** | | |
|  |  | **σ** |
| 1 | 10 | 0 | 0 | 0 |
| 2 | 15 | 0 | 0 | 0 |
| 3 | 20 | 0 | 0 | 0 |

## 9.2 Void

## 9.2A PDSCH Demodulation for CA

### 9.2A.1 NR CA between FR1 and FR2

FFS

## 9.2B PDSCH Demodulation for DC

### 9.2B.1 EN-DC

#### 9.2B.1.1 EN-DC within FR1

The NR PDSCH demodulation performance requirements and test case details for this test case are specified in Section 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

The NR PDSCH demodulation performance requirements and test case details for this test case are specified in Section 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 demodulation performance requirements are verified according to Section 9.2B.1.1 for EN-DC with FR1 NR carrier only and Section 9.2B.1.2 for EN-DC with FR2 NR carrier only.

During the test for EN-DC with FR2 NR carriers, only demodulation performance requirements on the FR2 carriers are verified.

No demodulation requirement for FR1 NR or LTE carriers is specified for EN-DC including FR2 carrier(s).

### 9.2B.2 NR DC between FR1 and FR2

The test setup for FR1 Pcell is specified in Table 5.5A.1.1.3-1 with antenna configuration 1x2. PDSCH demodulation performance requirements for NR FR2 cell (s) are specified in clause 7.2.

During the test, only the PDSCH performance on the FR2 NR cell (s) shall be verified.

## 9.3 Void

## 9.3A PDCCH Demodulation for CA

### 9.3A.1 NR CA between FR1 and FR2

FFS

## 9.3B PDCCH Demodulation for DC

### 9.3B.1 EN-DC

#### 9.3B.1.1 EN-DC within FR1

The NR PDCCH demodulation performance requirements and test case details for this test case are specified in Section 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

The NR PDCCH demodulation performance requirements and test case details for this test case are specified in Section 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 demodulation performance requirements are verified according to Section 9.3B.1.1 for EN-DC with FR1 NR carrier only and Section 9.3B.1.2 for EN-DC with FR2 NR carrier only.

During the test for EN-DC with FR2 NR carriers, only demodulation performance requirements on the FR2 carriers are verified.

No demodulation requirement for FR1 NR or LTE carriers is specified for EN-DC including FR2 carrier(s).

### 9.3B.2 NR DC between FR1 and FR2

The test setup for FR1 Pcell is specified in Table 5.5A.1.1.3-1 with antenna configuration 1x2. PDCCH demodulation performance requirements for NR FR2 cell (s) are specified in clause 7.3.

During the test, only the PDCCH performance on the FR2 NR cell (s) shall be verified.

## 9.4 Void

## 9.4A SDR test for CA

### 9.4A.1 Sustained downlink data rate performance for NR CA between FR1 and FR2

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

#### 9.4B.1.1 Sustained downlink data rate performance for EN-DC within FR1

9.4B.1.1.1 Test Purpose

The purpose of the test is to verify that the Layer 1 and Layer 2 correctly process in a sustained manner the received packets corresponding to the maximum data rate indicated by UE capabilities*.* The sustained downlink data rate shall be verified in terms of the success rate of delivered PDCP SDU(s) by Layer 2. The test case below specifies the RF conditions and the required success rate of delivered TB by Layer 1 to meet the sustained data rate requirement

9.4B.1.1.2 Test Applicability

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

9.4B.1.1.3 Minimum conformance requirements

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 [X].

The TB success rate is defined as 100%\*NDL\_correct\_rx/ (NDL\_newtx + NDL\_retx), where NDL\_newtx is the number of newly transmitted DL transport blocks, NDL\_retx is the number of retransmitted DL transport blocks, and NDL\_correct\_rx is the number of correctly received DL transport blocks.

The common test parameters for NR cell are specified in Table 9.4B.1.1.3-1. The parameters specified in Table 9.4B.1.1.3-2 are applicable for tests on FDD NR cell and parameters specified in Table 9.4B.1.1.3-3 are applicable for tests on TDD NR cell.

Unless otherwise stated, no user data is scheduled on slot #0, 10 and 11 within 20 ms for SCS 15 kHz for NR cell.

Unless otherwise stated, no user data is scheduled on slot #0, 20 and 21 within 20 ms for SCS 30 kHz for NR cell.

Table 9.4B.1.1.3-1: Common test parameters for FDD or TDD NR band

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | | | **Unit** | **Value** |
| PDSCH transmission scheme | | |  | Transmission scheme 1 |
| EPRE ratio of PTRS to PDSCH | | | dB | N/A |
| Channel bandwidth | | | MHz | Channel bandwidth from selected CA bandwidth combination |
| Common serving cell parameters | Physical Cell ID | |  | 0 |
| SSB position in burst | |  | First SSB in Slot #0 |
| SSB periodicity | | ms | 20 |
| First DMRS position for Type A PDSCH mapping | |  | 2 |
| Cross carrier scheduling | | |  | Not configured |
| Active DL BWP index | | |  | 1 |
| Actual carrier configuration | Offset between Point A and the lowest usable subcarrier on this carrier (Note 2) | | RBs | 0 |
| Subcarrier spacing | | kHz | 15 or 30 |
| DL BWP configuration #1 | RB offset | | RBs | 0 |
| Number of contiguous PRB | |  | Maximum transmission bandwidth configuration as specified in clause 5.3.2 of TS 38.101-1 [2] for tested channel bandwidth and subcarrier spacing |
| Subcarrier spacing | | kHz | 15 or 30 |
| Cyclic prefix | |  | Normal |
| PDCCH configuration | Slots for PDCCH monitoring | |  | Each slot |
| Symbols with PDCCH | |  | Symbols #0 |
| Number of PRBs in CORESET | |  | Table 9.4B.1.1.3-4 |
| Number of PDCCH candidates and aggregation levels | |  | 2/AL2 for 15 kHz / 5 MHz and 30 kHz / 15 MHz  2/AL4 for 15 kHz / 10 MHz, 30 kHz / 10 MHz and 30 kHz / 20 MHz  2/AL8 for other greater combinations |
| CCE-to-REG mapping type | |  | Non-interleaved |
| DCI format | |  | 1\_1 |
| TCI State | |  | TCI state #1 |
| PDCCH & PDCCH DMRS Precoding configuration | |  | For 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 |
| PDSCH configuration | Mapping type | |  | Type A |
| k0 | |  | 0 |
| PDSCH aggregation factor | |  | 1 |
| PRB bundling type | |  | Static |
| PRB bundling size | |  | WB |
| Resource allocation type | |  | Type 0 |
| VRB-to-PRB mapping type | |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size | |  | N/A |
| PDSCH DMRS configuration | DMRS Type | |  | Type 1 |
| Number of additional DMRS | |  | 1 |
| Length | |  | 1 |
| Antenna ports indexes | |  | {1000} for 1 Layer CCs {1000, 1001} for 2 Layers CCs  {1000 – 1003} for 4 Layers CCs |
| Number of PDSCH DMRS CDM group(s) without data | |  | 1 for 1 layer and 2 layers CCs  2 for 4 Layers CCs |
| PTRS configuration | | |  | PTRS is not configured |
| CSI-RS for tracking | Subcarrier indexes in the PRB used for CSI-RS | |  | k0 = 3 for CSI-RS resource 1,2,3,4 |
| OFDM symbols in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resource 1 and 3  l0 = 10 for CSI-RS resource 2 and 4 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4 |
| Density (ρ) | |  | 3 for CSI-RS resource 1,2,3,4 |
| CSI-RS periodicity | | Slots | 15 kHz SCS: 20 for CSI-RS resource 1,2,3,4  30 kHz SCS: 40 for CSI-RS resource 1,2,3,4 |
| CSI-RS offset | | Slots | 15 kHz SCS:  10 for CSI-RS resource 1 and 2  11 for CSI-RS resource 3 and 4  30 kHz SCS:  20 for CSI-RS resource 1 and 2  21 for CSI-RS resource 3 and 4 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = BWP size |
| QCL info | |  | TCI state #0 |
| NZP CSI-RS for CSI acquisition | Subcarrier indexes in the PRB used for CSI-RS | |  | k0 = 4 |
| OFDM symbols in the PRB used for CSI-RS | |  | l0 = 12 |
| Number of CSI-RS ports (X) | |  | Same as number of transmit antenna |
| CDM Type | |  | ‘FD-CDM2’ |
| Density (ρ) | |  | 1 |
| CSI-RS periodicity | |  | 15 kHz SCS: 20  30 kHz SCS: 40 |
| CSI-RS offset | |  | 0 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = BWP size |
| QCL info | |  | TCI state #1 |
| ZP CSI-RS for CSI acquisition | Subcarrier indexes in the PRB used for CSI-RS | |  | k0 = 0 |
| OFDM symbols in the PRB used for CSI-RS | |  | l0 = 12 |
| Number of CSI-RS ports (X) | |  | 4 |
| CDM Type | |  | ‘FD-CDM2’ |
| Density (ρ) | |  | 1 |
| CSI-RS periodicity | |  | 15 kHz SCS: 20  30 kHz SCS: 40 |
| CSI-RS offset | |  | 0 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = BWP size |
| TCI state #0 | Type 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| Type 2 QCL information | SSB index |  | N/A |
| QCL Type |  | N/A |
| TCI state #1 | Type 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from ‘CSI-RS for tracking’ configuration |
| QCL Type |  | Type A |
| Type 2 QCL information | CSI-RS resource |  | N/A |
| QCL Type |  | N/A |
| Maximum number of code block groups for ACK/NACK feedback | | |  | 1 |
| Maximum number of HARQ transmission | | |  | 4 |
| HARQ ACK/NACK bundling | | |  | Multiplexed |
| Redundancy version coding sequence | | |  | {0,2,3,1} |
| PDSCH & PDSCH DMRS Precoding configuration | | |  | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination with PRB bundling granularity |
| Symbols for all unused REs | | |  | OCNG Annex A.5 |
| Propagation condition | | |  | Static propagation condition  No external noise sources are applied |
| Antenna configuration | 1 layer CCs | |  | 1x2 or 1x4 |
| 2 layers CCs | |  | 2x2 or 2x4 |
| 4 layers CCs | |  | 4x4 |
| Physical signals, channels mapping and precoding | | |  | As specified in Annex B.4.1 |
| Note 1: UE assumes that the TCI state for the PDSCH is identical to the TCI state applied for the PDCCH transmission  Note 2: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-1 [2] for tested channel bandwidth and subcarrier spacing | | | | |

Table 9.4B.1.1.3-2: Additional test parameters for NR FDD band

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

Table 9.4B.1.1.3-3: Additional test parameters for NR TDD band

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

Table 9.4B.1.1.3-4: Number of PRBs in CORESET for NR cell

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

Table 9.4B.1.1.3-5: MCS indexes for indicated UE capabilities for NR cell

|  |  |  |  |
| --- | --- | --- | --- |
| **Maximum number of PDSCH MIMO layers** | **Maximum modulation format** | **Scaling factor** | **MCS** |
| 1 | 8 | 1 | 26 |
| 1 | 8 | 0.8 | 21 |
| 1 | 8 | 0.75 | 20 |
| 1 | 8 | 0.4 | 11 |
| 1 | 6 | 1 | 27 |
| 1 | 6 | 0.8 | 23 |
| 1 | 6 | 0.75 | 22 |
| 1 | 6 | 0.4 | 14 |
| 1 | 4 | 1 | 16 |
| 1 | 4 | 0.8 | 16 |
| 1 | 4 | 0.75 | 16 |
| 1 | 4 | 0.4 | 10 |
| 1 | 2 | 1 | 9 |
| 1 | 2 | 0.8 | 9 |
| 1 | 2 | 0.75 | 9 |
| 1 | 2 | 0.4 | 4 |
| 2 | 8 | 1 | 26 |
| 2 | 8 | 0.8 | 21 |
| 2 | 8 | 0.75 | 20 |
| 2 | 8 | 0.4 | 11 |
| 2 | 6 | 1 | 27 |
| 2 | 6 | 0.8 | 23 |
| 2 | 6 | 0.75 | 22 |
| 2 | 6 | 0.4 | 14 |
| 2 | 4 | 1 | 16 |
| 2 | 4 | 0.8 | 16 |
| 2 | 4 | 0.75 | 16 |
| 2 | 4 | 0.4 | 10 |
| 2 | 2 | 1 | 9 |
| 2 | 2 | 0.8 | 9 |
| 2 | 2 | 0.75 | 9 |
| 2 | 2 | 0.4 | 4 |
| 4 | 8 | 1 | 26 |
| 4 | 8 | 0.8 | 23 |
| 4 | 8 | 0.75 | 22 |
| 4 | 8 | 0.4 | 12 |
| 4 | 6 | 1 | 27 |
| 4 | 6 | 0.8 | 24 |
| 4 | 6 | 0.75 | 23 |
| 4 | 6 | 0.4 | 14 |
| 4 | 4 | 1 | 16 |
| 4 | 4 | 0.8 | 16 |
| 4 | 4 | 0.75 | 16 |
| 4 | 4 | 0.4 | 11 |
| 4 | 2 | 1 | 9 |
| 4 | 2 | 0.8 | 9 |
| 4 | 2 | 0.75 | 9 |
| 4 | 2 | 0.4 | 5 |

Table 9.4B.1.1.3-6: Additional test setup for E-UTRA CC

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Value** |
| Inter-TTI Distance |  | 1 |
| Number of OFDM symbols for PDCCH per component carrier | OFDM symbols | 1 |
| Cross carrier scheduling |  | Not configured |
| Propagation condition |  | Static propagation condition  No external noise sources are applied |
| at antenna port | dBm/15kHz | -85 |
| Antenna configuration | 2 layer CC | 2x2 or 2x4 |
| 4 layer CC | 4x4 |
| Codebook subset  restriction | 2 layer CC | 10 |
| 4 layer CC | 1000 |
| Downlink power  allocation | 2 layer CC | = -3dB,  = -3dB, σ = 0dB |
| 4 layer CC | = -6dB,  = -6dB, σ = 3dB |

Table 9.4B.1.1.3-7: E-UTRA FRC for SDR test (FDD)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| MIMO layer | Bandwidth | Reference channel | | |
| 64QAM | 256QAM | 1024QAM |
| 2 layer | 5 | R.PDSCH.4-1.1 FDD | R.PDSCH.4-3.1 FDD | R.PDSCH.4-5.1 FDD |
| 10 | R.PDSCH.4-1.2 FDD | R.PDSCH.4-3.2 FDD | R.PDSCH.4-5.2 FDD |
| 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 |
| 4 layer | 5 | R.PDSCH.4-2.1 FDD | R.PDSCH.4-4.1 FDD | R.PDSCH.4-6.1 FDD |
| 10 | R.PDSCH.4-2.2 FDD | R.PDSCH.4-4.2 FDD | R.PDSCH.4-6.2 FDD |
| 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.1.1.3-8: E-UTRA FRC for SDR test (TDD)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| MIMO layer | Bandwidth | Reference channel | | |
| 64QAM | 256QAM | 1024QAM |
| 2 layer | 10 | R.PDSCH.6-1.1 TDD | R.PDSCH.6-3.1 TDD | R.PDSCH.6-5.1 TDD |
| 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 |
| 4 layer | 10 | R.PDSCH.6-2.1 TDD | R.PDSCH.6-4.1 TDD | R.PDSCH.6-6.1 TDD |
| 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.1.1.3.1 Procedure for test parameter selection

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 TS 38.306 [14], Section 4.1.2.

- Set of per NR CC UE capabilities include channel bandwidth, subcarrier spacing, number of PDSCH MIMO layers, modulation format and scaling factor TS 38.306 [14] Section 4.1.2.

- Set of per E-UTRA CC UE capabilities includes channel bandwidth, number of PDSCH MIMO layers and modulation format TS 38.306 [14] Section 4.1.2.

- 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 9.4B.1.1.3-5 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.1.1.3-7 and Table 9.4B.1.1.3-8 to determine FRC based on test parameters and indicated UE capabilities.

Pasting relevant portion of max data rate equation from TS 38.306 [14] section 4.1

For NR, the approximate data rate for a given number of aggregated carriers in a band or band combination is computed as follows.



wherein

J is the number of aggregated component carriers in a band or band combination

Rmax = 948/1024

For the j-th CC,

 is the maximum number of supported layers given by higher layer parameter *maxNumberMIMO-LayersPDSCH* for downlink and maximum of higher layer parameters *maxNumberMIMO-LayersCB-PUSCH* and *maxNumberMIMO-LayersNonCB-PUSCH* for uplink.

 is the maximum supported modulation order given by higher layer parameter *supportedModulationOrderDL* for downlink and higher layer parameter *supportedModulationOrderUL* for uplink.

is the scaling factor given by higher layer parameter *scalingFactor* and can take the values 1, 0.8, 0.75, and 0.4.

 is the numerology (as defined in TS 38.211 [6])

 is the average OFDM symbol duration in a subframe for numerology , i.e. . Note that normal cyclic prefix is assumed.

 is the maximum RB allocation in bandwidth  with numerology , as defined in 5.3 TS 38.101-1 [2] and 5.3 TS 38.101-2 [3], where  is the UE supported maximum bandwidth in the given band or band combination.

is the overhead and takes the following values

0.14, for frequency range FR1 for DL

0.18, for frequency range FR2 for DL

0.08, for frequency range FR1 for UL

0.10, for frequency range FR2 for UL

NOTE: Only one of the UL or SUL carriers (the one with the higher data rate) is counted for a cell operating SUL.

For EUTRA in case of MR-DC, the approximate data rate for a given number of aggregated carriers in a band or band combination is computed as follows.

Data rate (in Mbps) = 

wherein

J is the number of aggregated EUTRA component carriers in MR-DC band combination

is the total maximum number of DL-SCH transport block bits received within a 1ms TTI for j-th CC, as derived from TS36.213 [22] based on the UE supported maximum MIMO layers for the j-th carrier, and based on the modulation order and number of PRBs based on the bandwidth of the j-th carrier.

The approximate maximum data rate can be computed as the maximum of the approximate data rates computed using the above formula for each of the supported band or band combinations.

For MR-DC, the approximate maximum data rate is computed as the sum of the approximate maximum data rates from NR and EUTRA

The normative reference for this requirement is TS 38.101-4 [5], clause 9.4B.1.1.

9.4B.1.1.4 Test description

9.4B.1.1.4.1 Initial conditions

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

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

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

E-UTRA configurations before measurement are specified in at Table 9.4B.1.1.3-6.

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

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

1. Connect the SS to the UE antenna connectors as shown in TS 38.508-1 [6] Annex A, in Figure A.3.1.7.1, A.3.1.7.4 and A.3.1.7.5 for TE diagram (without fader and AWGN) for 2Rx and 4Rx respectively and clause A.3.2.2 for UE diagram.

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

3. Downlink signals for E-UTRA cell are initially set up according to TS 36.521-1 [16] Annex C.0 and uplink signals according to TS 36.521-1 [16] Annex H

4. Propagation conditions are set according to TS 36.521-1 [16] and TS 38.521-1 [7] Annex B.0 for E-UTRA CG and NR CG respectively.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters Connectivity EN-DC, DC bearer *MCG(s)* and *SCG*, Connected without release *On, Test Loop Function On with UE Test Loop Mode A with UL\_PDCP\_SDU\_SIZE = 0* for MCG DRB and SCG DRB according to TS 38.508-1 [6] clause 4.5.4. Message content are defined in clause 5.5.1.4.3.

6. SS sends a RRCConnectionReconfiguration message to change PDCP version of MCG DRB to NR PDCP.

7. SS shall transmit UECapabilityEnquiry message containing *UE-CapabilityRAT-Request* with *rat-Type* set to *eutra-nr* and *eutra*.

8. The UE shall transmit UECapabilityInformation message.

9. Using the UE capabilities advertised in the *UE-CapabilityRAT-Container* of the type *UE-MRDC-Capability and UE-EUTRA-Capability,* and the procedure outlined in 9.4B.1.1.3.1 determine one EN-DC bandwidth combination that would provide the largest aggregated data rate.

10. Setup up the NR CG and E-UTRA CG using these parameters for the test.

11. Configure the NR CG TBsize, NR CG DL RMC, NR CG UL RMC from Annex A.3.2\_1 and Annex A.2.2 for UL as appropriate. Configure the E-UTRA CG TBsize, DL RMC and UL RMC from Table 9.4B.1.1.3-7, Table 9.4B.1.1.3-8 as appropriate.

9.4B.1.1.4.2 Test procedure

1. SS configures T-reordering timer to be infinity for both E-UTRA MCG DRB and NR SCG DRB.

2. SS sends a PDCP reestablishment via RRCConnectionReconfigurationmessage requesting for PDCP Status Report for both E-UTRA MCG DRB and NR SCG DRB.

3. SS sets the counters NDL\_newtx NDL\_retx per NR CG and E-UTRA CG to 0.

4. For each new DL HARQ transmission the SS generates sufficient NR PDCP SDUs (max PDCP SDU size and minimum number of consecutive PDCP SDUs) to fill up the TB in accordance with Annex A.3.2\_1 for both E-UTRA MCG DRB and NR SCG DRB. The SS ciphers the PDCP SDUs, concatenates the resultant PDCP PDUs to form an RLC PDU and then a MAC PDU. The SS transmits the MAC PDU per NR CG and E-UTRA CG. The SS increments then NDL\_newtx by one per CG.

5. If PHY requests a DL HARQ retransmission, the SS performs a HARQ retransmission and increments NDL\_retx by one for that CG accordingly.

6. Steps 5 to 6 are repeated at every TTI for at least 300 frames and the SS waits for 300ms to let any HARQ retransmissions and RLC retransmissions to finish.

7. SS sends a PDCP reestablishment via RRCConnectionReconfigurationmessage requesting for PDCP Status Report for both E-UTRA MCG and NR SCG DRB.

8. The SS calculates the TB success rate per NR CG and E-UTRA CG as A = 100% NDL\_correct\_rx \*/ (NDL\_newtx + NDL\_retx).

9. SS computes the PDCP SDU loss by looking into the FMC and Bitmap field in the PDCP Status Report. PDCP SDU loss B = COUNT reported in the Bitmap field of PDCP Status Report.

10. The UE passes the test if A ≥ 85% TB success rates for both NR CG and E-UTRA CG and B = 0.

NOTE 1: In case of RLC PDU retransmission, the number of new required PDCP SDUs is as many as to fill the rest of TB.

9.4B.1.1.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2 with the following exceptions

Table 9.4B.1.1.4.3-0: CLOSE UE TEST LOOP (MCG and SCG DRB in the preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.509 clause 6.3.1 | | | |
| Information Element | | Value/remark | Comment | Condition |
| Protocol discriminator | | 1 1 1 1 |  |  |
| Skip indicator | | 0 0 0 0 |  |  |
| Message type | | 1 0 0 0 0 0 0 0 |  |  |
| UE test loop mode | | 0 0 0 0 0 0 0 0 | UE test loop mode A |  |
| UE test loop mode A LB setup | |  |  |
| Length of UE test loop mode A LB setup list in bytes | | 0 0 0 0 1 1 0 0 | Length of two LB setup DRB (6 bytes) |
| LB setup DRB[1] | | 0 0 0 0 0 0 0 0,  0 0 0 0 0 0 0 0,  0 0 0 Q4 Q3 Q2 Q1 Q0 | UL PDCP SDU size = 0  Q4..Q0 = MCG Data Radio Bearer identity number -1 for the radio bearer. See 38.509 clause 6.3.1 |
| LB setup DRB[2] | | 0 0 0 0 0 0 0 0,  0 0 0 0 0 0 0 0,  0 0 0 Q4 Q3 Q2 Q1 Q0 | UL PDCP SDU size = 0  Q4..Q0 = SCG Data Radio Bearer identity number -1 for the radio bearer. See 38.509 clause 6.3.1 |
| UE test loop mode B LB setup | | Not present |  |

Table 9.4B.1.1.4.3-1 to -7: Void

Table 9.4B.1.1.4.3-8: RadioBearerConfig (Initial Conditions, Step 5)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3-132 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | 1 entry |  |  |
| DRB-ToAddMod[1] SEQUENCE { |  | entry 1 |  |
| cnAssociation CHOICE { |  |  |  |
| eps-BearerIdentity | Dedicated EPS bearer ID |  |  |
| } |  |  |  |
| drb-Identity | DRB-Identity of the SCG DRB |  |  |
| reestablishPDCP | Not Present |  |  |
| pdcp-Config | PDCP-Config | Table 9.4B.1.1.4.3-8A |  |
| } |  |  |  |
| } |  |  |  |

Table 9.4B.1.1.4.3-8A: *PDCP-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-99 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCP-Config ::= SEQUENCE { |  |  |  |
| drb SEQUENCE { |  |  |  |
| discardTimer | infinity |  |  |
| pdcp-SN-Size-UL | len18bits |  |  |
| pdcp-SN-Size-DL | len18bits |  |  |
| headerCompression CHOICE { |  |  |  |
| notUsed | Null |  |  |
| } |  |  |  |
| integrityProtection | Not present |  |  |
| statusReportRequired | true |  |  |
| outOfOrderDelivery | Not present |  |  |
| } |  |  |  |
| t-Reordering | Not present |  |  |
| } |  |  |  |

Table 9.4B.1.1.4.3-9: *RRCConnectionReconfiguration* (Initial conditions, step6)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 36.508 [7], Table 4.6.1-8 | | | |
| Information Element | Value/remark | Comment | Condition |
| RRCConnectionReconfiguration ::= SEQUENCE { |  |  |  |
| criticalExtensions CHOICE { |  |  |  |
| c1 CHOICE { |  |  |  |
| rrcConnectionReconfiguration-r8 SEQUENCE { |  |  |  |
| radioResourceConfigDedicated | RadioResourceConfigDedicated-MCG-DRB-NR-PDCP | As per Table 9.4B.1.1.4.3-10 |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nonCriticalExtension SEQUENCE { |  |  |  |
| nr-Config-r15 | Not present |  |  |
| nr-RadioBearerConfig1-r15 | OCTET STRING containing RadioBearerConfig according to TS 38.508-1 [6], Table 4.6.3-132 with conditions MCG\_NR\_PDCP |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |
| } |  |  |  |

Table 9.4B.1.1.4.3-10: *RadioResourceConfigDedicated-MCG-DRB-NR-PDCP*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 36.508 [7], Table 4.6.3-17 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioResourceConfigDedicated-MCG-DRB-NR-PDCP ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | 1 entry |  |  |
| DRB-ToAddMod[1] | DRB-ToAddMod-MCG-DRB-NR-PDCP | entry 1  As per Table 9.4B.1.1.4.3-11 |  |
| } |  |  |  |
| drb-ToReleaseList SEQUENCE (SIZE (1..maxDRB)) OF DRB-Identity { | 1 entry |  |  |
| DRB-Identity[1] | Same as the DRB identity associated with the default EPS bearer | entry 1 |  |
| } |  |  |  |
| } |  |  |  |

Table 9.4B.1.1.4.3-11: DRB-ToAddMod-MCG-DRB-NR-PDCP

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 36.508 [19], Table 4.8.2.1.7-1 | | | |
| Information Element | | Value/remark | Comment | Condition |
| DRB-ToAddMod ::= SEQUENCE { | |  |  |  |
| eps-BearerIdentity | | Same as the default EPS bearer Identity |  |  |
| drb-Identity | | Same as the DRB identity associated with the default EPS bearer |  |  |
| pdcp-Config | | Not present |  |  |
| reestablishPDCP | | Not present |  |  |
| } | |  |  |  |

Table 9.4B.1.1.4.3-12: RadioBearerConfig (Test procedure, step 2 and step 7)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], clause 4.6.3-132 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF DRB-ToAddMod { | 2 entries |  |  |
| DRB-ToAddMod[1] SEQUENCE { |  | entry 1 |  |
| cnAssociation CHOICE { |  |  |  |
| eps-BearerIdentity | Default EPS bearer ID |  |  |
| } |  |  |  |
| drb-Identity | DRB-Identity of the MCG DRB |  |  |
| reestablishPDCP | true |  |  |
| pdcp-Config | PDCP-Config |  |  |
| } |  |  |  |
| DRB-ToAddMod[2] SEQUENCE { |  | entry 2 |  |
| cnAssociation CHOICE { |  |  |  |
| eps-BearerIdentity | Dedicated EPS bearer ID |  |  |
| } |  |  |  |
| drb-Identity | DRB-Identity of the SCG DRB |  |  |
| reestablishPDCP | true |  |  |
| pdcp-Config | PDCP-Config |  |  |
| } |  |  |  |

9.4B.1.1.5 Test requirement

The PDCP SDU success rate of greater than 85% shall be sustained during at least 300 frames.

The TB success rate of greater than 85% with no PDCP SDU loss shall be sustained during at least 300 frames.

#### 9.4B.1.1\_1 Sustained downlink data rate performance for EN-DC within FR1 (2 NR CCs)

9.4B.1.1\_1.1 Test Purpose

Same as in clause 9.4B.1.1.1

9.4B.1.1\_1.2 Test applicability

This test applies to all types of EUTRA UE release 15 and forward supporting EN-DC with 2 NR CCs.

9.4B.1.1\_1.3 Minimum conformance requirements

Same as in clause 9.4B.1.1.3

9.4A.1.1\_1.3.1 Procedure for test parameter selection

Same as in clause 9.4B.1.1.3.1

9.4B.1.1\_1.4 Test description

Same as in clause 5.5A.1.1.4

9.4B.1.1\_1.4.3 Message contents

Same as in clause 9.4B.1.1.4.3

9.4B.1.1\_1.5 Test requirement

The TB success rate of greater than 85% with no PDCP SDU loss shall be sustained during at least 300 frames on each CC.

#### 9.4B.1.1\_2 Sustained downlink data rate performance for EN-DC within FR1 (3 NR CCs)

9.4B.1.1\_2.1 Test Purpose

Same as in clause 9.4B.1.1.1

9.4B.1.1\_2.2 Test applicability

This test applies to all types of EUTRA UE release 15 and forward supporting EN-DC with 2 NR CCs.

9.4B.1.1\_2.3 Minimum conformance requirements

Same as in clause 9.4B.1.1.3

9.4A.1.1\_2.3.1 Procedure for test parameter selection

Same as in clause 9.4B.1.1.3.1

9.4B.1.1\_2.4 Test description

Same as in clause 5.5A.1.1.4

9.4B.1.1\_2.4.3 Message contents

Same as in clause 9.4B.1.1.4.3

9.4B.1.1\_2.5 Test requirement

The TB success rate of greater than 85% with no PDCP SDU loss shall be sustained during at least 300 frames on each CC.

#### 9.4B.1.1\_3 Sustained downlink data rate performance for EN-DC within FR1 (4 NR CCs)

9.4B.1.1\_3.1 Test Purpose

Same as in clause 9.4B.1.1.1

9.4B.1.1\_3.2 Test applicability

This test applies to all types of EUTRA UE release 15 and forward supporting EN-DC with 2 NR CCs.

9.4B.1.1\_3.3 Minimum conformance requirements

Same as in clause 9.4B.1.1.3

9.4A.1.1\_3.3.1 Procedure for test parameter selection

Same as in clause 9.4B.1.1.3.1

9.4B.1.1\_3.4 Test description

Same as in clause 5.5A.1.1.4

9.4B.1.1\_3.4.3 Message contents

Same as in clause 9.4B.1.1.4.3

9.4B.1.1\_3.5 Test requirement

The TB success rate of greater than 85% with no PDCP SDU loss shall be sustained during at least 300 frames on each CC.

#### 9.4B.1.2 Sustained downlink data rate performance for EN-DC including FR2 NR carrier

Editor’s Note: MU analysis is complete for up to 400 MHz aggregated ChBW.

9.4B.1.2.1 Test Purpose

The purpose of the test is to verify that the Layer 1 and Layer 2 correctly process in a sustained manner the received packets corresponding to the maximum data rate indicated by UE 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.

9.4B.1.2.2 Test Applicability

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

9.4B.1.2.3 Minimum conformance requirements

The test setup for E-UTRA Pcell is specified in Clause 9.1.2 and Table 9.4B.1.1.1-1. 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.2.2.

The TB success rate of delivered PDCP SDU(s) by Layer2 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.

The test parameters are specified in Tables 9.4B.1.2.3-1, 9.4B.1.2.3-2.

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 9.4B.1.2.3-1: Test parameters for FR2 TDD

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Value |
| PDSCH transmission scheme | | |  | Transmission scheme 1 |
| PTRS epre-Ratio | | |  | 0 |
| Channel bandwidth | | | MHz | Channel bandwidth from selected CA bandwidth combination |
| Common serving cell parameters | Physical Cell ID | |  | 0 |
| SSB position in burst | |  | First SSB in Slot #0 |
| SSB periodicity | | ms | 20 |
| First DMRS position for Type A PDSCH mapping | |  | 2 |
| Cross carrier scheduling | | |  | Not configured |
| Active DL BWP index | | |  | 1 |
| Actual carrier configuration | Offset between Point A and the lowest usable subcarrier on this carrier (Note 3) | | RBs | 0 |
| Subcarrier spacing | | kHz | 60 or 120 |
| DL BWP configuration #1 | RB Offset | |  | 0 |
| Number of contiguous PRB | |  | Maximum transmission bandwidth configuration as specified in clause 5.3.2 of TS 38.101-2 [3] for tested channel bandwidth and subcarrier spacing |
| Subcarrier spacing | | kHz | 60 or 120 |
| Cyclic prefix | |  | Normal |
| PDCCH configuration | Slots for PDCCH monitoring | |  | Each slot |
| Symbols with PDCCH | |  | Symbols #0 |
| Number of PRBs in CORESET | |  | Table 7.5A.1-2 |
| Number of PDCCH candidates and aggregation levels | |  | 2/AL2 for 120 kHz / 50 MHz  2/AL4 for 60 kHz / 50 MHz, 120 kHz / 100 MHz  2/AL8 for other greater combinations |
| CCE-to-REG mapping type | |  | Non-interleaved |
| DCI format | |  | 1-1 |
| TCI State | |  | TCI state #1 |
| PDCCH &PDCCH DMRS Precoding configuration | |  | 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 |
| PDSCH configuration | Mapping type | |  | Type A |
| k0 | |  | 0 |
| PDSCH aggregation factor | |  | 1 |
| PRB bundling type | |  | Static |
| PRB bundling size | |  | WB |
| Resource allocation type | |  | Type 0 |
| RBG size | |  | Config2 |
| VRB-to-PRB mapping type | |  | Non-interleaved |
| VRB-to-PRB mapping interleaver bundle size | |  | N/A |
| Starting symbol (S) | |  | 1 |
| Length (L) | |  | 13 |
| PDSCH DMRS configuration | DMRS Type | |  | Type 1 |
| Number of additional DMRS | |  | 1 |
| Length | |  | 1 |
| Antenna ports indexes | |  | {1000} for 1 Layer CCs {1000, 1001} for 2 Layers CCs |
| Number of PDSCH DMRS CDM group(s) without data | |  | 1 |
| PTRS configuration | Frequency density (*KPT-RS*) | |  | 2 |
| Time density (*LPT-RS*) | |  | 1 |
| CSI-RS for tracking | Subcarrier indexes in the PRB used for CSI-RS | |  | k0 = 3 for CSI-RS resource 1,2,3,4 |
| OFDM symbols in the PRB used for CSI-RS | |  | l0 = 6 for CSI-RS resource 1 and 3  l0 = 10 for CSI-RS resource 2 and 4 |
| Number of CSI-RS ports (X) | |  | 1 for CSI-RS resource 1,2,3,4 |
| CDM Type | |  | ‘No CDM’ for CSI-RS resource 1,2,3,4 |
| Density (ρ) | |  | 3 for CSI-RS resource 1,2,3,4 |
| CSI-RS periodicity | | Slots | 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 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = BWP size |
| QCL info | |  | TCI state #0 |
| NZP CSI-RS for CSI acquisition | Subcarrier indexes in the PRB used for CSI-RS | |  | k0 = 4 |
| OFDM symbols in the PRB used for CSI-RS | |  | l0 = 13 |
| Number of CSI-RS ports (X) | |  | Same as number of transmit antenna |
| CDM Type | |  | ‘FD-CDM2’ |
| Density (ρ) | |  | 1 |
| CSI-RS periodicity | | Slots | 60 kHz SCS: 80  120 kHz SCS: 160 |
| CSI-RS offset | |  | 0 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = BWP size |
| QCL info | |  | TCI state #1 |
| ZP CSI-RS for CSI acquisition | Subcarrier indexes in the PRB used for CSI-RS | |  | k0 = 0 |
| OFDM symbols in the PRB used for CSI-RS | |  | l0 = 12 |
| Number of CSI-RS ports (X) | |  | 4 |
| CDM Type | |  | ‘FD-CDM2’ |
| Density (ρ) | |  | 1 |
| CSI-RS periodicity | | Slots | 60 kHz SCS: 80  120 kHz SCS: 160 |
| CSI-RS offset | |  | 0 |
| Frequency Occupation | |  | Start PRB 0  Number of PRB = BWP size |
| CSI-RS for beam refinement | First subcarrier index in the PRB used for CSI-RS | |  | k0=0 for CSI-RS resource 1,2 |
| First OFDM symbol in the PRB used for CSI-RS | |  | l0 = 8 for CSI-RS resource 1  l0 = 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 |
| Density (ρ) | |  | 3 for CSI-RS resource 1,2 |
| CSI-RS periodicity | | Slots | 60 kHz SCS: 80 for CSI-RS resource 1,2  120 kHz SCS: 160 for CSI-RS resource 1,2 |
| CSI-RS offset | | Slots | 0 for CSI-RS resource 1,2 |
| Repetition | |  | ON |
| QCL info | |  | TCI state #1 |
| TCI state #0 | ype 1 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type C |
| ype 2 QCL information | SSB index |  | SSB #0 |
| QCL Type |  | Type D |
| TCI state #1 | ype 1 QCL information | CSI-RS resource |  | CSI-RS resource 1 from ‘CSI-RS for tracking’ configuration |
| QCL Type |  | Type A |
| ype 2 QCL information | CSI-RS resource |  | CSI-RS resource 1 from ‘CSI-RS for tracking’ configuration |
| QCL Type |  | Type D |
| Maximum number of code block groups for ACK/NACK feedback | | |  | 1 |
| Number of HARQ Processes | | |  | 10 for FR2.60-1 and 8 for FR2.120-1 |
| K1 value | | |  | Specific to each UL-DL pattern |
| Maximum number of HARQ transmission | | |  | 4 |
| HARQ ACK/NACK bundling | | |  | Multiplexed |
| Redundancy version 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, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination, and with Wideband granularity for Rank 2 |
| Symbols for all unused REs | | |  | OCNG Annex A.5 |
| Propagation condition | | |  | Static propagation condition  No external noise sources are applied |
| Antenna configuration | 1 layer CCs | |  | 1x2 or 1x4 |
| 2 layers CCs | |  | 2x2 or 2x4 |
| Physical signals, channels 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 [3] for tested channel bandwidth and subcarrier spacing. | | | | |

Table 9.4B.1.2.3-2: 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 9.4B.1.2.3-3: MCS indexes for indicated UE capabilities

|  |  |  |  |
| --- | --- | --- | --- |
| **Maximum number of PDSCH MIMO layers** | **Maximum modulation format** | **Scaling factor** | **MCS** |
| 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 |

Table 9.4B.1.2.3-4: SNR required to achieve 85% of peak throughput under AWGN conditions

|  |  |  |
| --- | --- | --- |
| MCS Index (Note 1) | SNRBB(dB) for maximum number of PDSCH MIMO Layers = 1 | SNRBB(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 Table defined in clause 5.1.3 of TS 38.214 [12] when 256QAM is not enabled. | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 9.4B.1.2.

9.4B.1.2.3.1 Procedure for test parameter selection

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.

Pasting relevant portion of max data rate equation from TS 38.306 [14] section 4.1

For NR, the approximate data rate for a given number of aggregated carriers in a band or band combination is computed as follows.



wherein

J is the number of aggregated component carriers in a band or band combination

Rmax = 948/1024

For the j-th CC,

 is the maximum number of supported layers given by higher layer parameter *maxNumberMIMO-LayersPDSCH* for downlink and maximum of higher layer parameters *maxNumberMIMO-LayersCB-PUSCH* and *maxNumberMIMO-LayersNonCB-PUSCH* for uplink.

 is the maximum supported modulation order given by higher layer parameter *supportedModulationOrderDL* for downlink and higher layer parameter *supportedModulationOrderUL* for uplink.

is the scaling factor given by higher layer parameter *scalingFactor* and can take the values 1, 0.8, 0.75, and 0.4.

 is the numerology (as defined in TS 38.211 [6])

 is the average OFDM symbol duration in a subframe for numerology , i.e. . Note that normal cyclic prefix is assumed.

 is the maximum RB allocation in bandwidth  with numerology , as defined in 5.3 TS 38.101-1 [2] and 5.3 TS 38.101-2 [3], where  is the UE supported maximum bandwidth in the given band or band combination.

is the overhead and takes the following values

0.14, for frequency range FR1 for DL

0.18, for frequency range FR2 for DL

0.08, for frequency range FR1 for UL

0.10, for frequency range FR2 for UL

NOTE: Only one of the UL or SUL carriers (the one with the higher data rate) is counted for a cell operating SUL.

For EUTRA in case of MR-DC, the approximate data rate for a given number of aggregated carriers in a band or band combination is computed as follows.

Data rate (in Mbps) = 

wherein

J is the number of aggregated EUTRA component carriers in MR-DC band combination

is the total maximum number of DL-SCH transport block bits received within a 1ms TTI for j-th CC, as derived from TS36.213 [22] based on the UE supported maximum MIMO layers for the j-th carrier, and based on the modulation order and number of PRBs based on the bandwidth of the j-th carrier.

The approximate maximum data rate can be computed as the maximum of the approximate data rates computed using the above formula for each of the supported band or band combinations.

For MR-DC, the approximate maximum data rate is computed as the sum of the approximate maximum data rates from NR and EUTRA

9.4B.1.2.4 Test description

9.4B.1.2.4.1 Initial conditions

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

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

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

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

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

For EN-DC within FR2 operation, setup the LTE radiated link according to Annex D:

1. Connection between SS, the faders, AWGN noise source and the UE is shown in TS 38.508-1 [6] Annex A, Figure A.3.3.2 for TE diagram and Figure A.3.4.2 for UE diagram.

2. The parameter settings for the NR cell are set up according to Table 7.2-1 and Table 7.2.2.2.1.0-2 and as appropriate.

3. Downlink signals for NR cell are initially set up according to Annexes C.0, C.1, C.2, and uplink signals according to Annexes G.0, G.1, G.2, G.3.1 of TS 38.521-2 [8].

4. Propagation conditions for NR cell are set according to Annex B.0.

5. Ensure the UE is in state RRC\_CONNECTED with generic procedure parameters *Test Mode On*, (EN-DC, DC bearer *MCG* and *SCG), Connected without release On, Test Loop Function On with UE Test Loop Mode A with UL\_PDCP\_SDU\_SIZE = 0* according to TS 38.508-1 [6] clause 4.5.4. Message content are defined in clause 9.4B.1.2.4.3.

6. SS shall transmit UECapabilityEnquiry message containing *UE-CapabilityRAT-Request* with *rat-Type* set to *eutra-nr* and *eutra*.

7. The UE shall transmit UECapabilityInformation message.

8. Using the UE capabilities advertised in the *UE-CapabilityRAT-Container* of the type *UE-MRDC-Capability and UE-EUTRA-Capability,* and the procedure outlined in 9.4B.1.2.3.1 determine one EN-DC bandwidth combination that would provide the largest aggregated data rate.

9. Setup up the NR CG for these parameters for the test.

9.4B.1.2.4.2 Test Procedure

1. Set the UE in a direction that satisfies the 3 normative criteria specified in Annex H.0. If no direction found, mark the test as inconclusive.

2. Based on the maximum SNR capability of the FR2 chamber, determine the max MCS index from table 9.4B.1.2.3-4 to be configured for this test.

3. Configure the NR CG TBsize, NR CG DL RMC, NR CG UL RMC from Annex A.3.2\_1 and Annex A.2.2 for UL as appropriate based on the MCS index chosen in step 2.

4. SS configures T-reordering timer to be infinity for NR SCG DRB.

5. SS sends a PDCP reestablishment via RRC Reconfiguration message requesting for PDCP Status Report for NR SCG DRB.

6. SS sets the counters NDL\_newtx NDL\_retx per NR CG to 0.

7. For each new DL HARQ transmission the SS generates sufficient NR PDCP SDUs (max PDCP SDU size and minimum number of consecutive PDCP SDUs) to fill up the TB in accordance with Annex A.3.2\_1 for NR SCG DRB. The SS ciphers the PDCP SDUs, concatenates the resultant PDCP PDUs to form an RLC PDU and then a MAC PDU. The SS transmits the MAC PDU per NR CG. The SS increments then NDL\_newtx by one per CG.

8. If PHY requests a DL HARQ retransmission, the SS performs a HARQ retransmission and increments NDL\_retx by one for that CG accordingly.

9. Steps 7 and 8 are repeated at every TTI for at least 300 frames and the SS waits for 300ms to let any HARQ retransmissions and RLC retransmissions to finish.

10. SS sends a PDCP reestablishment via RRC Reconfiguration message requesting for PDCP Status Report for NR SCG DRB.

11. The SS calculates the TB success rate per NR CG as A = 100% NDL\_correct\_rx \*/ (NDL\_newtx + NDL\_retx).

12. SS computes the PDCP SDU loss by looking into the FMC and Bitmap field in the PDCP Status Report. PDCP SDU loss B = COUNT reported in the Bitmap field of PDCP Status Report.

13. The UE passes the test if A ≥ 85% TB success rates for NR CG and B = 0.

NOTE 1: In case of RLC PDU retransmission, the number of new required PDCP SDUs is as many as to fill the rest of TB.

9.4B.1.2.4.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.2 with the following exceptions

Table 9.4B.1.2.4.3-0: CLOSE UE TEST LOOP (in the preamble)

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: 38.509 clause 6.3.1 | | | |
| Information Element | | Value/remark | Comment | Condition |
| Protocol discriminator | | 1 1 1 1 |  |  |
| Skip indicator | | 0 0 0 0 |  |  |
| Message type | | 1 0 0 0 0 0 0 0 |  |  |
| UE test loop mode | | 0 0 0 0 0 0 0 0 | UE test loop mode A |  |
| UE test loop mode A LB setup | |  |  |
| Length of UE test loop mode A LB setup list in bytes | | 0 0 0 0 0 0 1 1 | Length of one LB setup DRB (3 bytes) |
| LB setup DRB | | 0 0 0 0 0 0 0 0,  0 0 0 0 0 0 0 0,  0 0 0 Q4 Q3 Q2 Q1 Q0 | UL PDCP SDU size = 0  Q4..Q0 = Data Radio Bearer identity number for the default radio bearer. See 38.509 clause 6.3.1 |
| UE test loop mode B LB setup | | Not present |  |

Table 9.4B.1.1.4.3-1: PDCCH-ControlResourceSet-spCellConfigDedicated

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-28 | | | |
| Information Element | Value/remark | Comment | Condition |
| ControlResourceSet ::= SEQUENCE { |  |  |  |
| frequencyDomainResources | CORESET value according to Table 9.4B.1.2.3-2 as applicable |  |  |
| } |  |  |  |
| } |  |  |  |

Table 9.4B.1.1.4.3-2: PDCCH *Search Space*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 4.6.3-162 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| monitoringSymbolsWithinSlot | 10000000000000 | Symbols 0 |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel1 | n0 |  |  |
| aggregationLevel2 | n0 |  |  |
| aggregationLevel4 | n0 |  |  |
| aggregationLevel8 | n1 | AL8 |  |
| aggregationLevel16 | n0 |  |  |
| } |  |  |  |
| } |  |  |  |

Table 9.4B.1.1.4.3-3: RadioBearerConfig

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508 [6], clause 4.6.3-132 | | | |
| Information Element | Value/remark | Comment | Condition |
| RadioBearerConfig ::= SEQUENCE { |  |  |  |
| drb-ToAddModList SEQUENCE (SIZE (1..maxDRB)) OF SEQUENCE { | 1 entry |  | EN-DC\_DRB |
| cnAssociation CHOICE { |  |  |  |
| eps-BearerIdentity | 6 |  |  |
| } |  |  |  |
| drb-Identity | DRB-Identity using condition DRB2 |  |  |
| reestablishPDCP | true |  | EN-DC\_DRB AND Re-establish\_PDCP |
| pdcp-Config | PDCP-Config |  |  |
| } |  |  |  |

Table 9.4B.1.1.4.3-4: *PDCP-Config*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508 [6], Table 4.6.3-99 | | | |
| Information Element | Value/remark | Comment | Condition |
| PDCP-Config ::= SEQUENCE { |  |  |  |
| drb SEQUENCE { |  |  |  |
| discardTimer | infinity |  |  |
| pdcp-SN-Size-UL | len18bits |  |  |
| pdcp-SN-Size-DL | len18bits |  |  |
| headerCompression CHOICE { |  |  |  |
| notUsed | Null |  |  |
| } |  |  |  |
| integrityProtection | Not present |  |  |
| statusReportRequired | true |  |  |
| outOfOrderDelivery | Not present |  |  |
| } |  |  |  |
| t-Reordering | Not present |  |  |
| } |  |  |  |

Table 9.4B.1.2.4.3-5: PDCCH *Search Space*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6], Table 5.4.2.3-7 | | | |
| Information Element | Value/remark | Comment | Condition |
| SearchSpace ::= SEQUENCE { |  |  |  |
| nrofCandidates SEQUENCE { |  |  |  |
| aggregationLevel1 | n0 |  |  |
| aggregationLevel2 | n2 | 1 for UL, 1 for DL | BW 50 MHz SCS 120 kHz |
| aggregationLevel4 | n2 | 1 for UL, 1 for DL | (BW 50 MHz SCS 60 kHz) OR (BW 100 MHz SCS 120 kHz) |
| aggregationLevel8 | n2 | 1 for UL, 1 for DL | (BW 100 MHz SCS 60 kHz) OR (BW 200 MHz SCS 120 kHz) OR (BW 400 MHz SCS 120 kHz) |
| aggregationLevel16 | n0 |  |  |
| } |  |  |  |
| } |  |  |  |

9.4B.1.2.5 Test requirement

The TB success rate of greater than 85% and no PDCP SDU loss shall be sustained during at least 300 frames.

#### 9.4B.1.2\_1 Sustained downlink data rate performance for EN-DC including FR2 (2 NR CCs)

9.4B.1.2\_1.1 Test Purpose

Same as in clause 9.4B.1.2

9.4B.1.2\_1.2 Test applicability

This test applies to all types of EUTRA UE release 15 and forward supporting EN-DC with 2 NR CCs.

9.4B.1.2\_1.3 Minimum conformance requirements

Same as in clause 9.4B.1.2\_1.3

9.4A.1.2\_1.3.1 Procedure for test parameter selection

Same as in clause 9.4B.1.2\_1.3.1

9.4B.1.2\_1.4 Test description

Same as in clause 9.4A.1.2\_1.4

9.4B.1.2\_1.4.3 Message contents

Same as in clause 9.4B.1.2\_1.4.3

9.4B.1.2\_1.5 Test requirement

The TB success rate of greater than 85% with no PDCP SDU loss shall be sustained during at least 300 frames on each NR CC.

#### 9.4B.1.2\_2 Sustained downlink data rate performance for EN-DC including FR2 (3 NR CCs)

9.4B.1.2\_2.1 Test Purpose

Same as in clause 9.4B.1.2

9.4B.1.2\_2.2 Test applicability

This test applies to all types of EUTRA UE release 15 and forward supporting EN-DC with 3 NR CCs.

9.4B.1.2\_2.3 Minimum conformance requirements

Same as in clause 9.4B.1.2\_1.3

9.4A.1.2\_2.3.1 Procedure for test parameter selection

Same as in clause 9.4B.1.2\_1.3.1

9.4B.1.2\_2.4 Test description

Same as in clause 9.4B.1.2\_1.4

9.4B.1.2\_2.4.3 Message contents

Same as in clause 9.4B.1.2\_1.4.3

9.4B.1.2\_2.5 Test requirement

The TB success rate of greater than 85% with no PDCP SDU loss shall be sustained during at least 300 frames on each NR CC.

#### 9.4B.1.2\_3 Sustained downlink data rate performance for EN-DC including FR2 (4 NR CCs)

9.4B.1.2\_3.1 Test Purpose

Same as in clause 9.4B.1.2

9.4B.1.2\_3.2 Test applicability

This test applies to all types of EUTRA UE release 15 and forward supporting EN-DC with 4 NR CCs.

9.4B.1.2\_3.3 Minimum conformance requirements

Same as in clause 9.4B.1.2\_1.3

9.4A.1.2\_3.3.1 Procedure for test parameter selection

Same as in clause 9.4B.1.2\_1.3.1

9.4B.1.2\_3.4 Test description

Same as in clause 9.4B.1.2\_1.4

9.4B.1.2\_3.4.3 Message contents

Same as in clause 9.4B.1.2\_1.4.3

9.4B.1.2\_3.5 Test requirement

The TB success rate of greater than 85% with no PDCP SDU loss shall be sustained during at least 300 frames on each NR CC.

### 9.4B.2 NR DC between FR1 and FR2

#### 9.4B.2.1 Sustained downlink data rate performance for 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.

The test setup for NR FR1 CC is specified in Clause 5.5A. The NR FR2 SDR test 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 NR DC bandwidth combination and with the downlink physical channel setup according to Annex C.3.1.

### 9.4B.3 NE-DC

#### 9.4B.3.1 Sustained downlink data rate performance for NE-DC within FR1

The sustained downlink data rate performance for NR CC and E-UTRA CC along with test case details for this test case are specified in clause 9.4B.1.1.

# 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 [4].

For conformance testing involving FR2 test cases in this specification, the UE under test shall be pre-configured with UL Tx diversity schemes disabled to account for single polarization System Simulator (SS) in the test environment. The UE under test may transmit with dual polarization.

### 10.1.1 Applicability of requirements

The following applicability rules are specified for demodulation performance requirements for interworking:

- For UEs supporting NR/5GC, EN-DC and NE-DC,

- The performance requirements specified in Clause 6 will be verified only for NR/5GC mode.

- The performance requirements specified in Clause 8 will be verifiedonly for NR/5GC mode.

- 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

#### 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 Void

## 10.2A Reporting of Channel Quality Indicator (CQI) for CA

FFS

## 10.2B Reporting of Channel Quality Indicator (CQI) for DC

### 10.2B.1 EN-DC

#### 10.2B.1.1 EN-DC within FR1

The NR CQI requirements and test case details for this test case are specified in Section 6.2.

During the test, only the CQI requirements on the NR cell shall be verified.

#### 10.2B.1.2 EN-DC including FR2 NR carrier

The NR CQI requirements and test case details for this test case are specified in Section 8.2.

During the test, only the CQI performance on the NR cell(s) on FR2 carriers shall be verified.

#### 10.2B.1.3 EN-DC including FR1 and FR2 NR carriers

The CSI performance requirements are verified according to section 10.2B.1.1 for EN-DC with FR1 NR carrier only and section 10.2B.1.2 for EN-DC with FR2 NR carrier only.

During the test for EN-DC with FR2 NR carriers, only the CSI performance requirements on the FR2 carriers are verified.

No CSI requirement for FR1 NR or LTE carriers is specified for EN-DC including FR2 carrier(s).

### 10.2B.2 NR DC between FR1 and FR2

The test setup for FR1 Pcell is specified in table 5.5A.1.1.3-1 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.

## 10.3A Reporting of Precoding Matrix Indicator (PMI) for CA

FFS

## 10.3B Reporting of Precoding Matrix Indicator (PMI) for DC

### 10.3B.1 EN-DC

#### 10.3B.1.1 EN-DC within FR1

The NR PMI requirements and test case details for this test case are specified in Section 6.3.

During the test, only the PMI requirements on the NR cell shall be verified.

#### 10.3B.1.2 EN-DC including FR2 NR carrier

The NR PMI requirements and test case details for this test case are specified in Section 8.3.

During the test, only the PMI performance on the NR cell(s) on FR2 carriers shall be verified.

#### 10.3B.1.3 EN-DC including FR1 and FR2 NR carriers

The PMI performance requirements are verified according to section 10.3B.1.1 for EN-DC with FR1 NR carrier only and section 10.3B.1.2 for EN-DC with FR2 NR carrier only.

During the test for EN-DC with FR2 NR carriers, only the PMI performance requirements on the FR2 carriers are verified.

No PMI requirement for FR1 NR or LTE carriers is specified for EN-DC including FR2 carrier(s).

### 10.3B.2 NR DC between FR1 and FR2

The test setup for FR1 PCell is specified in Table 5.5A.1.1.3-1 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.

## 10.4A Reporting of Rank Indicator (RI) for CA

FFS

## 10.4B Reporting of Rank Indicator (RI) for DC

### 10.4B.1 EN-DC

#### 10.4B.1.1 EN-DC within FR1

The NR RI requirements and test case details for this test case are specified in Section 6.4.

During the test, only the RI requirements on the NR cell shall be verified.

#### 10.4B.1.2 EN-DC including FR2 NR carrier

The NR RI requirements and test case details for this test case are specified in Section 8.4.

During the test, only the RI performance on the NR cell(s) on FR2 carriers shall be verified.

#### 10.4B.1.3 EN-DC including FR1 and FR2 NR carriers

The RI performance requirements are verified according to section 10.4B.1.1 for EN-DC with FR1 NR carrier only and section 10.4B.1.2 for EN-DC with FR2 NR carrier only.

During the test for EN-DC with FR2 NR carriers, only the RI performance requirements on the FR2 carriers are verified.

No RI requirement for FR1 NR or LTE carriers is specified for EN-DC including FR2 carrier(s).

### 10.4B.2 NR DC between FR1 and FR2

The test setup for FR1 PCell is specified in Table 5.5A1.1.3-1 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.

# 11 V2X requirements

This clause contains the performance requirements for the sidelink physical channels specified for V2X Sidelink Communication.

## 11.1 Demodulation performance requirements (Conducted requirements)

### 11.1.1 General

#### 11.1.1.1 Applicability of requirements

##### 11.1.1.1.1 General

The minimum performance requirements are applicable to all V2X operating bands defined in TS 38.101-1[2] Clause 5.2E.

The minimum performance requirements in Clause 11.1 are mandatory for UE supporting NR SL operation (*sl-Reception-r16*), except test cases listed in Clause 11.1.1.1.2.

##### 11.1.1.1.2 Applicability of requirements for mandatory UE V2X features with capability signalling

The performance requirements in Table 11.1.1.1.2-1 shall apply for V2X UEs which support mandatory UE features with capability signalling only.

Table 11.1.1.1.2-1: Requirements applicability for mandatory features with UE capability signalling

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| UE feature/capability [14] | Test type | | Test list | Applicability notes |
| Support of synchronization sources for NR sidelink (*sync-Sidelink-r16*) | FR1 | PSSCH | Clause 11.1.2.1.1  Clause 11.1.6.1.1  Clause 11.1.7.1.1 |  |
| PSCCH | Clause 11.1.3.1.1  Clause 11.1.8.1.1 |
| PSBCH | Clause 11.1.4.1.1 |
| PSFCH | Clause 11.1.5.1.1  Clause 11.1.9.1.1 |
| Supports of PSFCH format 0 (*psfch-FormatZeroSidelink-r16)* | FR1 | PSSCH | Clause 11.1.2.1.1  Clause 11.1.6.1.1  Clause 11.1.7.1.1 |  |
| PSCCH | Clause 11.1.3.1.1  Clause 11.1.8.1.1 |
| PSFCH | Clause 11.1.5.1.1  Clause 11.1.9.1.1 |

#### 11.1.1.2 Common test parameters

Parameters specified in Table 11.1.1.2-1 are applied for all test cases in this clause unless otherwise stated.

Table 11.1.1.2-1: Common test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Value |
| Carrier configuration | Offset between Point A and the lowest usable subcarrier on this carrier (Note 1) | RBs | 0 |
| Subcarrier spacing | kHz | 30 |
| SL BWP configuration #1 | Cyclic prefix |  | Normal |
| RB offset | RBs | 0 |
| Number of contiguous PRB | PRBs | Maximum transmission bandwidth configuration as specified in clause 5.3.2 of TS 38.101-1 [2] for tested channel bandwidth and subcarrier spacing |
| PT-RS configuration | |  | PT-RS is not configured |
| Resource pool configuration | PSCCH Time resource | Symbols | 2 |
| PSCCH Frequency resource | PRBs | 10 |
| PSFCH number of cyclic shift pairs |  | n1 |
| PSFCH hopping ID |  | 0 |
| PSFCH candidate resource type |  | allocSubCH |
| Set of PRBs for PSFCH transmission |  | ones(1,100) for 40 MHz and ones(1,50) for 20 MHz |
| PSSCH RSRP threshold |  | 66 (infinity dBm) |
| Synchronization reference |  | GNSS |
| Subchannel size | PRBs | 10 |
| Number of sub-channels |  | 5 for 20 MHz and 10 for 40 MHz |
| Start PRB for first sub-channel |  | 0 |
| Time resource bitmap |  | ones(1, 160) |
| Note 1: Point A coincides with minimum guard band as specified in Table 5.3.3-1 from TS 38.101-1 [2] for tested channel bandwidth and subcarrier spacing. | | | |

The normative reference for this requirement is TS 38.101-4 [5] clause 11.1.1.2.

### 11.1.2 PSSCH demodulation requirements

#### 11.1.2.1 2Rx requirements

##### 11.1.2.1.1 2Rx FR1 PSSCH performance

11.1.2.1.1.0 Minimum requirements

The minimum requirements are specified in Table 11.1.2.1.1.0-2 with the test parameters specified in Table 11.1.2.1.1.0-1. In this test scenario, GNSS or GNSS-equivalent synchronization source is used and sidelink UE 1 transmits PSCCH and PSSCH.

Table 11.1.2.1.1.0-1: Test parameters

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Parameter | | Unit | Value | | | | |
| Test 1 | Test 2 | | Test 3 | |
| Active cell(s) | |  | None | | | | |
| Sidelink UE 1 | Sidelink transmissions |  | PSCCH + PSSCH | | | | |
| PSSCH DMRS pattern (Note 1) |  | {3,4} | | {2,3} | | {2,2} |
| Index of sub-channel allocation |  | [0,1] | | [0,1] | | [0] |
| Timing offset (Note 2) | μs | CP/2-12\*64\*Tc | | | | |
| Frequency offset (Note 3) | Hz | +600 | | | | |
| Synchronization |  | GNSS or GNSS-equivalent | | | | |
| Antenna configuration |  | 1x2 Low | | | | |
| PSFCH resource period | | Slot | 4 | 4 | | 4 | |
| MinTimeGapPSFCH | | Slot | 3 | 3 | | 3 | |
| Note 1: {x, y}: x and y means the number of DMRS symbols for slot with PSFCH transmission and without PSFCH transmission, respectively.  Note 2: Time offset of transmitted Sidelink UE signal with respect to GNSS referring timing.  Note 3: Frequency offset of transmitted Sidelink UE signal with respect to GNSS reference frequency. | | | | | | | |

Table 11.1.2.1.1.0-2: Minimum performance

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz)/ Subcarrier spacing(kHz) | Modulation format and code rate | Propagation condition | Reference value | |
| PSSCH BLER (%) | SNR(dB) of PSSCH |
| 1 | R.PSSCH.2-1.1 | 20 / 30 | QPSK, 0.30 | TDLA30-2700 | 10% | 3.4 |
| 2 | R.PSSCH.2-1.2 | 20 / 30 | 16QAM, 0.37 | TDLA30-1400 | 8.8 |
| 3 | R.PSSCH.2-1.3 | 20 / 30 | 64QAM, 0.43 | TDLA30-180 | 14.8 |

The normative reference for this requirement is TS 38.101-4 [5], clause 11.1.2.1.1.

11.1.2.1.1\_1 2Rx FR1 PSSCH performance - single active PSSCH link

11.1.2.1.1\_1.1 Test purpose

The purpose is to verify the PSSCH for V2X demodulation performance with a single active PSSCH link.

11.1.2.1\_1.1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward which support NR sidelink communication, as specified in Table 11.1.1.1.2-1.

11.1.2.1\_1.1.3 Test description

11.1.2.1\_1.1.3.1 Initial conditions

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

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in 38.521-1 [7] subclause 5.3E.

PSCCH and PSSCH reference measurement channels are set according to Table 11.1.1.2-1, Table 11.1.2.1.1.0-1 and Annex A.6 as appropriate.

Configurations of the GNSS simulator are specified in TS 38.508-1 [6] Table 4.11.2-2 and the GNSS simulator is configured for Scenario #1: static in Geographical area #1. Geographical area #1 is also pre-configured in the UE.

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

Frequencies to be tested: Low Range, as defined in TS 38.508-1 [6] clause 4.3.1.8.

Channel Bandwidths to be tested: As specified per test number in Table 11.1.2.1.1.0‑2 as defined in TS 38.508-1 [6] clause 4.3.1.8.

1. Connect the SS, the faders, and the AWGN noise source to the UE antenna connectors, connect the SS COM port to the UE COM port, and connect the GNSS simulator to the UE GNSS RX antenna connector as shown in TS 38.508-1 [6] Annex A, Figure A.3.1.9.1(TE part) and Figure A.3.2.7.1 (UE part).

2. The parameter settings for the V2X sidelink transmission over PC5 interface are pre-configured according to TS 38.508-1 [6] clause 4.10.1. Message content exceptions are defined in clause 11.1.2.1\_1.1.3.3.

3. Sidelink physical channels and signals are initially set up according to Table 11.1.1.2-1, Table 11.1.2.1.1.0-1 and Annex A.6 as appropriate.

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

5. Ensure the UE is in state 4-A with generic procedure parameters Test Loop Function = *On* according to TS 38.508-1 [6] clause 4.4A.2. The UE is configured as the receiving UE. Message contents are defined in clause 11.1.2.1.1\_1.3.3.

6. The GNSS simulator is triggered to start step 1 of Scenario #1 to simulate a location in the centre of Geographical area #1. Wait for the UE to acquire the GNSS signal.

11.1.2.1.1\_1.3.2 Test procedure

1. Sidelink UE1 transmits PSCCH/PSSCH RMC according to *SL-PreconfigurationNR* and Table 11.1.2.1.1.0-1. The sidelink UE1 transmits MAC padding bits on the sidelink RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 11.1.2.1.4‑1 as appropriate.

3. Measure the average PSSCH BLER according to the test method described in Annex G.5 for a duration sufficient to achieve statistical significance. If the measured average PSSCH BLER is less than the reference value in Table 11.1.2.1.4‑1 pass the UE. Otherwise fail the UE.

4. Repeat steps from 1 to 3 for each subtest in Table 11.1.2.1.1\_1.4‑1 as appropriate.

11.1.2.1.1\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.3 with the following exceptions.

Table 11.1.2.1.1\_1.3.3-1: Physical layer parameters for SCI format 1-A

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6] Table 4.3.6.2.1.1-1 | | | |
| Parameter | Value | Value in binary | Condition |
| DMRS pattern | indicates the 2nd entry in sl-PSSCH-DMRS-TimePatternList-r16 if mod (i, 4), else indicates the 3rd entry in sl-PSSCH-DMRS-TimePatternList-r16.  where i is the logical slot index belong to resource pool per 1024 radio frame as specified in 38.214 [12] clause 8 | "01"B if mod (i, 4) = 0  "10"B if mod (i, 4) ≠ 0 | Test 1 |
|  | indicates the 1st entry in sl-PSSCH-DMRS-TimePatternList-r16 if mod (i, 4), else indicates the 2nd entry in sl-PSSCH-DMRS-TimePatternList-r16. | "00"B if mod (i, 4) = 0  "01"B if mod (i, 4) ≠ 0 | Test 2 |
|  | indicates the 1st entry in sl-PSSCH-DMRS-TimePatternList-r16 | "00"B | Test 3 |

Table 11.1.2.1.1\_1.3.3-2: *SL-ResourcePool*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6] Table 5.4.3-1 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SL-ResourcePool-r16 ::= SEQUENCE { | |  |  |  |
| sl-PSSCH-Config-r16 CHOICE { | |  |  |  |
| setup SEQUENCE { | |  |  |  |
| sl-PSSCH-DMRS-TimePatternList-r16 SEQUENCE (SIZE (1..3)) OF INTEGER (2..4) { | | 3 entries |  |  |
| INTEGER[1] | | 2 | entry 1 |  |
| INTEGER[2] | | 3 | entry 2 |  |
| INTEGER[3] | | 4 | entry 3 |  |
| } | |  |  |  |
| } | |  |  |  |

11.1.2.1.4 Test Requirements

For the parameters specified in Table 11.1.2.1.0-1 and SNR specified in Table 11.1.2.1.1\_1.4‑1, the average PSSCH BLER obtained in step 3 shall be below the reference value specified in Table 11.1.2.1.1\_1.4‑1. The PSSCH sidelink reference channels are defined in Annex A Table A.6.2.2-1.

Table 11.1.2.1.1\_1.4‑1: Test performance

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test num. | Reference channel | Bandwidth (MHz)/ Subcarrier spacing(kHz) | Modulation format and code rate | Propagation condition | Reference value | |
| PSSCH BLER (%) | SNR(dB) of PSSCH |
| 1 | R.PSSCH.2-1.1 | 20 / 30 | QPSK, 0.30 | TDLA30-2700 | 10% | 4.2 |
| 2 | R.PSSCH.2-1.2 | 20 / 30 | 16QAM, 0.37 | TDLA30-1400 | 9.6 |
| 3 | R.PSSCH.2-1.3 | 20 / 30 | 64QAM, 0.43 | TDLA30-180 | 15.6 |

### 11.1.3 PSCCH demodulation requirements

#### 11.1.3.1 2Rx requirements

##### 11.1.3.1.1 2Rx FR1 PSCCH performance

11.1.3.1.1.0 Minimum requirements

The minimum requirements are specified in Table 11.1.3.1.1.0-2 with the test parameters specified in Table 11.1.3.1.1.0-1. In this test scenario, GNSS or GNSS-equivalent synchronization source is used and sidelink UE 1 transmits PSCCH and PSSCH.

Table 11.1.3.1.1.0-1: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Active cell(s) | |  | None |
| Sidelink UE 1 | Sidelink Transmissions |  | PSCCH+PSSCH |
| Timing offset (Note 1) | μs | CP/2-12\*64\*Tc |
| Frequency offset (Note 2) | Hz | +600 |
| Synchronization |  | GNSS or GNSS-equivalent |
| Antenna configuration |  | 1x2 Low |
| PSSCH RMC |  | R.PSSCH.2-1.1 |
| NOTE 1: Time offset of transmitted Sidelink UE signal with respect to GNSS reference timing.  NOTE 2: Frequency offset of transmitted Sidelink UE signal with respect to GNSS reference frequency.  NOTE 3: OCC index i for PSCCH DMRS is randomly selected from {0, 1, 2} for each PSCCH transmission. | | | |

Table 11.1.3.1.1.0‑2: Minimum performance

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test number | PSCCH Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Propagation condition | Reference value | |
| Probability of missed PSCCH (%) | SNR (dB) of PSCCH |
| 1 | R.PSCCH.2-1.1 | 20 / 30 | TDLA30-1400 | 1 | 4.7 |

The normative reference for this requirement is TS 38.101-4 [5], clause 11.1.3.1.1.

11.1.3.1.1\_1 2Rx FR1 PSCCH performance - single active PSSCH link

11.1.3.1.1\_1.1 Test purpose

The purpose is to verify the PSCCH for V2X demodulation performance with a single active PSSCH link.

11.1.3.1.1\_1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward which support NR sidelink communication, as specified in Table 11.1.1.1.2-1.

11.1.3.1.1\_1.3 Test description

11.1.3.1.1\_1.3.1 Initial conditions

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

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in 38.521-1 [7] subclause 5.3E.

PSCCH and PSSCH reference measurement channels are set according to Table 11.1.1.2-1, Table 11.1.3.1.1.0-1 and Annex A.6 as appropriate.

Configurations of the GNSS simulator are specified in TS 38.508-1 [6] Table 4.11.2-2 and the GNSS simulator is configured for Scenario #1: static in Geographical area #1. Geographical area #1 is also pre-configured in the UE.

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

Frequencies to be tested: Low Range, as defined in TS 38.508-1 [6] clause 4.3.1.8.

Channel Bandwidths to be tested: As specified per test number in Table 11.1.3.1.1.0‑2 as defined in TS 38.508-1 [6] clause 4.3.1.8.

1. Connect the SS, the faders, and the AWGN noise source to the UE antenna connectors, connect the SS COM port to the UE COM port, and connect the GNSS simulator to the UE GNSS RX antenna connector as shown in TS 38.508-1 [6] Annex A, Figure A.3.1.9.1(TE part) and Figure A.3.2.7.1 (UE part).

2. The parameter settings for the V2X sidelink transmission over PC5 interface are pre-configured according to TS 38.508-1 [6] clause 4.10.1. Message content exceptions are defined in clause 11.1.3.1.1\_1.3.3.

3. Sidelink physical channels and signals are initially set up according to Table 11.1.1.2-1, Table 11.1.3.1.1.0-1 and Annex A.6 as appropriate.

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

5. Ensure the UE is in state 4-A with generic procedure parameters Test Loop Function = *On* according to TS 38.508-1 [6] clause 4.4A.2. The UE is configured as the received UE. Message contents are defined in clause 11.1.3.1.1\_1.3.3.

6. The GNSS simulator is triggered to start step 1 of Scenario #1 to simulate a location in the centre of Geographical area #1. Wait for the UE to acquire the GNSS signal.

11.1.3.1.1\_1.3.2 Test procedure

1. Sidelink UE1 transmits PSCCH/PSSCH RMC according to *SL-PreconfigurationNR* and Table 11.1.3.1.1.0-1. The sidelink UE1 transmits MAC padding bits on the sidelink RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 11.1.3.1.1\_1.4‑1 as appropriate.

3. Measure the probability of PSCCH miss-detection according to the test method described in Annex G.5 for a duration sufficient to achieve statistical significance. If the measured probability of PSCCH miss-detection is less than the reference value in Table 11.1.3.1.1\_1.4‑1 pass the UE. Otherwise fail the UE.

4. Repeat steps from 1 to 3 for each subtest in Table 11.1.3.1.1\_1.4‑1 as appropriate.

11.1.3.1.1\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.3.

11.1.3.1.1\_1.4 Test Requirements

For the parameters specified in Table 11.1.3.1.0-1 and SNR specified in Table 11.1.3.1.4‑1, the average PSSCH BLER obtained in step 3 shall be below the reference value specified in Table 11.1.3.1.4‑1. The PSSCH sidelink reference channels are defined in Annex A Table A.6.2.2-1.

Table 11.1.3.1.4‑1: Test performance requirements

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test number | PSCCH Reference channel | Bandwidth (MHz) / Subcarrier spacing (kHz) | Propagation condition | Reference value | |
| Probability of missed PSCCH (%) | SNR (dB) of PSCCH |
| 1 | R.PSCCH.2-1.1 | 20 / 30 | TDLA30-1400 | 1 | 5.5 |

### 11.1.4 PSBCH demodulation requirements

#### 11.1.4.1 2Rx requirements

##### 11.1.4.1.1 2Rx FR1 PSBCH performance

11.1.4.1.1.0 Minimum requirements

The minimum requirements are specified in Table 11.1.4.1.1.0-2 with the test parameters specified in Table 11.1.4.1.1.0-1. The Sidelink UE 1 transmits PSBCH to UE and the UE is synchronized to SLSS of Sidelink UE 1.

RAN4 has recommended that these requirements do not need to be tested.

Table 11.1.4.1.1.0-1: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Active cell(s) | |  | None |
| Sidelink UE 1 | Sidelink Transmissions |  | SLSS+PSBCH (Note 3) |
| slssid |  | 0 |
| Time offset (Note 1) | μs | 0 |
| Frequency offset (Note 2) | Hz | 0 |
| Synchronization source |  | GNSS |
| Antenna configuration |  | 1x2 Low |
| Note 1: Time offset of transmitted Sidelink UE 1 signal with respect to GNSS reference timing.  Note 2: Frequency offset of transmitted Sidelink UE 1 signal with respect to GNSS reference frequency.  Note 3: PSBCH transmits together with corresponding SLSS in the same slot. | | | |

Table 11.1.4.1.1.0‑2: Minimum performance

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz) / Subcarrier spacing (kHz) | PSBCH Reference channel | Propagation condition | Reference value | |
| Probability of missed PSBCH (%) | SNR (dB) |
| 1 | 20 / 30 | R.PSBCH.2-1 | TDLA30-180 | 1 | 0.1 |

The normative reference for this requirement is TS 38.101-4 [5], clause 11.1.4.1.1.

### 11.1.5 PSFCH demodulation requirements

#### 11.1.5.1 2Rx requirements

##### 11.1.5.1.1 2Rx FR1 PSFCH performance

11.1.5.1.1.0 Minimum requirements

11.1.5.1.1.0.1 NACK missed detection requirements

The minimum requirements are specified in Table 11.1.5.1.1.0.1-2 with the test parameters specified in Table 11.1.5.1.0.1-1. In this test scenario, GNSS or GNSS-equivalent synchronization source is used and sidelink UE 1 receives PSCCH and PSSCH sent by the UE under test and transmits PSFCH.

Table 11.1.5.1.1.0.1-1: Test parameters

|  |  |  |
| --- | --- | --- |
| Parameter | unit | Test 1 |
| Allocated resource blocks | RB | 1 |
| The number of PSFCH symbols (Note 1) | symbol | 2 |
| Number of information bits | bit | 1 |
| Synchronization source |  | GNSS |
| Timing offset (Note 2) | μs | CP/2-12\*64\*Tc |
| Frequency offset (Note 3) | Hz | 600 |
| PSFCH resource period | Slots | 1 |
| Antenna configuration |  | 1x2 Low |
| Note 1 First symbol is included. First symbol is used for AGC and not used for demodulation.  Note 2 Time offset of transmitted Sidelink UE signal with respect to GNSS referring timing.  Note 3 Frequency offset of transmitted Sidelink UE signal with respect to GNSS reference frequency. | | |

Table 11.1.5.1.1.0.1‑2: Minimum performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Test num. | Bandwidth (MHz) / Subcarrier spacing (kHz) | Propagation condition | Reference value | |
| NACK missed detection probability (%) | SNR (dB) |
| 1 | 20 / 30 | TDLA30-180 | 1 | 9.5 |

The normative reference for this requirement is TS 38.101-4 [5], clause 11.1.5.1.1.1.

11.1.5.1.1.0.2 DTX to NACK requirements

The DTX to NACK probability, i.e. the probability that NACK is detected when nothing was sent:



where:

- #(false NACK bits) denotes the number of detected NACK bits.

- #(NACK bits) denotes the number of encoded bits per slot

- #(PSFCH DTX) denotes the number of DTX occasions

The DTX to NACK probability shall not exceed 1% with the test parameters are configured in Table 11.1.5.1.1.0.1-1.

The normative reference for this requirement is TS 38.101-4 [5], clause 11.1.5.1.1.2.

11.1.5.1.1\_1 2Rx FR1 PSCCH performance - single active PSSCH link

11.1.5.1.1\_1.1 Test purpose

The purpose is to verify the PSFCH for V2X demodulation performance with a single active PSSCH link.

11.1.5.1.1\_1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward which support NR sidelink communication, as specified in Table 11.1.1.1.2-1.

11.1.5.1.1\_1.3 Test description

11.1.5.1.1\_1.3.1 Initial conditions

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

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in 38.521-1 [7] subclause 5.3E.

PSCCH and PSSCH reference measurement channels are set according to Table 11.1.1.2-1 and Annex A.6 as appropriate.

Configurations of the GNSS simulator are specified in TS 38.508-1 [6] Table 4.11.2-2 and the GNSS simulator is configured for Scenario #1: static in Geographical area #1. Geographical area #1 is also pre-configured in the UE.

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

Frequencies to be tested: Mid Range, as defined in TS 38.508-1 [6] clause 4.3.1.8.

Channel Bandwidths to be tested: As specified per test number in Table 11.1.5.1.1.0.1‑2 as defined in TS 38.508-1 [6] clause 4.3.1.8.

1. Connect the SS, the faders, and the AWGN noise source to the UE antenna connectors, connect the SS COM port to the UE COM port, and connect the GNSS simulator to the UE GNSS RX antenna connector as shown in TS 38.508-1 [6] Annex A, Figure A.3.1.9.1(TE part) and Figure A.3.2.7.1 (UE part).

2. The parameter settings for the V2X sidelink transmission over PC5 interface are pre-configured according to TS 38.508-1 [6] clause 4.10.1. Message content exceptions are defined in clause 11.1.5.1.1\_1.3.3.

3. Sidelink physical channels and signals are initially set up according to Table 11.1.1.2-1, Table 11.1.5.1.1.0.1-1 and Annex A.6 as appropriate.

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

5. Ensure the UE is in state 4-A with generic procedure parameters Test Loop Function = *On* according to TS 38.508-1 [6] clause 4.4A.2. The UE is configured as the transmitting UE and operates in NACK-only HARQ groupcast mode. Message contents are defined in clause 11.1.5.1.1\_1.3.3.

6. The GNSS simulator is triggered to start step 1 of Scenario #1 to simulate a location in the centre of Geographical area #1. Wait for the UE to acquire the GNSS signal.

11.1.5.1.1\_1.3.2 Test procedure

1. The UE under test transmits PSCCH/PSSCH in every PSCCH/PSSCH duration for NR sidelink communication according to *SL-PreconfigurationNR*. The Sidelink UE1 receives the PSSCH sent by the UE under test. For every PSSCH received, the Sidelink UE1 sends NACK on PSFCH if the corresponding PSFCH falls in even slot and sends nothing if the corresponding PSFCH falls in odd slot.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 11.1.5.1.1\_1.4‑1 as appropriate.

3. Measure probability of NACK miss-detection and DTX to NACK probability according to the test method described in Annex G.5 for a duration sufficient to achieve statistical significance. Pass the UE if the measured probability of PSFCH miss-detection is less than the reference value in Table 11.1.5.1.1\_1.4‑1 and the measured DTX to NACK probability is not exceed the reference value in clause 11.1.5.1.1.0.2. Otherwise fail the UE.

4. Repeat steps from 1 to 3 for each subtest in Table 11.1.5.1.1\_1.4‑1 as appropriate.

11.1.5.1.1\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.3 with the following exceptions.

Table 11.1.5.1.1\_1.3.3-1: *SL-ResourcePool*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6] Table 5.4.3-1 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SL-ResourcePool-r16 ::= SEQUENCE { | |  |  |  |
| sl-PSFCH-Config-r16 CHOICE { | |  |  |  |
| setup SEQUENCE { | |  |  |  |
| sl-PSFCH-Period-r16 | | sl1 |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

11.1.5.1.1\_1.4 Test Requirements

For the parameters specified in Table 11.1.5.1.0-1 and SNR specified in Table 11.1.5.1.1\_1.4‑1, the NACK missed detection probability obtained in step 3 shall be below the reference value specified in Table 11.1.5.1.1\_1.4‑1.

For the parameters specified in Table 11.1.5.1.1.0.1-1, the DTX to NACK probability shall not exceed 1%.

Table 11.1.5.1.1\_1.4‑1: Test performance requirements

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Test num. | Bandwidth (MHz) / Subcarrier spacing (kHz) | Propagation condition | Reference value | |
| NACK missed detection probability (%) | SNR (dB) |
| 1 | 20 / 30 | TDLA30-180 | 1 | 10.3 |

### 11.1.6 Power imbalance performance with two links

#### 11.1.6.1 2Rx requirements

##### 11.1.6.1.1 2Rx FR1 Power imbalance performance

11.1.6.1.1.0 Minimum requirements

The minimum requirements are specified in Table 11.1.6.1.1.0-2 with the test parameters specified in Table 11.1.6.1.1.0-1. In this test scenario, The Sidelink UE 1 and 2 are synchronized to GNSS or GNSS-equivalent synchronization reference.

Table 11.1.6.1.1.0-1: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Active cell(s) | |  | None |
| Active Sidelink UE(s) | |  | Sidelink UE 1, Sidelink UE 2 |
| Sidelink UE 1 | Sidelink Transmissions |  | PSCCH + PSSCH |
| PSSCH DMRS pattern(Note 1) |  | {2,3} |
| Sub-channel allocation |  | Sub-channel 0 |
| Time offset (Note 2) | μs | 0 |
| Frequency offset (Note 3) | Hz | 0 |
| Antenna configuration |  | 1x2 Low |
| PSFCH periodicity | Slots | 4 |
| MinTimeGapPSFCH | Slots | 3 |
| Sidelink UE 2 | Sidelink Transmissions |  | PSCCH + PSSCH |
| PSSCH DMRS pattern(Note 1) |  | {2,3} |
| Sub-channel allocation |  | Sub-channel 3 |
| Time offset (Note 2) | μs | 0 |
| Frequency offset (Note 3) | Hz | 0 |
| Antenna configuration |  | 1x2 Low |
| PSFCH periodicity | Slots | 4 |
| MinTimeGapPSFCH | Slots | 3 |
| Note 1: {x, y}: x and y means the number of DMRS symbols for slot with PSFCH transmission and without PSFCH transmission, respectively.  Note 2: Time offset of transmitted Sidelink UE signal with respect to GNSS reference timing.  Note 3: Frequency offset of transmitted Sidelink UE signal with respect to GNSS reference frequency. | | | |

Table 11.1.6.1.1.0‑2: Minimum performance

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz)/ Subcarrier spacing(kHz) | Sidelink UE | PSSCH Reference channel | Modulation format and  code rate | Propagation condition | Reference value | |
| PSSCH BLER (%) | SNR (dB) of PSSCH |
| 1 | 20 / 30 | 1 | R.PSSCH.2-1.4 | QPSK, 0.30 | AWGN | (Note 1) | 30.35 |
| 2 | R.PSSCH.2-1.4 | QPSK, 0.30 | AWGN | 10 | 4.8 |
| Note 1: There is no BLER requirement for Sidelink UE 1. | | | | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 11.1.6.1.1.

11.1.6.1.1\_1 2Rx FR1 Power imbalance performance - two active PSSCH link

11.1.6.1.1\_1.1 Test purpose

The purpose is to verify the demodulation performance when receiving PSSCH transmissions from two Sidelink UEs with power imbalance in one slot.

11.1.6.1.1\_1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward which support NR sidelink communication, as specified in Table 11.1.1.1.2-1.

11.1.6.1.1\_1.3 Test description

11.1.6.1.1\_1.3.1 Initial conditions

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

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in 38.521-1 [7] subclause 5.3E.

PSCCH and PSSCH reference measurement channels are set according to Table 11.1.1.2-1, Table 11.1.6.1.1.0-1 and Annex A.6 as appropriate.

Configurations of the GNSS simulator are specified in TS 38.508-1 [6] Table 4.11.2-2 and the GNSS simulator is configured for Scenario #1: static in Geographical area #1. Geographical area #1 is also pre-configured in the UE.

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

Frequencies to be tested: Low Range, as defined in TS 38.508-1 [6] clause 4.3.1.8.

Channel Bandwidths to be tested: As specified per test number in Table 11.1.6.1.1.0 as defined in TS 38.508-1 [6] clause 4.3.1.8.

1. Connect the SS, the faders, and the AWGN noise source to the UE antenna connectors, connect the SS COM port to the UE COM port, and connect the GNSS simulator to the UE GNSS RX antenna connector as shown in TS 38.508-1 [6] Annex A, Figure A.3.1.9.1(TE part) and Figure A.3.2.7.1 (UE part).

2. The parameter settings for the V2X sidelink transmission over PC5 interface are pre-configured according to TS 38.508-1 [6] clause 4.10.1. Message content exceptions are defined in clause 11.1.6.1.1\_1.3.3.

3. Sidelink physical channels and signals are initially set up according to Table 11.1.1.2-1, Table 11.1.6.1.1.0-1 and Annex A.6 as appropriate.

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

5. Ensure the UE is in state 4-A with generic procedure parameters Test Loop Function = *On* according to TS 38.508-1 [6] clause 4.4A.2. The UE is configured as the receiving UE. Message contents are defined in clause 11.1.6.1.1\_1.3.3.

6. The GNSS simulator is triggered to start step 1 of Scenario #1 to simulate a location in the centre of Geographical area #1. Wait for the UE to acquire the GNSS signal.

11.1.6.1.1\_1.3.2 Test procedure

1. Sidelink UE1 and Sidelink UE2 transmit PSCCH/PSSCH RMC according to *SL-PreconfigurationNR* and Table 11.1.6.1.1.0-1. Both sidelink UE1 and sidelink UE2 transmit MAC padding bits on their sidelink RMC respectively.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 11.1.6.1.1\_1.4‑1 as appropriate.

3. Measure the average PSSCH BLER of sidelink UE2 according to the test method described in Annex G.5 for a duration sufficient to achieve statistical significance. If the measured average PSSCH BLER of sidelink UE2 is less than the reference value in Table 11.1.6.1.1\_1.4‑1 pass the UE. Otherwise fail the UE.

4. Repeat steps from 1 to 3 for each subtest in Table 11.1.6.1..1\_14‑1 as appropriate.

11.1.6.1.1\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4 with the following exceptions.

Table 11.1.6.1.1\_1.3.3-1: Physical layer parameters for SCI format 1-A

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6] Table 4.3.6.2.1.1-1 | | | |
| Parameter | Value | Value in binary | Condition |
| DMRS pattern | indicates the 1st entry in sl-PSSCH-DMRS-TimePatternList-r16 if mod (i, 4), else indicates the 2nd entry in sl-PSSCH-DMRS-TimePatternList-r16.  where i is the logical slot index belong to resource pool per 1024 radio frame as specified in 38.214 [12] clause 8 | "0"B if mod (i, 4) = 0  "1"B if mod (i, 4) ≠ 0 |  |

Table 11.1.6.1.1\_1.3.3-2: *SL-ResourcePool*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6] Table 5.4.3-1 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SL-ResourcePool-r16 ::= SEQUENCE { | |  |  |  |
| sl-PSSCH-Config-r16 CHOICE { | |  |  |  |
| setup SEQUENCE { | |  |  |  |
| sl-PSSCH-DMRS-TimePatternList-r16 SEQUENCE (SIZE (1..3)) OF INTEGER (2..4) { | | 2 entries |  |  |
| INTEGER[1] | | 2 | entry 1 |  |
| INTEGER[2] | | 3 | entry 2 |  |
| } | |  |  |  |
| } | |  |  |  |

11.1.6.1.1\_1.4 Test Requirements

For the parameters specified in Table 11.1.6.1.1.0-1 and SNR specified in Table 11.1.6.1.1.4‑1, the average PSSCH BLER of sidelink UE2 obtained in step 3 shall be below the reference value specified in Table 11.1.6.1.1\_1.4‑1. The PSSCH sidelink reference channels are defined in Annex A Table A.6.2.2-1.

Table 11.1.6.1.1\_1.4‑1: Test performance

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Test number | Bandwidth (MHz)/ Subcarrier spacing(kHz) | Sidelink UE | PSSCH Reference channel | Modulation format and  code rate | Propagation condition | Reference value | |
| PSSCH BLER (%) | SNR (dB) of PSSCH |
| 1 | 20 / 30 | 1 | R.PSSCH.2-1.4 | QPSK, 0.30 | AWGN | (Note 1) | 30.35 |
| 2 | R.PSSCH.2-1.4 | QPSK, 0.30 | AWGN | 10 | 5.4 |
| Note 1: There is no BLER requirement for Sidelink UE 1. | | | | | | | |

### 11.1.7 HARQ buffer soft combining

#### 11.1.7.1 2Rx requirements

##### 11.1.7.1.1 2Rx FR1 HARQ buffer soft combining performance

11.1.7.1.1.0 Minimum requirements

The minimum requirements are specified in Table 11.1.7.1.1.0-2 with the test parameters specified in Table 11.1.7.1.1.0-1. In this test scenario, GNSS or GNSS-equivalent synchronization source is used and all sidelink UE i (0 ≤ i ≤ *n*) transmit PSCCH and PSSCH.

Table 11.1.7.1.1.0-1: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| Active cell(s) | |  | None |
| Active Sidelink UE(s) | |  | Sidelink UE i, 0 ≤ i < *n* (Note 1,2) |
| Sidelink UE i,  0 ≤ i < *n* | Sidelink Transmissions |  | PSCCH + PSSCH |
| PSSCH DMRS pattern |  | {2} |
| Time gap between initial transmission and retransmission | Slots | [*n* (Note 3)] |
| Timing offset (Note 4) | μs | 0 |
| Frequency offset (Note 5) | Hz | 0 |
| Synchronization source |  | GNSS or GNSS-equivalent |
| Antenna configuration |  | 1x2 Low |
| Redundancy version coding sequence |  | {0,2} |
| PSFCH resource period | | Slots | 1 |
| Note 1: *n* is the number of HARQ process UE can support (based on IE harq-RxProcessSidelink)  Note 2: When *n* = 16 or 24, sidelink UEs transmit one by one circularly for every slot;  When *n*=32, the first 31 UEs transmit signal one by one circularly for every slot and in the first subchannel, and the 32nd UE transmits signal in the first slot but in the second subchannel;  When *n*=48, the first 31 UEs transmit signal one by one circularly for every slot and in the first subchannel, the next 17 UEs transmit signal in the same slot as the first 17 UEs but in the second subchannel;  When *n*=64, first 31 UEs transmit signal one by one circularly for every slot and in the first subchannel, the next 31 UEs transmit signal one by one circularly for every slot and in the second subchannel, the last 2 UEs transmit signal in the same slot as the first 2 UEs in the third subchannel  Note 3: *k* = *n* if *n* < 32, otherwise *k* = 31  Note 4: Time offset of transmitted Sidelink UE signal is with respect to GNSS reference timing.  Note 5: Frequency offset of transmitted Sidelink UE signal with respect to GNSS reference frequency. | | | |

Table 11.1.7.1.1.0: Minimum performance

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test num. | Bandwidth (MHz) / Subcarrier spacing(kHz) | PSSCH Reference channel | Propagation condition | Reference value | |
| PSSCH BLER (%) | SNR (dB) of PSSCH |
| 1 | 20 / 30 | R.PSSCH.2-1.5 | AWGN | 5 | 10.9 |

The normative reference for this requirement is TS 38.101-4 [5], clause 11.1.7.1.1

11.1.7.1.1\_1 2Rx FR1 HARQ buffer soft combining performance - maximum number of HARQ processes11.1.7.1.1\_1.1 Test purpose

The purpose is to verify the maximum number of HARQ processes per TTI supported by the V2X UE.

11.1.7.1.1\_1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward which support NR sidelink communication, as specified in Table 11.1.1.1.2-1.

11.1.7.1.1\_1.3 Test description

11.1.7.1.1\_1.3.1 Initial conditions

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

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in 38.521-1 [7] subclause 5.3E.

PSCCH and PSSCH reference measurement channels are set according to Table 11.1.1.2-1, Table 11.1.7.1.1.0-1 and Annex A.6 as appropriate.

Configurations of the GNSS simulator are specified in TS 38.508-1 [6] Table 4.11.2-2 and the GNSS simulator is configured for Scenario #1: static in Geographical area #1. Geographical area #1 is also pre-configured in the UE.

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

Frequencies to be tested: Low Range, as defined in TS 38.508-1 [6] clause 4.3.1.8.

Channel Bandwidths to be tested: As specified per test number in Table 11.1.7.1.1.0‑2 as defined in TS 38.508-1 [6] clause 4.3.1.8.

1. Connect the SS, the faders, and the AWGN noise source to the UE antenna connectors, connect the SS COM port to the UE COM port, and connect the GNSS simulator to the UE GNSS RX antenna connector as shown in TS 38.508-1 [6] Annex A, Figure A.3.1.9.1(TE part) and Figure A.3.2.7.1 (UE part).

2. The parameter settings for the V2X sidelink transmission over PC5 interface are pre-configured according to TS 38.508-1 [6] clause 4.10.1. Message content exceptions are defined in clause 11.1.7.1.1\_1.3.3.

3. Sidelink physical channels and signals are initially set up according to Table 11.1.1.2-1, Table 11.1.7.1.1.0-1 and Annex A.6 as appropriate.

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

5. Determine the number of sidelink UEs, i.e. N, as:

- N = 16 if pc\_harq\_RxProcessSidelink\_n16 = true

- N = 24 if pc\_harq\_RxProcessSidelink\_n24 = true

- N = 32 if pc\_harq\_RxProcessSidelink\_n32 = true

- N = 48 if pc\_harq\_RxProcessSidelink\_n48 = true

- N = 64 if pc\_harq\_RxProcessSidelink\_n64 = true

6. Ensure the UE is in state 4-A with generic procedure parameters Test Loop Function = *On* according to TS 38.508-1 [6] clause 4.4A.2. The UE is configured as the received UE. Message contents are defined in clause 11.1.7.1.1\_1.3.3.

7. The GNSS simulator is triggered to start step 1 of Scenario #1 to simulate a location in the centre of Geographical area #1. Wait for the UE to acquire the GNSS signal.

11.1.7.1.1\_1.3.2 Test procedure

1. Sidelink UE i, 0≤i<N, transmits PSCCH/PSSCH RMC according to *SL-PreconfigurationNR* and Table 11.1.7.1.1.0-1. The sidelink UE i, 0≤i<N transmits MAC padding bits on the sidelink RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 11.1.7.1.1\_1.4‑1 as appropriate.

3. Measure the average PSSCH BLER according to the test method described in Annex G.5 for a duration sufficient to achieve statistical significance. If the measured average PSSCH BLER is less than the reference value in Table 11.1.7.1.1\_1.4‑1 pass the UE. Otherwise fail the UE.

4. Repeat steps from 1 to 3 for each subtest in Table 11.1.7.1.1\_1.4‑1 as appropriate.

11.1.7.1.1\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4 with the following exceptions.

Table 11.1.7.1.1\_1.3.3-1: Physical layer parameters for SCI format 1-A

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6] Table 4.3.6.2.1.1-1 | | | |
| Parameter | Value | Value in binary | Condition |
| DMRS pattern | Not present | - |  |

Table 11.1.7.1.1\_1.3.3-2: *SL-ResourcePool*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6] Table 5.4.3-1 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SL-ResourcePool-r16 ::= SEQUENCE { | |  |  |  |
| sl-PSSCH-Config-r16 CHOICE { | |  |  |  |
| setup SEQUENCE { | |  |  |  |
| sl-PSSCH-DMRS-TimePatternList-r16 SEQUENCE (SIZE (1..3)) OF INTEGER (2..4) { | | 1 entry |  |  |
| INTEGER[1] | | 2 | entry 1 |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

11.1.7.1.1\_1.4 Test Requirements

For the parameters specified in Table 11.1.7.1.0-1 and SNR specified in Table 11.1.7.1.1\_1.4‑1, the average PSSCH BLER obtained in step 3 shall be below the reference value specified in Table 11.1.7.1.1\_1.4‑1. The PSSCH sidelink reference channels are defined in Annex A Table A.6.2.2-1.

Table 11.1.7.1.1\_1.4‑1: Test performance

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Test num. | Bandwidth (MHz) / Subcarrier spacing(kHz) | PSSCH Reference channel | Propagation condition | Reference value | |
| PSSCH BLER (%) | SNR (dB) of PSSCH |
| 1 | 20 / 30 | R.PSSCH.2-1.5 | AWGN | 5 | 11.5 |

### 11.1.8 PSCCH decoding capability test

#### 11.1.8.1 2Rx requirements

##### 11.1.8.1.1 2Rx FR1 PSCCH decoding capability

11.1.8.1.1.0 Minimum requirements

The minimum requirements are specified in Table 11.1.8.1.1.0-2 with the test parameters specified in Table 11.1.8.1.1.0-1. In this test scenario, GNSS or GNSS-equivalent synchronization source is used and sidelink UE 1 transmits PSCCH and PSSCH and the test procedure is specified as follows:

- 10 UEs transmit PSCCHs and corresponding PSSCHs to the tested UE per slot with each UE occupying one subchannel.

- x UEs transmit PSCCHs and corresponding PSSCHs with high priority level on x subchannels that are randomly selected from 10 subchannels per slot and 10-x UEs transmit PSCCHs and corresponding PSSCHs with low priority level on the remaining subchannels. The indication of priority level specified in Clause 5.4.3.3 of TS 23.287 [23] and Clause 5.22.1.3.1 of TS 38.321 [24] is included in PSCCH.

Where x equals to:

- The number of PSFCH(s) resources that the tested UE can transmit in a slot (i.e. IE *psfch-TxNumber* specified in clause 4.2.16.1.6 of TS 38.306 [14]) if the number of PSFCH(s) resources that the tested UE can transmit in a slot is less than 10

- 10, otherwise.

The probability of PSCCH miss detection is calculated as follows:

Where:

- #(Tx high priority PSCCH/PSSCH) denotes the total number of transmitted PSCCH/PSSCH with high priority level.

- #(missing ACK/NACK) denotes the total number of missing ACK/NACK with high priority.

Table 11.1.8.1.1.0-1: Test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Parameter | | | Unit | Value |
| Member ID (Note 1) | | |  | 0 |
| Sidelink UE i,  0 ≤ i ≤ 9 (Note 5) | Sidelink Transmissions | |  | PSCCH + PSSCH |
| Timing offset (Note 2) | | μs | 0 |
| Frequency offset (Note 3) | | Hz | 0 |
| Synchronization source | |  | GNSS |
| Propagation Channel | |  | Static propagation condition without external noise |
| Antenna configuration | |  | 1x2 Low |
| PSSCH RMC | |  | R.PSSCH.2-1.1 |
| PSCCH RMC (Note 4) | |  | R.PSCCH.2-1.1 |
| Source ID | |  | 0 |
| PSFCH periodicity | | Slots | 1 |
| MinTimeGapPSFCH | | Slots | 2 |
| PSFCH Resource (Note 6) | RB index |  | 10\*i |
| CS pair index |  | 0 |
| Note 1: Member ID is an identifier uniquely identifying a member.  Note 2: Time offset of transmitted Sidelink UE signal with respect to GNSS reference timing.  Note 3: Frequency offset of transmitted Sidelink UE signal with respect to GNSS reference frequency.  Note 4: OCC index for PSCCH DMRS is randomly selected between {0, 1, 2} for each PSCCH transmission as per in Clause 8.4.1.3.2 of TS 38.211 [9].  Note 5: Each UE occupies one sub-channel so that all sub-channels are filled.  Note 6: The mapping procedure of PSSCH resource and PSFCH resource is specified in Clause 16.3 of TS 38.213 [11]. | | | | |

Table 11.1.8.1.1.0‑2: Minimum performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Test  Number | Bandwidth (MHz) / Subcarrier spacing(kHz) | PSCCH Reference channel | Propagation Channel | Reference value |
| Probability of missed PSCCH (%) |
| 1 | 40 / 30 | R.PSCCH.2-1.1 | Static propagation condition without external noise | 1 |

The normative reference for this requirement is TS 38.101-4 [5], clause 11.1.8.1.1.

11.1.8.1.1\_1 2Rx FR1 PSCCH decoding capability - maximum number of received PSCCHs

11.1.8.1.1\_1.1 Test purpose

The purpose is to verify the maximum number of received PSCCHs per TTI supported by the V2X UE.

11.1.8.1.1\_1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward which support NR sidelink communication, as specified in Table 11.1.1.1.2-1.

11.1.8.1.1\_1.3 Test description

11.1.8.1.1\_1.3.1 Initial conditions

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

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in 38.521-1 [7] subclause 5.3E.

PSCCH and PSSCH reference measurement channels are set according to Table 11.1.1.2-1, Table 11.1.8.1.1.0-1 and Annex A.6 as appropriate.

Configurations of the GNSS simulator are specified in TS 38.508-1 [6] Table 4.11.2-2 and the GNSS simulator is configured for Scenario #1: static in Geographical area #1. Geographical area #1 is also pre-configured in the UE.

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

Frequencies to be tested: Low Range, as defined in TS 38.508-1 [6] clause 4.3.1.8.

Channel Bandwidths to be tested: As specified per test number in Table 11.1.8.1.1.0‑2 as defined in TS 38.508-1 [6] clause 4.3.1.8.

1. Connect the SS, the faders, and the AWGN noise source to the UE antenna connectors, connect the SS COM port to the UE COM port, and connect the GNSS simulator to the UE GNSS RX antenna connector as shown in TS 38.508-1 [6] Annex A, Figure A.3.1.9.1(TE part) and Figure A.3.2.7.1 (UE part).

2. The parameter settings for the V2X sidelink transmission over PC5 interface are pre-configured according to TS 38.508-1 [6] clause 4.10.1. Message content exceptions are defined in clause 11.1.8.1.1\_1.3.3.

3. Sidelink physical channels and signals are initially set up according to Table 11.1.1.2-1, Table 11.1.8.1.1.0-1 and Annex A.6 as appropriate.

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

5. Determine the number of sidelink UE transmitting PSSCH with high priority, i.e. x, as follows:

- x = 4 if pc\_psfch\_TxNumber\_n4 = true;

- x = 8 if pc\_psfch\_TxNumber\_n8 = true;

- x = 10 if pc\_psfch\_TxNumber\_n16 = true.

6. Ensure the UE is in state 4-A with generic procedure parameters Test Loop Function = *On* according to TS 38.508-1 [6] clause 4.4A.2. The UE is configured as the received UE. Message contents are defined in clause 11.1.8.1.1\_1.3.3.

7. The GNSS simulator is triggered to start step 1 of Scenario #1 to simulate a location in the centre of Geographical area #1. Wait for the UE to acquire the GNSS signal.

11.1.8.1.1\_1.3.2 Test procedure

1. Sidelink UE 0~9 transmit PSCCH/PSSCH RMC according to *SL-PreconfigurationNR* and Table 11.1.8.1.0-1. The SS randomly chooses x sidelink UEs among sidelink UE 0~9 to transmit PSSCHs with high priority and let the remaining 10-x sidelink UEs transmit PSSCH with low priority level. The sidelink UE 0~9 transmit MAC padding bits on the sidelink RMC.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 11.1.8.1.1\_1.4‑1 as appropriate.

3. Measure the probability of missed PSCCH according to clause 11.1.8.1.1.0 for a duration sufficient to achieve statistical significance as given in Annex G.5. If the measured probability of PSCCH miss-detection is less than the reference value in Table 11.1.8.1.1\_1.4‑1 pass the UE. Otherwise fail the UE.

4. Repeat steps from 1 to 3 for each subtest in Table 11.1.8.1.1\_1.4‑1 as appropriate.

11.1.8.1.1\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.3 with the following exceptions.

Table 11.1.8.1.1\_1.3.3-1: *SL-ResourcePool*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6] Table 5.4.3-1 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SL-ResourcePool-r16 ::= SEQUENCE { | |  |  |  |
| sl-PSFCH-Config-r16 CHOICE { | |  |  |  |
| setup SEQUENCE { | |  |  |  |
| sl-PSFCH-Period-r16 | | sl1 |  |  |
| sl-MinTimeGapPSFCH-r16 | | sl2 |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

11.1.8.1\_1.1.4 Test Requirements

For the parameters specified in Table 11.1.8.1.1.0-1 and SNR specified in Table 11.1.8.1.1\_1.4‑1, the average PSSCH BLER obtained in step 3 shall be below the reference value specified in Table 11.1.8.1.1\_1.4‑1. The PSSCH sidelink reference channels are defined in Annex A Table A.6.2.2-1.

Table 11.1.8.1.1\_1.4‑1: Test performance requirements

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Test  Number | Bandwidth (MHz) / Subcarrier spacing(kHz) | PSCCH Reference channel | Propagation Channel | Reference value |
| Probability of missed PSCCH (%) |
| 1 | 40 / 30 | R.PSCCH.2-1.1 | Static propagation condition without external noise | 1 |

### 11.1.9 PSFCH decoding capability Test

#### 11.1.9.1 2Rx requirements

##### 11.1.9.1.1 2Rx FR1 PSFCH decoding capability

11.1.9.1.0 Minimum requirements

The minimum requirements are specified in Table 11.1.9.1.1.0-2 with the test parameters specified in Table 11.1.9.1.1.0-1. In each slot, a group of UEs transmits PSFCHs to the tested UE.

Table 11.1.9.1.1.0-1: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | | Unit | Test 1 |
| HARQ-ACK information | |  | ACK or NACK |
| Source ID of tested UE | |  | 0 |
| Sidelink UE i,  0 ≤ i ≤ N-1(Note 3) | Sidelink transmissions for |  | PSFCH |
| Timing offset (Note 1) | μs | 0 |
| Frequency offset (Note 2) | Hz | 0 |
| Synchronization source |  | GNSS or GNSS-equivalent |
| Propagation Channel |  | Static propagation condition  No external noise sources are applied |
| Antenna configuration |  | 1x2 Low |
| Member ID(Note 4) |  | i |
| PSFCH resource allocation(Note 5) |  | N UEs transmit PSFCHs one by one on each RB with CS pair index 0. i.e. UE 0 transmits PSFCH on RB 0, UE 1 transmits PSFCH on RB 1,…, UE (N-1) transmits PSFCH on RB N-1 |
| PSFCH periodicity | Slots | 1 |
| Note 1: Time offset of transmitted Sidelink UE signal with respect to GNSS reference timing.  Note 2: Frequency offset of transmitted Sidelink UE signal with respect to GNSS reference frequency.  Note 3: N equals to the number of PSFCH(s) resources that UE can receive in a slot as specified in Clause 4.2.16.1.6 of TS 38.306[14] ( IE *psfch-RxNumber*)) .  Note 4: Member ID is an identifier uniquely identifying a member  Note 5: All PSFCHs in a slot are corresponding to one PSSCH that occupies all sub channels. | | | |

Table 11.1.9.1.1.0‑2: Minimum performance

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Test  Number | Bandwidth (MHz) / Subcarrier spacing(kHz) | Propagation Channel | Reference value | |
| Probability of success detection slot with ACK only | Probability of success detection slot with NACK or DTX |
| 1 | 40 / 30 | Static propagation condition without external noise | 99 | 99 |
| Note 1: The probability of success detection slot with ACK only is the probability that the corresponding PSSCH is not retransmitted when Option A is selected.  Note 2: The probability of success detection slot with NACK or DTX is the probability that the corresponding PSSCH is retransmitted when Option B or option C is selected. | | | | |

The normative reference for this requirement is TS 38.101-4 [5], clause 11.1.9.1.1.1.

11.1.9.1.1\_1 2Rx FR1 PSFCH decoding capability - maximum number of received PSFCHs

11.1.9.1\_1.1.1 Test purpose

The purpose is to verify the maximum number of PSFCHs received by UE per slot in group cast scenario by using ACK/NACK feedback mode.

11.1.9.1\_1.1.2 Test applicability

This test case applies to all types of NR UE release 16 and forward which support NR sidelink communication, as specified in Table 11.1.1.1.2-1.

11.1.9.1\_1.1.3 Test description

11.1.9.1\_1.1.3.1 Initial conditions

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

The initial test configurations consist of environmental conditions, test frequencies, test channel bandwidths and sub-carrier spacing based on NR operating bands specified in 38.521-1 [7] subclause 5.3E.

PSCCH and PSSCH reference measurement channels are set according to Table 11.1.1.2-1 and Annex A.6 as appropriate.

Configurations of the GNSS simulator are specified in TS 38.508-1 [6] Table 4.11.2-2 and the GNSS simulator is configured for Scenario #1: static in Geographical area #1. Geographical area #1 is also pre-configured in the UE.

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

Frequencies to be tested: Low Range, as defined in TS 38.508-1 [6] clause 4.3.1.8.

Channel Bandwidths to be tested: As specified per test number in Table 11.1.9.1.1.0‑2 as defined in TS 38.508-1 [6] clause 4.3.1.8.

1. Connect the SS, the faders, and the AWGN noise source to the UE antenna connectors, connect the SS COM port to the UE COM port, and connect the GNSS simulator to the UE GNSS RX antenna connector as shown in TS 38.508-1 [6] Annex A, Figure A.3.1.9.1(TE part) and Figure A.3.2.7.1 (UE part).

2. The parameter settings for the V2X sidelink transmission over PC5 interface are pre-configured according to TS 38.508-1 [6] clause 4.10.1. Message content exceptions are defined in clause 11.1.9.1\_1.1.3.3.

3. Sidelink physical channels and signals are initially set up according to Table 11.1.1.2-1, Table 11.1.9.1.1.0-1 and Annex A.6 as appropriate.

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

5. Determine the number of sidelink UEs, i.e. N, as follows:

- N = 5 if pc\_psfch\_RxNumber\_n5 = true;

- N = 15 if pc\_psfch\_RxNumber\_n15 = true;

- N = 25 if pc\_psfch\_RxNumber\_n25 = true;

- N = 32 if pc\_psfch\_RxNumber\_n32 = true;

- N = 35 if pc\_psfch\_RxNumber\_n35 = true;

- N = 45 if pc\_psfch\_RxNumber\_n45 = true;

- N = 50 if pc\_psfch\_RxNumber\_n50 = true;

- N = 64 if pc\_psfch\_RxNumber\_n64 = true;

6. Ensure the UE is in state 4-A with generic procedure parameters Test Loop Function = *On* according to TS 38.508-1 [6] clause 4.4A.2. The UE is configured as the transmitting UE and operates in ACK/NACK HARQ groupcast mode. Message contents are defined in clause 11.1.9.1\_1.1.3.3.

7. The GNSS simulator is triggered to start step 1 of Scenario #1 to simulate a location in the centre of Geographical area #1. Wait for the UE to acquire the GNSS signal.

11.1.9.1\_1.1.3.2 Test procedure

1. The UE under test transmits PSCCH/PSSCH in every PSCCH/PSSCH duration for NR sidelink communication according to *SL-PreconfigurationNR*. The Sidelink UEs receive the PSSCH sent by the UE under test and send PSFCH. Information transmitted in each PSFCH is randomly selected from Option A, Option B and Option C with probability of 50%, 25% and 25% respectively. Transmitted PSFCHs are related to one PSSCH which is transmitted by tested UE and occupies all the subchannels.

- Option A: All the UEs in the group transmit ACKs

- Option B: One UE transmits NACK and the rest of UEs transmit ACKs. The PSFCH resource index with NACK is random per slot

- Option C: One UE transmits nothing (i.e. DTX) and the rest of UEs transmit ACKs. The PSFCH resource index of the DTX is random per slot.

2. Set the parameters of the bandwidth, MCS, reference channel, the propagation condition, the correlation matrix and the SNR according to Table 11.1.9.1\_1.1.4‑1 as appropriate.

3. Measure probability of success detection slot with ACK only, and probability of success detection slot with NACK or DTX according to the test method described in Annex G.5 for a duration sufficient to achieve statistical significance. Pass the UE if the measured probability of success detection slot with ACK only, and probability of success detection slot with NACK or DTX are no less than the reference value in Table 11.1.9.1.1\_1.4‑1. Otherwise fail the UE.

4. Repeat steps from 1 to 3 for each subtest in Table 11.1.9.1.1\_1.4‑1 as appropriate.

11.1.9.1.1\_1.3.3 Message contents

Message contents are according to TS 38.508-1 [6] clause 5.4.3 with the following exceptions.

Table 11.1.9.1.1\_1.3.3-1: *SL-ResourcePool*

|  |  |  |  |
| --- | --- | --- | --- |
| Derivation Path: TS 38.508-1 [6] Table 5.4.3-1 | | | |
| Information Element | | Value/remark | Comment | Condition |
| SL-ResourcePool-r16 ::= SEQUENCE { | |  |  |  |
| sl-PSFCH-Config-r16 CHOICE { | |  |  |  |
| setup SEQUENCE { | |  |  |  |
| sl-PSFCH-Period-r16 | | sl1 |  |  |
| } | |  |  |  |
| } | |  |  |  |
| } | |  |  |  |

11.1.9.1.1\_1.4 Test Requirements

For the parameters specified in Table 11.1.9.1.0-1 and SNR specified in Table 11.1.9.1.1\_1.4‑1, the probability of success detection slot with ACK only, and probability of success detection slot with NACK or DTX obtained in step 3 shall be no less the reference value specified in Table 11.1.9.1.1\_1.4‑1.

Table 11.1.9.1.1\_1.4‑1: Test performance requirements

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Test  Number | Bandwidth (MHz) / Subcarrier spacing(kHz) | Propagation Channel | Reference value | |
| Probability of success detection slot with ACK only | Probability of success detection slot with NACK or DTX |
| 1 | 40 / 30 | Static propagation condition without external noise | 99 | 99 |
| Note 1: The probability of success detection slot with ACK only is the probability that the corresponding PSSCH is not retransmitted when Option A is selected.  Note 2: The probability of success detection slot with NACK or DTX is the probability that the corresponding PSSCH is retransmitted when Option B or option C is selected. | | | | |