**3GPP TSG-RAN WG4 Meeting # 101-e R4-2120825**

**Electronic Meeting, November 01-12, 2021**

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| *CR-Form-v12.1* |
| **CHANGE REQUEST** |
|  |
|  | **38.174** | **CR** |  | **rev** | - | **Current version:** | **16.4.0** |  |
|  |
| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **X** | Core Network |  |

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| ***Title:***  | Big CR for TS 38.174 Maintenance |
|  |  |
| ***Source to WG:*** | MCC, CATT |
| ***Source to TSG:*** | R4 |
|  |  |
| ***Work item code:*** | NR\_IAB-CoreNR\_IAB-Perf |  | ***Date:*** | 2021-11-16 |
|  |  |  |  |  |
| ***Category:*** | F |  | ***Release:*** | Rel-16 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)…Rel-15 (Release 15)Rel-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)* |
|  |  |
| ***Reason for change:*** | This big CR merges the multiple endorsed draft CRs: R4-2117324, R4-2119026, R4-2119449.The reasons for changes in each endorsed draft CR are copied below.R4-2117324 Draft CR for TS 38.174: correction of the referencesSome references are missing.R4-2119026 draftCR on IAB-DU performance requirements in TS 38.174Notes in “Test parameters for testing PUSCH” tables should be updated to remove FDD related instruction.R4-2119449 Inclusion of scope of RRM in TS 38.174To include the RRM in the scope of the IAB core specification |
|  |  |
| ***Summary of change:*** | The summary of change in each endorsed draft CR is copied below.R4-2117324 Draft CR for TS 38.174: correction of the references1. Add TS 38.101-4 to the reference clause.
2. Correct the reference [TBA] to the correct number.

R4-2119026 draftCR on IAB-DU performance requirements in TS 38.174For removing FDD related instruction, update Table 8.1.2.1.1-1, Table 8.1.2.2.1-1, Table 8.1.2.3.1-1.R4-2119449 Inclusion of scope of RRM in TS 38.174In the scope of the IAB spec 38.174, both minimum radio resource management (RRM) requirements and RRM test cases are included. |
|  |  |
| ***Consequences if not approved:*** | The consequences if not approved for each endorsed draft CR are coppied below.R4-2117324 Draft CR for TS 38.174: correction of the referencesSpec is not clear.R4-2119026 draftCR on IAB-DU performance requirements in TS 38.174There will be inconsistence between the specification 38.174 and RAN 4 agreements.R4-2119449 Inclusion of scope of RRM in TS 38.174The scope of 38.174 is unclear. |
|  |  |
| ***Clauses affected:*** | R4-2117324 Draft CR for TS 38.174: correction of the references2, 8.2.3.2.1, 8.2.3.3.1, 8.2.3.4.1, 11.2.2.1.1, 11.2.2.1.2, 11.2.2.2.1, 11.2.2.2.2, 11.2.3.2.2, 11.2.3.2.3, 11.2.3.2.4R4-2119026 draftCR on IAB-DU performance requirements in TS 38.1748.1.2.1.1, 8.1.2.2.1, 8.1.2.3.1R4-2119449 Inclusion of scope of RRM in TS 38.1741 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **x** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ... |
| ***(show related CRs)*** |  | **x** |  O&M Specifications | TS/TR ... CR ...  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

***<Start of change>***

1 Scope

The present document establishes the minimum RF characteristics, minimum radio resource management (RRM) requirements, RRM test cases and minimum performance requirements of NR Integrated access and backhaul (IAB).

***<Next change>***

# 2 References

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

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

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

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

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

[2] 3GPP TS 38.104: “NR; Base Station (BS) radio transmission and reception”

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

[4] 3GPP TS 38.101-2: “NR User Equipment (UE) radio transmission and reception: Part 2: Range 2 Standalone”

[5] 3GPP TS 38.101-3: "NR; User Equipment (UE) radio transmission and reception; Part 3: Range 1 and Range 2 Interworking operation with other radios "

[6] 3GPP TS 38.133: “NR: Requirements for support of radio resource management”

[7] 3GPP TS 38.300: "NR; Overall description; Stage-2".

[8] 3GPP TS 38.211: "NR; Physical channels and modulation”.

[9] 3GPP TS 38.212 "NR; Multiplexing and channel coding".

[10] 3GPP TS 38.213: "NR; Physical layer procedures for control".

[11] 3GPP TS 38.214: "NR; Physical layer procedures for data".

[12] 3GPP TS 38.215: "NR; Physical layer measurements".

[13] 3GPP TS 38.304: "NR; User Equipment (UE) procedures in idle mode".

[14] 3GPP TS 38.321: "NR; Medium Access Control (MAC) protocol specification".

[15] 3GPP TS 38.331: "NR; Radio Resource Control (RRC); Protocol specification".

[16] ITU-R Recommendation SM.329: "Unwanted emissions in the spurious domain".

[17] ERC Recommendation 74-01, "Unwanted emissions in the spurious domain".

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

[19] Recommendation ITU-R SM.328: "Spectra and bandwidth of emissions".

[20] "Title 47 of the Code of Federal Regulations (CFR)", Federal Communications Commission.

[21] 3GPP TS 38.141-2: "NR; Base Station (BS) conformance testing; Part 2: Radiated conformance testing".

[22] 3GPP TS 38.141-1: "NR; Base Station (BS) conformance testing; Part 1: Conducted conformance testing".

[23] 3GPP TS 38.521-1: “NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Range 1 Standalone”.

[24] 3GPP TS 38.521-2: “NR; User Equipment (UE) conformance specification; Radio transmission and reception; Part 2: Range 2 Standalone”.

[25] 3GPP TS 38.176-1: "NR; Integrated Access and Backhaul (IAB) conformance testing; Part 1: Conducted conformance testing".

[26] 3GPP TS 38.176-2: "NR; Integrated Access and Backhaul (IAB) conformance testing; Part 2: Radiated conformance testing".

[27] 3GPP TR 38.901: "Study on channel model for frequencies from 0.5 to 100 GHz"

[28] 3GPP TR 38.101-4: " NR; User Equipment (UE) radio transmission and reception; Part 4: Performance requirements"

***<Next change>***

### 8.1.2 Performance requirements for PUSCH

#### 8.1.2.1 Requirements for PUSCH with transform precoding disabled

##### 8.1.2.1.1 General

The performance requirement of PUSCH is determined by a minimum required throughput for a given SNR. The required throughput is expressed as a fraction of maximum throughput for the FRCs listed in annex A. The performance requirements assume HARQ retransmissions.

Table 8.1.2.1.1-1: Test parameters for testing PUSCH

|  |  |
| --- | --- |
| Parameter | Value |
| Transform precoding | Disabled |
| Default TDD UL-DL pattern (Note 1) | 15 kHz SCS:3D1S1U, S=10D:2G:2U30 kHz SCS:7D1S2U, S=6D:4G:4U |
| Cyclic prefix | Normal |
| HARQ | Maximum number of HARQ transmissions | 4 |
| RV sequence | 0, 2, 3, 1 |
| DM-RS | DM-RS configuration type | 1 |
| DM-RS duration | single-symbol DM-RS |
| Additional DM-RS position | pos1 |
| Number of DM-RS CDM group(s) without data | 2 |
| Ratio of PUSCH EPRE to DM-RS EPRE | -3 dB |
| DM-RS port | {0}, {0, 1} |
| DM-RS sequence generation | NID0=0, nSCID =0 |
| Time domain resource assignment | PUSCH mapping type | A, B |
| Start symbol | 0  |
| Allocation length | 14  |
| Frequency domain resource assignment | RB assignment | Full applicable test bandwidth |
| Frequency hopping | Disabled |
| TPMI index for 2Tx two-layer spatial multiplexing transmission  | 0 |
| Code block group based PUSCH transmission | Disabled |
| NOTE 1: The same requirements are applicable to different UL-DL patterns. |

***<Next change>***

#### 8.1.2.2 Requirements for PUSCH with transform precoding enabled

##### 8.1.2.2.1 General

The performance requirement of PUSCH is determined by a minimum required throughput for a given SNR. The required throughput is expressed as a fraction of maximum throughput for the FRCs listed in annex A. The performance requirements assume HARQ retransmissions.

Table 8.1.2.2.1-1: Test parameters for testing PUSCH

|  |  |
| --- | --- |
| Parameter | Value |
| Transform precoding | Enabled |
| Cyclic Prefix | Normal |
| Default TDD UL-DL pattern (Note 1) | 15 kHz SCS:3D1S1U, S=10D:2G:2U30 kHz SCS:7D1S2U, S=6D:4G:4U |
| HARQ | Maximum number of HARQ transmissions | 4 |
| RV sequence | 0, 2, 3, 1 |
| DM-RS | DM-RS configuration type | 1 |
| DM-RS duration | single-symbol DM-RS |
| Additional DM-RS position | pos1 |
| Number of DM-RS CDM group(s) without data | 2 |
| Ratio of PUSCH EPRE to DM-RS EPRE | -3 dB |
| DM-RS port(s) | 0 |
| DM-RS sequence generation | NID0=0, group hopping and sequence hopping are disabled |
| Time domain resource assignment | PUSCH mapping type | A, B |
| Start symbol | 0 |
| Allocation length | 14 |
| Frequency domain resource assignment | RB assignment | 15 kHz SCS: 25 PRBs in the middle of the test bandwidth 30 kHz SCS: 24 PRBs in the middle of the test bandwidth |
| Frequency hopping | Disabled |
| Code block group based PUSCH transmission | Disabled |
| NOTE 1: The same requirements are applicable to different UL-DL patterns. |

***<Next change>***

#### 8.1.2.3 Requirements for UCI multiplexed on PUSCH

##### 8.1.2.3.1 General

In the tests for UCI multiplexed on PUSCH, the UCI information only contains CSI part 1 and CSI part 2 information, and there is no HACK/ACK information transmitted.

The CSI part 1 block error probability (BLER) is defined as the probability of incorrectly decoding the CSI part 1 information when the CSI part 1 information is sent as follow:

 $BLER\_{CSI part 1}= \frac{\#(false CSI part 1)}{\#(CSI part 1)}$

where:

- #(false CSI part 1) denotes the number of incorrectly decoded CSI part 1 information transmitted occasions

- #(CSI part 1) denotes the number of CSI part 1 information transmitted occasions.

The CSI part 2 block error probability is defined as the probability of incorrectly decoding the CSI part 2 information when the CSI part 2 information is sent as follows:

 $BLER\_{CSI part 2}= \frac{\#(false CSI part 2)}{\#(CSI part 2)}$

where:

- #(false CSI part 2) denotes the number of incorrectly decoded CSI part 2 information transmitted occasions

- #(CSI part 2) denotes the number of CSI part 2 information transmitted occasions.

The number of UCI information bit payload per slot is defined for two cases as follows:

- 5 bits in CSI part 1, 2 bits in CSI part 2

- 20 bits in CSI part 1, 20 bits in CSI part 2

The 7bits UCI case is further defined with the bitmap [c0 c1 c2 c3 c4] = [0 1 0 1 0] for CSI part 1 information, where c0 is mapping to the RI information, and with the bitmap [c0 c1] = [1 0] for CSI part2 information.

The 40bits UCI information case is assumed random information bit selection.

In both tests, PUSCH data, CSI part 1 and CSI part 2 information are transmitted simultaneously.

Table 8.1.2.3.1-1: Test parameters for testing UCI on PUSCH

|  |  |
| --- | --- |
| Parameter | Value |
| Transform precoding | Disabled |
| Default TDD UL-DL pattern (Note 1) | 30 kHz SCS:7D1S2U, S=6D:4G:4U |
| Cyclic Prefix | Normal |
| HARQ | Maximum number of HARQ transmissions | 1 |
| RV sequence | 0 |
| DM-RS | DM-RS configuration type | 1 |
| DM-RS duration | Single-symbol DM-RS |
| Additional DM-RS position | pos1 |
| Number of DM-RS CDM group(s) without data | 2 |
| Ratio of PUSCH EPRE to DM-RS EPRE  | -3 dB |
| DM-RS port(s) | {0} |
| DM-RS sequence generation | NID0=0, nSCID=0 |
| Time domain resource assignment | PUSCH mapping type | A,B |
| Start symbol | 0 |
| Allocation length | 14 |
| Frequency domain resource assignment | RB assignment | Full applicable test bandwidth |
| Frequency hopping | Disabled |
| Code block group based PUSCH transmission | Disabled |
| UCI | Number of CSI part 1 and CSI part 2 information bit payload | {5,2},{20,20} |
| scaling | 1 |
| betaOffsetACK-Index1 | 11 |
| betaOffsetCSI-Part1-Index1 and betaOffsetCSI-Part1-Index2 | 13 |
| betaOffsetCSI-Part2-Index1 and betaOffsetCSI-Part2-Index2 | 13 |
| UCI partition for frequency hopping | Disabled |
| NOTE 1: The same requirements are applicable to different UL-DL patterns. |

***<Next change>***

##### 8.2.3.2.1 General

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 [11]. 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.

Table 8.2.3.2.1-1: Test parameters for testing CQI reporting

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter | Unit | Test 1 | Test 2 |
| Bandwidth | MHz | 40 |
| Subcarrier spacing | kHz | 30 |
| Default TDD UL-DL pattern (Note 1) |  | 7D1S2U, S=6D:4G:4U |
| SNR |  dB | 5 | 6 | 11 | 12 |
| Propagation channel |  | AWGN |
| Antenna configuration |  | 2x4 |
| Beamforming Model |  | As specified in Annex TBA |
| 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-timeConfigperiodicity and offset | slot | 10/1 |
| ReportConfigType |  | Periodic |
| CQI-table |  | Table 2 |
| reportQuantity |  | cri-RI-PMI-CQI |
| cqi-FormatIndicator |  | Wideband |
| pmi-FormatIndicator |  | Wideband |
| Sub-band Size | RB | 16 |
| Csi-ReportingBand |  | 1111111 |
| CSI-Report periodicity and offset | slot | 10/9 |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1, CodebookConfig-N2) |  | Not configured |
| CodebookSubsetRestriction |  | 010000 |
| RI Restriction |  | N/A |
| Maximum number of HARQ transmission |  | 1 |
| Measurement channel |  | M-FR1-A.3.5-2 |
| Note 1: The same requirements are applicable for TDD with different UL-DL pattern.Note 2: SSB, TRS, CSI-RS, and/or other unspecified test parameters with respect to TS 38.101-4 [28] are left up to test implementation, if transmitted or needed. |

***<Next change>***

##### 8.2.3.3.1 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 propability 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 mode 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 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.

Table 8.2.3.3.1-1: Test parameters for testing PMI reporting

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Unit** | **Test 1** | **Test 2** |
| Bandwidth | MHz | 40 |
| Subcarrier spacing | kHz | 30 |
| TDD DL-UL configuration (Note 1) |  | 7D1S2U, S=6D:4G:4U |
| Propagation channel |  | TDLA30-5 |
| Antenna configuration |  | High XP 4 x 4(N1,N2) = (2,1) | High XP 8 x 4(N1,N2) = (4,1) |
| Beamforming Model |  | As specified in Annex TBA |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Aperiodic |
| Number of CSI-RS ports (*X*) |  | 4 | 8 |
| CDM Type |  | FD-CDM2 | CDM4 (FD2, TD2) |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1) |  | Row 4, (0,-) | Row 8, (4,6) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (13,-) | (5,-) |
| CSI-RSinterval and offset | slot | Not configured |
| ReportConfigType |  | Aperiodic |
| CQI-table |  | Table 1 |
| reportQuantity |  | cri-RI-PMI-CQI |
| 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 |
| CSI-AperiodicTriggerStateList |  | One State with one Associated Report ConfigurationAssociated 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) | (4,1) |
| (CodebookConfig-O1, CodebookConfig-O2) |  | (4,1) |
| CodebookSubsetRestriction |  | 11111111 | 0x FFFF |
| RI Restriction |  | 00000001 | 00000010 |
| CQI/RI/PMI delay  | ms | 5.5 | 6.5 |
| Maximum number of HARQ transmission |  | 4 |
| Measurement channel |  | M-FR1-A.3.5-5 | M-FR1-A.3.5-6 |
| Note 1: The same requirements are applicable for TDD with different UL-DL pattern.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-4) for test 1 and not later than slot#(n-6) for test 2, this reported PMI cannot be applied at the gNB downlink before slot#(n+4) for test 1 and before slot#(n+6) for test 2.Note 4: Randomization of the principle beam direction shall be used as specified in TBANote 5: SSB, TRS, CSI-RS, and/or other unspecified test parameters with respect to TS 38.101-4 [28] are left up to test implementation, if transmitted or needed. |

***<Next change>***

##### 8.2.3.4.1 General

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.

Table 8.2.3.4.1-1: Test parameters for testing RI reporting

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Test 1** | **Test 2** | **Test 3** | **Test 4** |
| Bandwidth | MHz | 40 |
| Subcarrier spacing | kHz | 30 |
| Default TDD UL-DL pattern (Note 1) |  | 7D1S2U, S=6D:4G:4U |
| SNR  | dB | -2 | 16 | 16 | 22 |
| Propagation channel |  | TDLA30-5 |
| Antenna configuration |  | ULA Low 2x4 | ULA Low 2x4 | ULA High 2x4 | ULA Low 4x4 |
| Beamforming Model |  | As defined in Annex TBA |
| NZP CSI-RS for CSI acquisition | CSI-RS resource Type |  | Periodic |
| Number of CSI-RS ports (*X*) |  | 2 | 2 | 2 | 4 |
| CDM Type |  | FD-CDM2 |
| Density (ρ) |  | 1 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1) |  | Row 3 (6,-) | Row 3 (6,-) | Row 3 (6,-) | Row 4 (0,-) |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (13, -) |
| NZP CSI-RS-timeConfigperiodicity and offset | slot | 10/1 |
| ReportConfigType |  | Periodic |
| CQI-table |  | Table 2 |
| reportQuantity |  | cri-RI-PMI-CQI |
| cqi-FormatIndicator |  | Wideband |
| pmi-FormatIndicator |  | Wideband |
| Sub-band Size | RB | 16 |
| 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 | 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 |
| CQI/RI/PMI delay  | ms | 9.5 |
| Maximum number of HARQ transmission |  | 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: The same requirements are applicable for TDD with different UL-DL pattern.Note 2: SSB, TRS, CSI-RS, and/or other unspecified test parameters with respect to TS 38.101-4 [28] are left up to test implementation, if transmitted or needed.Note 3: Measurements channels are specified in Table A.3.5-1. M-FR1-A.3.5-1 is used for Rank 1 case. M-FR1-A.3.5-2 is used for Rank 2 case. M-FR1-A.3.5-3 is used for Rank 3 case. M-FR1-A.3.5-4 is used for Rank 4 case. |

***<Next change>***

11.2.2.1.1.1 General

The performance requirement of PDSCH is determined by a minimum required throughput for a given SNR. The required throughput is expressed as a fraction of maximum throughput for the FRCs listed in annex A. The performance requirements assume HARQ retransmissions.

Table: 11.2.2.1.1.1-1 Test parameters for PDSCH testing

|  |  |
| --- | --- |
| Parameter | Value |
| Cyclic prefix | Normal |
| Default TDD UL-DL pattern (Note 1) | 7D1S2U, S=6D:4G:4U |
| HARQ | Maximum number of HARQ transmissions | 4 |
| RV sequence | 0, 2, 3, 1 |
| DM-RS | DM-RS configuration type | 1 |
| DM-RS duration | single-symbol DM-RS |
| DM-RS position (*l0*) | 2 |
| Additional DM-RS position | pos1 |
| Number of DM-RS CDM group(s) without data | 1 for Rank 1 and Rank 2 tests2 for Rank 3 and Rank 4 tests |
| DM-RS port(s) | {1000} for Rank 1 tests{1000-1001} for Rank 2 tests{1000-1002} for Rank 3 tests{1000-1003} for Rank 4 tests |
| DM-RS sequence generation | NID0=0 |
| Time domain resource assignment | PDSCH mapping type | A |
| Start symbol | 2 |
| Allocation length | 12 |
| Frequency domain resource assignment | RB assignment | Full applicable test bandwidth |
| PT-RS configuration | Not configured |
| PRB bundling size | 2 |
| VRB-to-PRB mapping type | Not interleaved |
| 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 PRB bundling granularity |
| Note 1: The same requirements are applicable to TDD with different UL-DL patterns.Note 2: SSB, TRS, CSI-RS, and/or other unspecified test parameters with respect to TS 38.101-4 [28] are left up to test implementation, if transmitted or needed. |

***<Next change>***

11.2.2.1.2.1 General

The receiver characteristics of the PDCCH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg).

Table: 11.2.2.1.2.1-1 Test parameters for PDCCH testing

|  |  |
| --- | --- |
| Parameter | Value |
| Cyclic prefix | Normal |
| Default TDD UL-DL pattern (Note 1) | 7D1S2U, S=6D:4G:4U |
| DM-RS sequence generation | NID=0 |
| Frequency domain resource allocation for CORESET | Start from RB = 0 with contiguous RB allocation |
| CCE to REG mapping type | Interleaved |
| Interleaver size | 3 |
| REG bundle size | 6 for test with aggregation level 82 for others |
| Shift Index | 0 |
| Slots for PDCCH monitoring | Each slot |
| Number of PDCCH candidates for the tested aggregation level | 1 |
| PDCCH Precoding configuration | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination with REG bundling granularity for number of Tx larger than 1 |
| Note 1: The same requirements are applicable to TDD with different UL-DL patterns.Note 2: SSB, TRS, CSI-RS, and/or other unspecified test parameters with respect to TS 38.101-4 [28] are left up to test implementation, if transmitted or needed. |

***<Next change>***

11.2.2.2.1.1 General

The performance requirement of PDSCH is determined by a minimum required throughput for a given SNR. The required throughput is expressed as a fraction of maximum throughput for the FRCs listed in annex A. The performance requirements assume HARQ retransmissions.

Table: 11.2.2.2.1.1-1 Test parameters for PDSCH testing

|  |  |
| --- | --- |
| Parameter | Value |
| Cyclic prefix | Normal |
| Default TDD UL-DL pattern (Note 1) | 3D1S1U, S=10D:2G:2U |
| HARQ | Maximum number of HARQ transmissions | 4 |
| RV sequence | 0, 2, 3, 1 |
| DM-RS | DM-RS configuration type | 1 |
| DM-RS duration | single-symbol DM-RS |
| DM-RS position (*l0*) | 2 |
| Additional DM-RS position | pos1 |
| Number of DM-RS CDM group(s) without data | 1 |
| DM-RS port(s) | {1000} for Rank 1 tests{1000-1001} for Rank 2 tests |
| DM-RS sequence generation | NID0=0 |
| Time domain resource assignment | PDSCH mapping type | A |
| Start symbol | 1 |
| Allocation length | 13 |
| Frequency domain resource assignment | RB assignment | Full applicable test bandwidth |
| PT-RS configuration | Frequency density (*KPT-RS*) | 2 |
| Time density (*LPT-RS*) | 1 |
| PRB bundling size | 2 |
| VRB-to-PRB mapping type | Not interleaved |
| 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 PRB bundling granularity |
| Note 1: The same requirements are applicable to TDD with different UL-DL patterns.Note 2: SSB, TRS, CSI-RS, and/or other unspecified test parameters with respect to TS 38.101-4 [28] are left up to test implementation, if transmitted or needed. |

***<Next change>***

11.2.2.2.2.1 General

The receiver characteristics of the PDCCH are determined by the probability of miss-detection of the Downlink Scheduling Grant (Pm-dsg).

Table: 11.2.2.2.2.1-1 Test parameters for testing PDCCH

|  |  |
| --- | --- |
| Parameter | Value |
| Cyclic prefix | Normal |
| Default TDD UL-DL pattern (Note 1) | 3D1S1U, S=10D:2G:2U |
| DM-RS sequence generation | NID=0 |
| Frequency domain resource allocation for CORESET | Start from RB = 0 with contiguous RB allocation |
| CCE to REG mapping type | Interleaved |
| Interleaver size | 2 for test with Aggregation level 43 for others |
| REG bundle size | 6 for test with Aggregation level 42 for others |
| Shift Index | 0 |
| Slots for PDCCH monitoring | Each slot |
| Number of PDCCH candidates for the tested aggregation level | 1 |
| PDCCH Precoding configuration | Single Panel Type I, Random precoder selection updated per slot, with equal probability of each applicable i1, i2 combination with REG bundling granularity for number of Tx larger than 1 |
| Note 1: The same requirements are applicable to TDD with different UL-DL patterns.Note 2: SSB, TRS, CSI-RS, and/or other unspecified test parameters with respect to TS 38.101-4 [28] are left up to test implementation, if transmitted or needed. |

***<Next change>***

11.2.3.2.2.1 General

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 [11]. 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.

Table 11.2.3.2.2.1-1: Test parameters

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | **Unit** | **Test 1** | **Test 2** |
| Bandwidth | MHz | 100 |
| Subcarrier spacing | kHz | 120 |
| Duplex Mode |  | TDD |
| Default TDD UL-DL pattern (Note 1) |  | 3D1S1U |
| Special Slot Configuration |  | 10D+2G+2U |
| SNRBB  |  dB | 8 | 9 | 14 | 15 |
| Propagation channel |  | AWGN |
| Antenna configuration |  | 2×2 with static channel specified in Annex I.1 |
| Beamforming Model |  | As specified in Annex I.3.1 |
| 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-timeConfigperiodicity and offset | slot | 8/1 |
| ReportConfigType |  | *Periodic* |
| CQI-table |  | Table 1 |
| reportQuantity |  | *cri-RI-PMI-CQI* |
| cqi-FormatIndicator |  | *Wideband* |
| pmi-FormatIndicator |  | *Wideband* |
| Sub-band Size | RB | 8 |
| csi-ReportingBand |  | 111111111 |
| CSI-Report periodicity and offset | slot | 8/3 |
| Codebook configuration | Codebook Type |  | *typeI-SinglePanel* |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | *Not configured* |
| CodebookSubsetRestriction |  | 010000 |
| RI Restriction |  | N/A |
| Maximum number of HARQ transmission |  | 1 |
| Measurement channel |  | M-FR2-A.3.5-2 |
| Note 1: The same requirements are applicable to with different UL-DL patterns.Note 2: SSB, TRS, CSI-RS, and/or other unspecified test parameters with respect to TS 38.101-4 [28] are left up to test implementation, if transmitted or needed. |

***<Next change>***

11.2.3.2.3.1 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 mode 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.

Table 11.2.3.2.3.1-1: Test parameters

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Test 1** |
| Bandwidth | MHz | 100 |
| Subcarrier spacing | kHz | 120 |
| Default TDD UL-DL pattern (Note 1) |  | 3D1S1U |
| Special Slot Configuration |  | 10D+2G+2U |
| Propagation channel |  | TDLA30-35 |
| Antenna configuration |  | 2 x 2 ULA Low |
| Beamforming Model |  | As specified in Annex I.3.1 |
| 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, l1) |  | (13,-) |
| CSI-RSinterval and offset | slot | 8/1 |
| ReportConfigType |  | Periodic |
| CQI-table |  | Table 1 |
| reportQuantity |  | cri-RI-PMI-CQI |
| cqi-FormatIndicator |  | Wideband |
| pmi-FormatIndicator |  | Wideband |
| Sub-band Size | RB | 8 |
| csi-ReportingBand |  | 111111111 |
| CSI-Report interval and offset | slot | 8/3 |
| Codebook configuration | Codebook Type |  | typeI-SinglePanel |
| Codebook Mode |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | N/A |
| CodebookSubsetRestriction |  | 001111 |
| RI Restriction |  | N/A |
| CQI/RI/PMI delay | ms | 1.75 |
| Maximum number of HARQ transmission |  | 4 |
| Measurement channel |  | M-FR2-A.3.5-3 |
| Note 1: The same requirements are applicable for TDD with different UL-DL pattern.Note 2: For random precoder selection, the precoder shall be updated in each slot (0.125 ms granularity).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 shall be used as specified in Annex I.2.3.2.3.Note 5: SSB, TRS, CSI-RS and/or other unspecified test parameters with respect to TS 38.101-4 [28] are left up to test implementation, if transmitted or needed. |

***<Next change>***

11.2.3.2.4.1 General

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.

The minimum performance requirement in Table 11.2.3.2.4.2-1 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 ≥ ;

Table 11.2.3.2.4.1-1: Test parameters

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Test 1** | **Test 2** | **Test 3** |
| Bandwidth | MHz | 100 | 100 | 100 |
| Subcarrier spacing | kHz | 120 | 120 | 120 |
| Duplex Mode |  | TDD | TDD | TDD |
| Default TDD UL-DL pattern (Note 1) |  | 3D1S1U | 3D1S1U | 3D1S1U |
| Special Slot Configuration |  | 10D+2G+2U | 10D+2G+2U | 10D+2G+2U |
| 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 I.3.1 | As defined in Annex I.3.1 | As defined in Annex I.3.1 |
| 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, 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-timeConfiginterval and offset | slot | 8/1 | 8/1 | 8/1 |
| ReportConfigType |  | Periodic | Periodic | Periodic |
| CQI-table |  | Table 1 | Table 1 | Table 1 |
| reportQuantity |  | cri-RI-PMI-CQI | cri-RI-PMI-CQI | cri-RI-PMI-CQI |
| 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 | 8/3 | 8/3 | 8/3 |
| 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 |
| 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: The same requirements are applicable to with different UL-DL patterns.Note 2: SSB, TRS, CSI-RS and/or other unspecified test parameters with respect to TS 38.101-4 [28] are left up to test implementation, if transmitted or needed.Note 3: Measurements channels are specified in Table A.3.5-2. M-FR2-A.3.5-1 is used for Rank 1 case. M-FR2-A.3.5-2 is used for Rank 2 case. |

***<End of change>***