**3GPP TSG-RAN WG4 Meeting # 104-e *R4-2213796***

**Electronic Meeting, Aug 15th – 26th, 2022**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.101-4** | **CR** | **-** | **rev** | **1** | **Current version:** | **17.5.0** |  |
|  | | | | | | | | |
| *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 | **X** | Radio Access Network |  | Core Network |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | for RedCap | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Huawei, HiSilicon | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_redcap-Perf | | | | |  | ***Date:*** | | | 2022-08-03 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-17 |
|  | *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 can be 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-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Based on the work plan R4-2210931, RAN4 should submit the draft CR for RedCap for review. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Introduced the PMI requirments for RedCap | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | The performance requirements will still be incomplete | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.3.1.1 (New), 6.3.1.2(New), 6.3.2.1, 6.3.2.2, 8.3.2.2 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | | **x** |  | Test specifications | | | | TS 38.521-4 | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

<The first Changes>

## 6.3 Reporting of Precoding Matrix Indicator (PMI)

The minimum performance requirements of PMI reporting are defined based on the precoding gain, expressed as the relative increase in throughput when the transmitter is configured according to the UE reported PMI compared to the case when the transmitter is using random precoding, respectively. When the transmitter uses random precoding, for each PDSCH allocation a precoder is randomly generated with equal propability of each applicable 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 Single PMI with 4TX TypeI-SinglePanel Codebook

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. The requirements are

Table 6.3.1.1.1-1: 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  (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) |  | 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 | |  | 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  R.PDSCH.TBD 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. | | | |

Table 6.3.1.1.1-2: Minimum requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 1.3 |

#### 6.3.1.2 TDD

##### 6.3.1.2.1 Single PMI with 4TX TypeI-SinglePanel Codebook

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 6.3.1.2.1-1: 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 | |  | ULA XP 4 x 1  (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) |  | 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 Annex B.2.3.2.3. | | | |

Table 6.3.2.2.1-2: Minimum requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 1.3 |

### 6.3.2 2RX requirements

#### 6.3.2.1 FDD

##### 6.3.2.1.1 Single PMI with 4TX TypeI-SinglePanel Codebook

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

Table 6.3.2.1.1-1: Test parameters (single layer)

|  |  |  |  |
| --- | --- | --- | --- |
| **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) |  | 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 | |  | 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: When Throughput is measured using random precoder selection, the precoder shall be updated in each slot (1 ms granularity) with equal probability of each applicable i1, i2 combination.  Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation at a downlink slot not later than slot#(n-3), this reported PMI cannot be applied at the gNB downlink before slot#(n+3).  Note 3: Randomization of the principle beam direction shall be used as specified in Annex B.2.3.2.3. | | | |

Table 6.3.2.1.1-2: Minimum requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 1.3 |

<Unchanged Sections Skipped>

#### 6.3.2.2 TDD

<Unchanged Sections Skipped>

##### 6.3.2.2.7 Single PMI with 4TX TypeI-SinglePanel Codebook

For the parameters specified in Table 6.3.2.2.7-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.2.7-2.

Table 6.3.2.2.7-1: 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 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 Annex B.2.3.2.3. | | | |

Table 6.3.2.2.7-2: Minimum requirement

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | 1.3 |

<Unchanged Sections Skipped>

#### 8.3.2.2 TDD

##### 8.3.2.2.1 Single PMI with 2TX TypeI-SinglePanel Codebook

For the parameters specified in Table 8.3.2.2.1-1, and using the downlink physical channels specified in Annex C.5.1, the minimum requirements are specified in Table 8.3.2.2.1-2.

Table 8.3.2.2.1-1: Test parameters (single layer)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **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  periodicity 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  periodicity 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  periodicity 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 periodicity 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 8.3.2.2.1-2: Minimum requirement

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Test 1** | **Test 2** |
| ** | 1.05 | 1.05 |

<Unchanged Sections Skipped>

### A.3.2.2 TDD

<Unchanged Sections Skipped>

Table A.3.2.2.2-8: PDSCH Reference Channel for TDD PMI reporting requirements with UL-DL pattern FR1.30-1

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Unit** | **Value** | | | | |
| Reference channel |  | R.PDSCH.2-8.1 TDD | R.PDSCH.2-8.2 TDD | R.PDSCH.2-8.3 TDD | R.PDSCH.2-8.4 TDD |  |
| Channel bandwidth | MHz | 40 | 40 | 40 | 20 |  |
| Subcarrier spacing | kHz | 30 | 30 | 30 | 30 |  |
| Allocated resource blocks | PRBs | 106 | 106 | 106 | 51 |  |
| Number of consecutive PDSCH symbols |  | 12 | 12 | 12 | 12 |  |
| Allocated slots per 2 frames |  | 23 | 23 | 23 | 23 |  |
| MCS table |  | 64QAM | 64QAM | 64QAM | 64QAM |  |
| MCS index |  | 13 | 13 | 20 | 13 |  |
| Modulation |  | 16QAM | 16QAM | 64QAM | 16QAM |  |
| Target Coding Rate |  | 0.48 | 0.48 | 0.55 | 0.48 |  |
| Number of MIMO layers |  | 1 | 2 | 2 | 1 |  |
| Number of DMRS REs (Note 3) |  | 24 | 24 | 24 | 24 |  |
| Overhead for TBS determination |  | 0 | 0 | 0 | 0 |  |
| Information Bit Payload per Slot |  |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 10) = {7,8,9} for i from {0,…,39} | Bits | N/A | N/A | N/A | N/A |  |
| For CSI-RS Slot i, if mod(i,10) =1 for i from {0,…,39} | Bits | N/A | N/A | N/A | N/A |  |
| For Slot i = 20 | Bits | 24576 | 49176 | 83976 | 11784 |  |
| For Slot i, if mod(i, 10) = {0,2,3,4,5,6} for i from {1,…,19,22,…,39} | Bits | 24576 | 49176 | 83976 | 11784 |  |
| Transport block CRC per Slot |  |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 10) = {7,8,9} for i from {0,…,39} | Bits | N/A | N/A | N/A | N/A |  |
| For CSI-RS Slot i, if mod(i,10) =1 for i from {0,…,39} | Bits | N/A | N/A | N/A | N/A |  |
| For Slot i = 20 | Bits | 24 | 24 | 24 | 24 |  |
| For Slot i, if mod(i, 10) = {0,2,3,4,5,6} for i from {1,…,19,22,…,39} | Bits | 24 | 24 | 24 | 24 |  |
| Number of Code Blocks per Slot |  |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 10) = {7,8,9} for i from {0,…,39} | CBs | N/A | N/A | N/A | N/A |  |
| For CSI-RS Slot i, if mod(i,10) =1 for i from {0,…,39} | CBs | N/A | N/A | N/A | N/A |  |
| For Slot i = 20 | CBs | 3 | 6 | 10 | 2 |  |
| For Slot i, if mod(i, 10) = {0,2,3,4,5,6} for i from {1,…,19,22,…,39} | CBs | 3 | 6 | 10 | 2 |  |
| Binary Channel Bits Per Slot |  |  |  |  |  |  |
| For Slots 0 and Slot i, if mod(i, 10) = {7,8,9} for i from {0,…,39} | Bits | N/A | N/A | N/A | N/A |  |
| For CSI-RS Slot i, if mod(i,10) =1 for i from {0,…,39} | Bits | N/A | N/A | N/A | N/A |  |
| For Slot i = 20 | Bits | 48336 | 96672 | 145008 | 23256 |  |
| For Slot i, if mod(i, 10) = {0,2,3,4,5,6} for i from {1,…,19,22,…,39} | Bits | 50880 | 101760 | 152640 | 24480 |  |
| Max. Throughput averaged over 2 frames | Mbps | 28.2624 | 56.5524 | 96.5724 | 13.5516 |  |
| Note 1: SS/PBCH block is transmitted in slot #0 with periodicity 20 ms  Note 2: Slot i is slot index per 2 frames  Note 3: Number of DMRS REs includes the overhead of the DM-RS CDM groups without data | | | | | | |

<The end of Changes>