**3GPP TSG- Meeting #**

**, , 20 -**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  |  | **CR** |  | **rev** |  | **Current version:** |  |  |
|  | | | | | | | | |
| *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)*.* | | | | | | | | |
|  | | | | | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network |  | Core Network |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** |  | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** |  | | | | | | | | | |
| ***Source to TSG:*** |  | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_MIMO\_evo\_DL\_UL-Perf | | | | |  | ***Date:*** | | |  |
|  |  | | | |  | |  | | |  |
| ***Category:*** |  |  | | | | | ***Release:*** | | |  |
|  | *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-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)  Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Introduce PMI reporting requirements of typeII-doppler-r18 for FR1. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | For introducing PMI reporting requirements of typeII-doppler-r18 for FR1, add new clause 6.3.2.1.X1, 6.3.2.2.X2, 6.3.3.1.X3, 6.3.3.2.X4. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | There will be inconsist between specification and RAN4 agreements. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.3.2.1.X1 (New clause), 6.3.2.2.X2 (New clause), 6.3.3.1.X3 (New clause), 6.3.3.2.X4 (New clause) | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **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:*** | | Based on the draft big CR R4-2404756.  New clause: 6.3.2.1.X1, 6.3.2.2.X2, 6.3.3.1.X3, 6.3.3.2.X4 | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

*<START OF THE CHANGE 1>*

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 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' or typeII-doppler-r18 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.

*<END OF THE CHANGE 1>*

*<START OF THE CHANGE 2>*

6.3.2.1.X1 Multiple PMI with 16TX Enhanced Type II codebook for predicted PMI

For the parameters specified in Table 6.3.2.1.X1-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.1.X1-2.

**Table 6.3.2.1.X1-1: Test parameters (dual-layer)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** |
| Bandwidth | | MHz | 10 |
| Subcarrier spacing | | kHz | 15 |
| Duplex Mode | |  | FDD |
| Propagation channel | |  | TDLA30-TBD |
| 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 |
| The number of CSI-RS resources *(K)* |  | 4 |
| Number of CSI-RS ports (*X*) |  | 16 for CSI-RS resource 1,2,3,4 |
| CDM Type |  | CDM4 (FD2, TD2) for CSI-RS resource 1,2,3,4 |
| Density (ρ) |  | 1 for CSI-RS resource 1,2,3,4 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1, k2, k3) |  | Row 12, (2, 4, 6, 8) for CSI-RS resource 1,2,3,4 |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (5, -) for CSI-RS resource 1,2,3,4 |
| CSI-RS  interval and offset | slot | Not configured for CSI-RS resource 1,2,3,4 |
| aperiodicTriggeringOffset |  | 0 |
| Separation between two consecutive CSI-RS resources (*m*) | slot | 2 |
| 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 | |  | 1111111111111 |
| CSI-Report interval and offset | | slot | Not configured |
| Aperiodic Report Slot Offset | |  | 10 |
| CSI request | |  | 1 in slots i, where mod(i, 10) = 0, 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-doppler-r18 |
| *paramCombination-Doppler-r18* |  | 7  (L =4, *pν* =1/2, β=1/2 ) |
| R*(numberOfPMI-SubbandsPerCQI-Subband-r18)* |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (4,2) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,4) |
| CodebookSubsetRestriction |  | 0x 7FF FFFF FFFF |
| RI Restriction (*typeII-RI-Restriction-r18*) |  | 0010 |
| Doppler/time-domain basis vector length *(N4)* |  | 1 |
| Doppler-/time-domain unit duration (*d*) | slot | 1 |
| Prediction delay *(delta)* | slot | 1 |
| Physical channel for CSI report | |  | PUSCH |
| CQI/RI/PMI delay | | ms | 15 |
| Maximum number of HARQ transmission | |  | 4 |
| Measurement channel | |  | R.PDSCH.1-X.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 i1 wideband granularity and i2 subband 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. The random precoder generation shall follow 'typeI-SinglePanel' codebook configuration as specified in table 6.3.2.1.3-1.  Note 2: If the UE reports in an available uplink reporting instance at slot#n based on PMI estimation using a CSI-RS resource set in which the last CSI-RS resource is transmitted 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.X1-2: Minimum requirement**

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | [1.8] |

*<END OF THE CHANGE 2>*

*<START OF THE CHANGE 3>*

6.3.2.2.X2 Multiple PMI with 16Tx Enhanced Type II codebook for predicted PMI

For the parameters specified in Table 6.3.2.2.X2-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.2.X2-2.

**Table 6.3.2.2.X2-1: 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-TBD |
| 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 |
| The number of CSI-RS resources *(K)* |  | 4 |
| Number of CSI-RS ports (*X*) |  | 16 for CSI-RS resource 1,2,3,4 |
| CDM Type |  | CDM4 (FD2, TD2) for CSI-RS resource 1,2,3,4 |
| Density (ρ) |  | 1 for CSI-RS resource 1,2,3,4 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1, k2, k3) |  | Row 12, (2, 4, 6, 8) for CSI-RS resource 1,2,3,4 |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (5, -) for CSI-RS resource 1,2,3,4 |
| CSI-RS  interval and offset | slot | Not configured for CSI-RS resource 1,2,3,4 |
| aperiodicTriggeringOffset |  | 0 |
| Separation between two consecutive CSI-RS resources *(m)* | slot | 1 |
| 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 | |  | 11111111111111 |
| CSI-Report interval and offset | | slot | Not configured |
| Aperiodic Report Slot Offset | |  | 9 |
| CSI request | |  | 1 in slots i, where mod(i, 10) = 0, 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-doppler-r18 |
| *paramCombination-Doppler-r18* |  | 7  (L =4, *pν* =1/2, β=1/2 ) |
| R*(numberOfPMI-SubbandsPerCQI-Subband-r18)* |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (4,2) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,4) |
| CodebookSubsetRestriction |  | 0x 7FF FFFF FFFF |
| RI Restriction (*typeII-RI-Restriction-r18*) |  | 0010 |
| Doppler/time-domain basis vector length *(N4)* |  | 1 |
| Doppler-/time-domain unit duration (*d*) | slot | 1 |
| Prediction delay *(delta)* | slot | 1 |
| Physical channel for CSI report | |  | PUSCH |
| CQI/RI/PMI delay | | ms | 7.5 |
| Maximum number of HARQ transmission | |  | 4 |
| Measurement channel | |  | R.PDSCH.2-Y.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 i1 wideband granularity and i2 subband 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. 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 using a CSI-RS resource set in which the last CSI-RS resource is transmitted 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.X2-2: Minimum requirement**

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | [2.5] |

*<END OF THE CHANGE 3>*

*<START OF THE CHANGE 4>*

6.3.3.1.X3 Multiple PMI with 16Tx Enhanced Type II codebook for predicted PMI

For the parameters specified in Table 6.3.3.1.X3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.1.X3-2.

**Table 6.3.3.1.X3-1: Test parameters (dual-layer)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Parameter** | | **Unit** | **Test 1** |
| Bandwidth | | MHz | 10 |
| Subcarrier spacing | | kHz | 15 |
| Duplex Mode | |  | FDD |
| Propagation channel | |  | TDLA30-TBD |
| 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 |
| The number of CSI-RS resources *(K)* |  | 4 |
| Number of CSI-RS ports (*X*) |  | 16 for CSI-RS resource 1,2,3,4 |
| CDM Type |  | CDM4 (FD2, TD2) for CSI-RS resource 1,2,3,4 |
| Density (ρ) |  | 1 for CSI-RS resource 1,2,3,4 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1, k2, k3) |  | Row 12, (2, 4, 6, 8) for CSI-RS resource 1,2,3,4 |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (5, -) for CSI-RS resource 1,2,3,4 |
| CSI-RS  interval and offset | slot | Not configured for CSI-RS resource 1,2,3,4 |
| aperiodicTriggeringOffset |  | 0 |
| Separation between two consecutive CSI-RS resources *(m)* | slot | 2 |
| 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 | |  | 1111111111111 |
| CSI-Report interval and offset | | slot | Not configured |
| Aperiodic Report Slot Offset | |  | 10 |
| CSI request | |  | 1 in slots i, where mod(i, 10) = 0, 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-doppler-r18 |
| *paramCombination-Doppler-r18* |  | 7  (L =4, *pν* =1/2, β=1/2 ) |
| R*(numberOfPMI-SubbandsPerCQI-Subband-r18)* |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (4,2) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,4) |
| CodebookSubsetRestriction |  | 0x 7FF FFFF FFFF |
| RI Restriction (*typeII-RI-Restriction-r18*) |  | 0010 |
| Doppler/time-domain basis vector length *(N4)* |  | 1 |
| Doppler-/time-domain unit duration (*d*) | slot | 1 |
| Prediction delay *(delta)* | slot | 1 |
| Physical channel for CSI report | |  | PUSCH |
| CQI/RI/PMI delay | | ms | 15 |
| Maximum number of HARQ transmission | |  | 4 |
| Measurement channel | |  | R.PDSCH.1-X.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 i1 wideband granularity and i2 subband 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. 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 using a CSI-RS resource set in which the last CSI-RS resource is transmitted 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.X3-2: Minimum requirement**

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | [1.8] |

*<END OF THE CHANGE 4>*

*<START OF THE CHANGE 5>*

6.3.3.2.X4 Multiple PMI with 16Tx Enhanced Type II codebook for predicted PMI

For the parameters specified in Table 6.3.3.2.X4-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.3.2.X4-2.

**Table 6.3.3.2.X4-1: 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-TBD |
| 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 |
| The number of CSI-RS resources *(K)* |  | 4 |
| Number of CSI-RS ports (*X*) |  | 16 for CSI-RS resource 1,2,3,4 |
| CDM Type |  | CDM4 (FD2, TD2) for CSI-RS resource 1,2,3,4 |
| Density (ρ) |  | 1 for CSI-RS resource 1,2,3,4 |
| First subcarrier index in the PRB used for CSI-RS (k0, k1, k2, k3) |  | Row 12, (2, 4, 6, 8) for CSI-RS resource 1,2,3,4 |
| First OFDM symbol in the PRB used for CSI-RS (l0, l1) |  | (5, -) for CSI-RS resource 1,2,3,4 |
| CSI-RS  interval and offset | slot | Not configured for CSI-RS resource 1,2,3,4 |
| aperiodicTriggeringOffset |  | 0 |
| Separation between two consecutive CSI-RS resources *(m)* | slot | 1 |
| 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 | |  | 11111111111111 |
| CSI-Report interval and offset | | slot | Not configured |
| Aperiodic Report Slot Offset | |  | 9 |
| CSI request | |  | 1 in slots i, where mod(i, 10) = 0, 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-doppler-r18 |
| *paramCombination-Doppler-r18* |  | 7  (L =4, *pν* =1/2, β=1/2 ) |
| R*(numberOfPMI-SubbandsPerCQI-Subband-r18)* |  | 1 |
| (CodebookConfig-N1,CodebookConfig-N2) |  | (4,2) |
| (CodebookConfig-O1,CodebookConfig-O2) |  | (4,4) |
| CodebookSubsetRestriction |  | 0x 7FF FFFF FFFF |
| RI Restriction (*typeII-RI-Restriction-r18*) |  | 0010 |
| Doppler/time-domain basis vector length *(N4)* |  | 1 |
| Doppler-/time-domain unit duration (*d*) | slot | 1 |
| Prediction delay *(delta)* | slot | 1 |
| Physical channel for CSI report | |  | PUSCH |
| CQI/RI/PMI delay | | ms | 7.5 |
| Maximum number of HARQ transmission | |  | 4 |
| Measurement channel | |  | R.PDSCH.2-Y.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 i1 wideband granularity and i2 subband 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. 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 using a CSI-RS resource set in which the last CSI-RS resource is transmitted 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.X4-2: Minimum requirement**

|  |  |
| --- | --- |
| **Parameter** | **Test 1** |
| ** | [2.5] |

*<END OF THE CHANGE 5>*