**3GPP TSG-RAN WG4 Meeting #111  *Draft\_R4-2409912***

**Fukuoka City, Japan, May 20th - May. 25th,2024**

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.101-4** | **CR** | **draftCR** | **rev** | **-** | **Current version:** | **18.3.0** |  |
|  | | | | | | | | |
| *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:*** | DraftCR for 38.101-4 on PMI req for typeII-CJT-r18 for FR1 FDD | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Nokia | | | | | | | | | |
| ***Source to TSG:*** | R4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_MIMO\_evo\_DL\_UL-Perf | | | | |  | ***Date:*** | | | 2024-05-13 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-18 |
|  | *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:*** | | Introduction of minimum requirements for PMI typeI-CJT-r18 for FR1 FDD | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | Introduction of new sections for PMI requirements and addition of RMC for typeI-CJT-r18 for FR1 FDD | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | No PMI requirements will be defined for typeI-CJT-r18 for FR1 FDD. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.3, 6.3.2.1.X3 (New clause), 6.3.3.1.X3 (New clause) | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | |  | | |
| ***affected:*** | | **X** |  | Test specifications | | | | TS38.521-4 | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | |  | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

C

<< Start of 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-CJT-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.

<< Unchanged sections omitted>>

### 6.3.2 2RX requirements

#### 6.3.2.1 FDD

<< Unchanged sections omitted>>

##### 6.3.2.1.X3 Multiple PMI with 8 ports Enhanced Type II Codebook for CJT

For the parameters specified in Table 6.3.2.1.X3-1, and using the downlink physical channels specified in Annex C.3.1, the minimum requirements are specified in Table 6.3.2.1.X3-2.

Table 6.3.2.1.X3-1: Test parameters

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | |
| 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 | |
| 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 | |  | 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 | |
| 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 | | | |  | 1000,1001 | |
| TCI state | | | |  | TCI State #1 | |
| 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 | |
| QCL Type |  | Type A | |
| Type 2 QCL information | | | CSI-RS resource |  | N/A | |
| QCL Type |  | 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 #5 | Resource #6 |
| 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 | | | | |  | Mode2 | |
| timeRestrictionForChannelMeasurements | | | | |  | Not configured | |
| timeRestrictionForInterferenceMeasurements | | | | |  | Not configured | |
| cqi-FormatIndicator | | | | |  | Wideband | |
| pmi-FormatIndicator | | | | |  | Not Configured | |
| 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 | | |  | TypeII-CJT-r18 | |
| CodebookMode | | |  | Mode 2 | |
| (CodebookConfig-N1,CodebookConfig-N2) | | |  | (4,1) | |
| (CodebookConfig-O1,CodebookConfig-O2) | | |  | (4,1) | |
| CodebookSubsetRestriction | | |  | 0x FFFF | |
| paramCombination-CJT-L-r18 | | |  | 7 ({4, 4}) | |
| paramCombination-CJT-r18 | | |  | 4 (pν=1/4 and 1/8, β=1/2) | |
| 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 | |
| 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 subband granularity | |
| Note 1: PDSCH transmission is done from both TRxPs, where both TRxPs will send the same PDSCH data  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. For each TRP, use random type I SP PMI precoding independently.  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-7)], this reported PMI cannot be applied at the gNB downlink before slot#[(n+7)].  Note 4: 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.X3-2: Minimum requirement

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

<< Unchanged sections omitted>>

### 6.3.3 4RX requirements

#### 6.3.3.1 FDD

<< Unchanged sections omitted>>

##### 6.3.3.1.X3 Multiple PMI with 8 ports Enhanced Type II Codebook for CJT

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

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | |
| 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 | |
| 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 | |  | 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 | |
| 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 | | | |  | 1000,1001 | |
| TCI state | | | |  | TCI State #1 | |
| 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 | |
| QCL Type |  | Type A | |
| Type 2 QCL information | | | CSI-RS resource |  | N/A | |
| QCL Type |  | 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 #5 | Resource #6 |
| 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 | | | | |  | Mode2 | |
| timeRestrictionForChannelMeasurements | | | | |  | Not configured | |
| timeRestrictionForInterferenceMeasurements | | | | |  | Not configured | |
| cqi-FormatIndicator | | | | |  | Wideband | |
| pmi-FormatIndicator | | | | |  | Not Configured | |
| 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 | | |  | TypeII-CJT-r18 | |
| CodebookMode | | |  | Mode 2 | |
| (CodebookConfig-N1,CodebookConfig-N2) | | |  | (4,1) | |
| (CodebookConfig-O1,CodebookConfig-O2) | | |  | (4,1) | |
| CodebookSubsetRestriction | | |  | 0x FFFF | |
| paramCombination-CJT-L-r18 | | |  | 7 ({4, 4}) | |
| paramCombination-CJT-r18 | | |  | 4 (pν=1/4 and 1/8, β=1/2) | |
| RI Restriction | | |  | 00000010 | |
| Physical channel for CSI report | | | | |  | PUSCH | |
| CQI/RI/PMI delay | | | | | ms | 14 | |
| Maximum number of HARQ transmission | | | | |  | 4 | |
| Measurement channel | | | | |  | R.PDSCH.1-6.3 | |
| 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: PDSCH transmission is done from both TRxPs, where both TRxPs will send the same PDSCH data  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. For each TRP, use random type I SP PMI precoding independently.  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-7), this reported PMI cannot be applied at the gNB downlink before slot# (n+7).  Note 4: 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.X3-2: Minimum requirement

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

## << End of change 1>>