**3GPP TSG-RAN WG1 Meeting #108-eR1-22xxxxx**

**E-Meeting, February 21 – March 3, 2022**

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| *CR-Form-v12.2* |
| **DRAFT CHANGE REQUEST** |
|  |
|  | **38.212** | **CR** |  | **rev** |  | **Current version:** | **17.0.0** |  |
|  |
| *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 | **X** | Core Network |  |

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| --- |
|  |
| ***Title:***  | Corrections on Further enhancements on MIMO for NR in TS 38.212 |
|  |  |
| ***Source to WG:*** | Huawei |
| ***Source to TSG:*** | R1 |
|  |  |
| ***Work item code:*** | NR\_FeMIMO |  | ***Date:*** | 2022-03-08 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***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 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-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
|  |  |
| ***Reason for change:*** | 1. Capture agreements on UE reporting of UE capability value (UE panel type) along with CRI/SSBRI for UE-initiated panel activation and selection
2. Incorporate the TP in Section 2 of R1-2202647 on CSI enhancements.
3. Incorporate the TP for TS 38.212 in section 1 of in R1-2202637 on the field of PTRS-DMRS association.
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|  |  |
| ***Summary of change:*** | 1. Capture agreements on UE reporting of UE capability value (UE panel type) along with CRI/SSBRI for UE-initiated panel activation and selection in section 6.3.1.1.2
2. Clarify the mapping order of $K^{NZ}$ in section 6.3.2.1.2.
3. Clarify that when SRS resource set indicator indicates "10" and "11", the MSB and LSB of PTRS-DMRS association applies to two TRPs, in sections 7.3.1.1.2 and 7.3.1.1.3.
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|  |  |
| ***Consequences if not approved:*** | The specification for Further enhancements on MIMO is incomplete or inaccurate. |
|  |  |
| ***Clauses affected:*** | 6.3.1.1.2, 6.3.2.1.2, 7.3.1.1.2, 7.3.1.1.3 |
|  |  |
|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  |  |
| ***affected:*** |  | **X** |  Test specifications |   |
| ***(show related CRs)*** |  | **X** |  O&M Specifications |  |
|  |  |
| ***Other comments:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

##### 6.3.1.1.2 CSI only

< Unchanged parts are omitted >

The bitwidth for CRI, SSBRI, RSRP, differential RSRP, and CapabilityIndex are provided in Table 6.3.1.1.2-6.

**Table 6.3.1.1.2-6: CRI, SSBRI, RSRP, and CapabilityIndex**

|  |  |
| --- | --- |
| **Field** | **Bitwidth** |
| CRI |  |
| SSBRI |  |
| RSRP | 7 |
| Differential RSRP | 4 |
| CapabilityIndex | x |

where  is the number of CSI-RS resources in the corresponding resource set, and  is the configured number of SS/PBCH blocks in the corresponding resource set for reporting 'ssb-Index-RSRP'.

The bitwidth for CRI, SSBRI, SINR, differential SINR, and CapabilityIndex are provided in Table 6.3.1.1.2-6A.

**Table 6.3.1.1.2-6A: CRI, SSBRI, SINR, and CapabilityIndex**

|  |  |
| --- | --- |
| **Field** | **Bitwidth** |
| CRI | $$\left⌈log\_{2}\left(K\_{s}^{CSI-RS}\right)\right⌉$$ |
| SSBRI | $$\left⌈log\_{2}\left(K\_{s}^{SSB}\right)\right⌉$$ |
| SINR | 7 |
| Differential SINR | 4 |
| CapabilityIndex | x |

where $K\_{s}^{CSI-RS}$ is the number of CSI-RS resources in the corresponding resource set, and $K\_{s}^{SSB}$ is the configured number of SS/PBCH blocks in the corresponding resource set for reporting 'ssb-Index-SINR'.

< Unchanged parts are omitted >

**Table 6.3.1.1.2-8: Mapping order of CSI fields of one report for CRI/RSRP or SSBRI/RSRP or CRI/RSRP/CapabilityIndex or SSBRI/RSRP/CapabilityIndex reporting, or mapping order of CSI fields of one report for inter-cell SSBRI/RSRP reporting**

|  |  |
| --- | --- |
| **CSI report number** | **CSI fields** |
| CSI report #n | CRI or SSBRI #1 as in Table 6.3.1.1.2-6, if reported |
| CRI or SSBRI #2 as in Table 6.3.1.1.2-6, if reported |
| CRI or SSBRI #3 as in Table 6.3.1.1.2-6, if reported |
| CRI or SSBRI #4 as in Table 6.3.1.1.2-6, if reported |
| RSRP #1 as in Table 6.3.1.1.2-6, if reported |
| Differential RSRP #2 as in Table 6.3.1.1.2-6, if reported |
| Differential RSRP #3 as in Table 6.3.1.1.2-6, if reported |
| Differential RSRP #4 as in Table 6.3.1.1.2-6, if reported |
| CapabilityIndex #1 as in Table 6.3.1.1.2-6, if reported |
| CapabilityIndex #2 as in Table 6.3.1.1.2-6, if reported |
| CapabilityIndex #3 as in Table 6.3.1.1.2-6, if reported |
| CapabilityIndex #4 as in Table 6.3.1.1.2-6, if reported |

**Table 6.3.1.1.2-8A: Mapping order of CSI fields of one report for CRI/SINR or SSBRI/SINR or CRI/SINR/CapabilityIndex or SSBRI/SINR/CapabilityIndex reporting**

|  |  |
| --- | --- |
| **CSI report number** | **CSI fields** |
| CSI report #n | CRI or SSBRI #1 as in Table 6.3.1.1.2-6A, if reported |
| CRI or SSBRI #2 as in Table 6.3.1.1.2-6A, if reported |
| CRI or SSBRI #3 as in Table 6.3.1.1.2-6A, if reported |
| CRI or SSBRI #4 as in Table 6.3.1.1.2-6A, if reported |
| SINR #1 as in Table 6.3.1.1.2-6A, if reported |
| Differential SINR #2 as in Table 6.3.1.1.2-6A, if reported |
| Differential SINR #3 as in Table 6.3.1.1.2-6A, if reported |
| Differential SINR #4 as in Table 6.3.1.1.2-6A, if reported |
| CapabilityIndex #1 as in Table 6.3.1.1.2-6, if reported |
| CapabilityIndex #2 as in Table 6.3.1.1.2-6, if reported |
| CapabilityIndex #3 as in Table 6.3.1.1.2-6, if reported |
| CapabilityIndex #4 as in Table 6.3.1.1.2-6, if reported |

< Unchanged parts are omitted >

##### 6.3.2.1.2 CSI

< Unchanged parts are omitted >

For CSI on PUSCH, two UCI bit sequences are generated,  and . The CSI fields of all CSI reports, in the order from upper part to lower part in Table 6.3.2.1.2-6, are mapped to the UCI bit sequence  starting with . The CSI fields of all CSI reports, in the order from upper part to lower part in Table 6.3.2.1.2-7, are mapped to the UCI bit sequence  starting with .

The mapping order of CSI fields of one report for CRI/RSRP or SSBRI/RSRPor CRI/RSRP/CapabilityIndex or SSBRI/RSRP/CapabilityIndex reporting is provided in Table 6.3.1.1.2-8. The mapping order of CSI fields of one report for inter-cell SSBRI/RSRP reporting is provided in Table 6.3.1.1.2-8. The mapping order of CSI fields of one report for CRI/SINR or SSBRI/SINR or CRI/SINR/CapabilityIndex or SSBRI/SINR/CapabilityIndex reporting is provided in Table 6.3.1.1.2-8A. The mapping order of CSI fields of one report for group-based CRI/RSRP or SSBRI/RSRP reporting is provided in Table 6.3.1.1.2-8B. The procedure in clause 6.3.2 described for CSI part 1 is also applicable for one report for CRI/RSRP, SSBRI/RSRP, CRI/SINR, or SSBRI/SINR reporting.

**Table 6.3.2.1.2-3: Mapping order of CSI fields of one CSI report, CSI part 1**

|  |  |
| --- | --- |
| **CSI report number** | **CSI fields** |
| CSI report #nCSI part 1 | CRI as in Tables 6.3.1.1.2-3/4/6, if reported |
| Rank Indicator as in Tables 6.3.1.1.2-3/4/5 or 6.3.2.1.2-8/9, if reported |
| Wideband CQI for the first TB as in Tables 6.3.1.1.2-3/4/5 or 6.3.2.1.2-8/9, if reported |
| Subband differential CQI for the first TB with increasing order of subband number as in Tables 6.3.1.1.2-3/4/5 or 6.3.2.1.2-8/9, if reported |
| Indicator of the number of non-zero wideband amplitude coefficients $M\_{0}$ for layer 0 as in Table 6.3.1.1.2-5, if reported |
| Indicator of the number of non-zero wideband amplitude coefficients $M\_{1}$ for layer 1 as in Table 6.3.1.1.2-5 (if the rank according to the reported RI is equal to one, this field is set to all zeros), if 2-layer PMI reporting is allowed according to the rank restriction in Clauses 5.2.2.2.3 and 5.2.2.2.4 [6, TS 38.214] and if reported |
| Indicator of the total number of non-zero coefficients summed across all layers $K^{NZ}$ as in Table 6.3.2.1.2-8/9, if reported |
| Note: Subbands for given CSI report *n* indicated by the higher layer parameter *csi-ReportingBand* are numbered continuously in the increasing order with the lowest subband of *csi-ReportingBand* as subband 0. |

< Unchanged parts are omitted >

The bitwidth for RI/CQI of codebookType= typeII-r16 or codebookType=typeII-PortSelection-r16 is provided in Table 6.3.2.1.2-8.

Table 6.3.2.1.2-8: RI and CQI of codebookType=typeII-r16 or typeII-PortSelection-r16

|  |  |
| --- | --- |
| Field | Bitwidth |
| Rank Indicator | $$min\left(2,\left⌈log\_{2}n\_{RI}\right⌉\right)$$ |
| Wide-band CQI | 4 |
| Subband differential CQI | 2 |
| Indicator of the total number of non-zero coefficients summed across all layers $K^{NZ}$ | $\left⌈log\_{2}(K\_{0})\right⌉$ if max allowed rank is 1;$\left⌈log\_{2}(2K\_{0})\right⌉$ otherwise |

where $n\_{RI}$ is the number of allowed rank indicator values according to Clauses 5.2.2.2.5 and 5.2.2.2.6 [6, TS 38.214],$ K\_{0}=\left⌈2L\left⌈p\_{1}×\frac{N\_{3}}{R}\right⌉β\right⌉$, where $p\_{1}$, $N\_{3}$, $R$, and $β$ are given by Clause 5.2.2.2.5 and 5.2.2.2.6 in [6, TS 38.214]. The values of the rank indicator field are mapped to allowed rank indicator values with increasing order, where ‘0’ is mapped to the smallest allowed rank indicator value. The values of the $K^{NZ}$ indicator field are mapped to the allowed values of $K^{NZ}$, according to Clauses 5.2.2.2.5 and 5.2.2.2.6 [6, TS 38.214], with increasing order, where ‘0’ is mapped to $K^{NZ}=1$.

The bitwidth for RI/CQI of codebookType=typeII-PortSelection-r17 is provided in Table 6.3.2.1.2-9.

Table 6.3.2.1.2-9: RI and CQI of codebookType=typeII-PortSelection-r17

|  |  |
| --- | --- |
| Field | Bitwidth |
| Rank Indicator | $$min\left(2,\left⌈log\_{2}n\_{RI}\right⌉\right)$$ |
| Wide-band CQI | 4 |
| Subband differential CQI | 2 |
| Indicator of the total number of non-zero coefficients summed across all layers $K^{NZ}$ | $\left⌈log\_{2}(K\_{0})\right⌉$ if max allowed rank is 1;$\left⌈log\_{2}(2K\_{0})\right⌉$ otherwise |

where $n\_{RI}$ is the number of allowed rank indicator values according to Clauses 5.2.2.2.7 [6, TS 38.214],$ K\_{0}=\left⌈K\_{1}Mβ\right⌉$, where $K\_{1}$, $M$, and $β$ are given by Clause 5.2.2.2.7 in [6, TS 38.214]. The values of the rank indicator field are mapped to allowed rank indicator values with increasing order, where ‘0’ is mapped to the smallest allowed rank indicator value. The values of the $K^{NZ}$ indicator field are mapped to the allowed values of $K^{NZ}$, according to Clauses 5.2.2.2.7 [6, TS 38.214], with increasing order, where ‘0’ is mapped to $K^{NZ}=1$.

< Unchanged parts are omitted >

7.3.1.1.2 Format 0\_1

DCI format 0\_1 is used for the scheduling of one or multiple PUSCH in one cell, or indicating CG downlink feedback information (CG-DFI) to a UE.

< Unchanged parts are omitted >

- PTRS-DMRS association – number of bits determined as follows

- 0 bit if *PTRS-UplinkConfi*g is not configured in either *dmrs-UplinkForPUSCH-MappingTypeA* or *dmrs-UplinkForPUSCH-MappingTypeB* and transform precoder is disabled, or if transform precoder is enabled, or if *maxRank=1*;

- 2 bits otherwise, where Table 7.3.1.1.2-25/7.3.1.1.2-25A and 7.3.1.1.2-26 are used to indicate the association between PTRS port(s) and DMRS port(s) when one PT-RS port and two PT-RS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig* respectively, and the DMRS ports are indicated by the Antenna ports field. When the SRS resource set indicator field is present and *maxRank>2*, this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field according to Table 7.3.1.1.2-25 and 7.3.1.1.2-26. When the SRS resource set indicator field is present and equals "10" and "11" and *maxRank=2*, the MSB of this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator and/or Precoding information and number of layers field, and the LSB of this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to Second SRS resource indicator field and/or Second Precoding information field, according to Table 7.3.1.1.2-25A.

< Unchanged parts are omitted >

##### 7.3.1.1.3 Format 0\_2

DCI format 0\_2 is used for the scheduling of PUSCH in one cell.

< Unchanged parts are omitted >

- PTRS-DMRS association – number of bits determined as follows

- 0 bit if *PTRS-UplinkConfi*g is not configured in either *dmrs-UplinkForPUSCH-MappingTypeA* or *dmrs-UplinkForPUSCH-MappingTypeB* and transform precoder is disabled, or if transform precoder is enabled, or if *maxRankDCI-0-2=1*;

- 2 bits otherwise, where Table 7.3.1.1.2-25/7.3.1.1.2-25A and 7.3.1.1.2-26 are used to indicate the association between PTRS port(s) and DMRS port(s) when one PT-RS port and two PT-RS ports are configured by *maxNrofPorts* in *PTRS-UplinkConfig* respectively, and the DMRS ports are indicated by the Antenna ports field. When the SRS resource set indicator field is present and *maxRankDCI-0-2>2*, this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field according to Table 7.3.1.1.2-25 and 7.3.1.1.2-26 field according to Table 7.3.1.1.2-25 and 7.3.1.1.2-26. When the SRS resource set indicator field is present and equals "10" and "11" and *maxRankDCI-0-2=2*, the MSB of this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to SRS resource indicator field and/or Precoding information and number of layers field, and the LSB of this field indicates the association between PTRS port(s) and DMRS port(s) corresponding to Second SRS resource indicator field and/or Second Precoding information field, according to Table 7.3.1.1.2-25A.

< Unchanged parts are omitted >