**3GPP TSG RAN WG1 #107-e R1-21xxxxx**

**e-Meeting, November 11th – November 19th, 2021**

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| *CR-Form-v11.2* |
| **DRAFT CHANGE REQUEST** |
|  |
|  | **TS38.212** | **CR** | **0211** | **rev** | **-** | **Current version:** | **15.12.0** |  |
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| *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:***  | CR to 38.212 to clarify UCI bitwidth and UCI mapping order for non-PMI based CSI feedback |
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| ***Source to WG:*** | Moderator (Qualcomm Incorporated), ZTE, Ericsson, Huawei/HiSilicon |
| ***Source to TSG:*** | R1 |
|  |  |
| ***Work item code:*** | NR\_newRAT-Core |  | ***Date:*** | 2021-11-17 |
|  |  |  |  |  |
| ***Category:*** | **F** |  | ***Release:*** | Rel-15 |
|  | *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-12 (Release 12)**Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
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| ***Reason for change:*** | Non-PMI CSI feedback was introduced (with report quantity set to “cri-ri-cqi”) to NR since Rel-15. In non-PMI CSI feedback, CRI, RI, LI and CQI are reported, but their bitwidth and mapping order are not clearly defined in TS 38.212 spec.More specifically, in TS38.212 spec, * The UCI bitwidth table is defined per codebook. However, codebook is not configured for non-PMI based CSI feedback.
* The RI bitwidth is dependent on the allowable ranks in RI restriction configured with the codebook. However, for non-PMI based CSI, the allowable rank is defined by higher-layer parameter *PortIndexFor8Ranks*, and it is configured per CSI-RS resource. So the allowable rank may be different from one resource to another. The bitwidth defined for codebook based CSI cannot be reused.
* The UCI mapping table is defined based on the *pmi-FormatIndicator* and *cqi-FormatIndicator*. However, for non-PMI based CSI, the pmi-formatIndicator may not be configured.
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| ***Summary of change:*** | Following are clarified in TS 38.212 spec:* Clarify the UCI bitwidth, for non-PMI based CSI reporting by reusing the UCI bitwidth table defined for Type I single-panel (table 6.3.1.1.2-3), because they have similar bitwidth in reporting CLI, RI, LI and CQI.
* Adding a new row to table 6.3.1.1.2-3 to explicit describe the RI bitwidth for number of antenna ports being equal to 1, 2, 4 and 8. The RI field is mapped to rank values in increasing order, where ‘0’ is mapped to rank-1.
* For wideband CSI reporting on PUCCH, clarify the UCI mapping order for non-PMI based CSI by reusing table 6.3.1.1.2-7.
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| ***Consequences if not approved:*** | Ambiguity UCI bitwidth and mapping order for non-PMI based CSI. |
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| ***Clauses affected:*** | 6.3.1.1.2 |
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|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **N** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **N** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **N** |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** | * It is an alignment of UE and BS behavior based on common understanding among companies.
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### 6.3.1.1.2 CSI only

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The bitwidth for RI/LI/CQI/CRI of *codebookType=typeI-SinglePanel* or *reportQuantity* set to 'cri-RI-CQI' is provided in Tables 6.3.1.1.2-3.

Table 6.3.1.1.2-3: RI, LI, CQI, and CRI of *codebookType=typeI-SinglePanel*, or *reportQuantity* set to 'cri-RI-CQI'

|  |  |
| --- | --- |
| **Field** | **Bitwidth** |
| **1 antenna port** | **2 antenna ports** | **4 antenna ports** | **>4 antenna ports** |
| **Rank1~4** | **Rank5~8** |
| Rank Indicator when *codebookType=typeI-SinglePanel* | 0 |  |  |  |  |
| Rank Indicator when *reportQuantity* set to 'cri-RI-CQI' | 0 | 1 | 2 | 3 | 3 |
| Layer Indicator | 0 |  |  |  |  |
| Wide-band CQI for the first TB | 4 | 4 | 4 | 4 | 4 |
| Wideband CQI for the second TB | 0 | 0 | 0 | 0 | 4 |
| Subband differential CQI for the first TB | 2 | 2 | 2 | 2 | 2 |
| Subband differential CQI for the second TB | 0 | 0 | 0 | 0 | 2 |
| CRI |  |  |  |  |  |

 in Table 6.3.1.1.2-3 is the number of allowed rank indicator values according to Clause 5.2.2.2.1 [6, TS 38.214].  is the value of the rank. The value of  is the number of CSI-RS resources in the corresponding resource set. 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. For higher layer parameter *reportQuantity* set to 'cri-RI-CQI', the values of the rank indicator field are mapped to rank indicator values with increasing order, where '0' is mapped to rank-1.

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Table 6.3.1.1.2-7: Mapping order of CSI fields of one CSI report, *pmi-FormatIndicator=widebandPMI* and *cqi-FormatIndicator=widebandCQI, or reportQuantity* set to ‘cri-RI-CQI’ and *cqi-FormatIndicator=widebandCQI*

|  |  |
| --- | --- |
| CSI report number | CSI fields |
| CSI report #n | CRI as in Tables 6.3.1.1.2-3/4, if reported |
| Rank Indicator as in Tables 6.3.1.1.2-3/4, if reported |
| Layer Indicator as in Tables 6.3.1.1.2-3/4, if reported |
| Zero padding bits , if needed |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1/2, if reported |
| PMI wideband information fields , from left to right as in Tables 6.3.1.1.2-1/2, or codebook index for 2 antenna ports according to Clause 5.2.2.2.1 in [6, TS38.214], if reported |
| Wideband CQI for the first TB as in Tables 6.3.1.1.2-3/4, if reported  |
| Wideband CQI for the second TB as in Tables 6.3.1.1.2-3/4, if reported |

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