**3GPP TSG RAN WG1 #103-e R1-20xxxxx**

**e-Meeting, August 16th – August 27th, 2021**

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| *CR-Form-v11.2* |
| **DRAFT CHANGE REQUEST** |
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|  | **TS38.214** | **CR** | **draft** | **rev** | **-** | **Current version:** | **15.13.0** |  |
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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 38.214 clarification on coefficients packing order for Type II CSI |
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| ***Source to WG:*** | Qualcomm Incorporated |
| ***Source to TSG:*** | R1 |
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| ***Work item code:*** | NR\_newRAT-Core |  | ***Date:*** | 2021-08-18 |
|  |  |  |  |  |
| ***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:*** | In Rel-15 Type II CSI, a precoding matrix on a subband is obtained as linear combination of 2L spatial beams. Each linear combination coefficients are quantized by wideband amplitude (i.e., ), subband amplitude (i.e., ) and subband phase (i.e., ). For wideband amplitude, though not explicitly written in the spec, it seems that the only possible reporting order is following the beam indices. That is, the elements of are applied to the 1st, 2nd, …, the (2L-1)-th beam, respectively, where the beam indices are in increasing order. However, for subband amplitude and subband phase, there are two possible understandings.* Alt1: the elements of and are mapped following the same order as (i.e., based on beam indices)
* Alt2: the elements of and are mapped based on the beam strength, i.e., the value reported in wideband amplitude indicator .

For instance, let us consider L=4, subband amplitude is on, N\_PSK=8, and , and the first beam on first polarization is the strongest beam. Then, the top 6 strongest beams are the {0, 1, 4, 5, 6, 7}-th beams and are reported with 3-bit each for subband phase, while the subband phase for beam 2 and 3 are reported with 2-bit. In this case, Alt1 will map the bit sequence for as [001, 10, 11, 101, 111, 001, 010] for the {1, 2, 3, 4, 5, 6, 7}-th beams respectively, while Alt2 will map the bit sequence for as [001, 101, 111, 001, 010, 10, 11,] for the {1, 4, 5, 6, 7, 2, 3}-th beams respectively.We already identify mismatched behivaor between UE and gNB in testing, and would like to align the understanding among companies. Based on the discussion in email thread [106-e-NR-7.1CRs-08], there seems clear majority view on supporting Alt1. |
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| ***Summary of change:*** | In 38.214, clarify that the elements in , and are reported in the increasing order of their indices. |
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| ***Consequences if not approved:*** | Ambiguity on coefficients reporting order for type II CSI. |
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| ***Clauses affected:*** | 5.2.3 |
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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:*** | * Different maping order applied by UE and gNB would not affect the CSI reporting payload, but may degrade the performance dramatically. It is an alignment of UE and BS behavior based on common understanding among companies.
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### 5.2.3 CSI reporting on PUSCH

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For Type I and Type II CSI feedback on PUSCH, a CSI report comprises of two parts. Part 1 has a fixed payload size and is used to identify the number of information bits in Part 2. Part 1 shall be transmitted in its entirety before Part 2.

- For Type I CSI feedback, Part 1 contains RI (if reported), CRI (if reported), CQI for the first codeword (if reported). Part 2 contains PMI (if reported) and contains the CQI for the second codeword (if reported) when RI (if reported) is larger than 4.

- For Type II CSI feedback, Part 1 contains RI (if reported), CQI, and an indication of the number of non-zero wideband amplitude coefficients per layer for the Type II CSI (see clause 5.2.2). The fields of Part 1 – RI (if reported), CQI, and the indication of the number of non-zero wideband amplitude coefficients for each layer – are separately encoded. Part 2 contains the PMI of the Type II CSI. The elements of , and are reported in the increasing order of their indices, where the lowest index is mapped to the most significant bits and the last index to be reported is mapped to the least significant bits.. Part 1 and 2 are separately encoded.

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