**3GPP TSG-RAN WG1 Meeting #114 R1-23xxxxx**

**Toulouse, France, 21-25 August, 2023**

**Agenda Item: 9.17**

**Source: Moderator (Huawei)**

**Title: Summary of email discussion [Post114-38.212-NR\_MIMO\_evo\_DL\_UL]**

**Document for: Discussion and Decision**

# Introduction

This document summarizes the discussions on the 38.212 draft CR on NR MIMO Evolution for Downlink and Uplink, and aims to stabilize the 38.212 draft CR.

[Post114-38.212-NR\_MIMO\_evo\_DL\_UL] Email discussion on Rel-18 draft CRs by September 7 – Editors

# First round discussions

This section summarize the first round email discussions on draft CR v00. Companies are encouraged to provide the first round views by 09/05 (Tuesday), 6:00am UTC, then we can update the draft CR accordingly for the next step discussions.

## Multi-TRP enhancements

Please provide your comments/suggestions on Multi-TRP enhancements here, including unified TCI framework and two TAs for multi-DCI.

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| *Company* | *View* |
| Editor | The changes are marked with author “Yan Cheng\_post RAN1#114” on top of the version R1-2306315 endorsed in RAN1#113, which are to reflect the agreements RAN1#114. |
| QC | For two TAs for multi-DCI, our understanding is that the following agreements should be implemented in 38.212, Section 7.3.1.2.1 (DCI format 1\_0, the part that describes PDCCH order):**Agreement (RAN1 #114)**For inter-cell multi-DCI based Multi-TRP operation with two TA enhancement, support indication of additionalPCI in the PDCCH order* as baseline capability: support PRACH triggering towards servingCell PCI or active additionalPCI.

**Agreement (RAN1 #112-b)**For intercell multi-DCI based Multi-TRP operation with two TA enhancement, support indication of which PRACH configuration to be used in the RACH procedure in the PDCCH order.* FFS: Whether *additionalPCI* or a generic identifier is indicated in PDCCH order
* FFS: The detail of the indication in PDCCH order in terms of whether to support PRACHtriggered for inactive *additionalPCI*.

[Chengyan]: Yes, these agreements need to be captured in TS 38.212. However, there are still some uncertainty which will have impact on how to reflect it in the spec, e.g. the relationship with the “Cell indicator” field for R-18 LTM, do we need to introduce a separate field or just reuse the cell indicator field? I feel safer to reflect it later once more details are available. It would be great if the issue can be discussed and decided in next RAN1 meeting.  |
| Samsung | We would like to suggest the following change to unify the field(s) name in 1\_1 and 1\_2.[Chengyan]: Ok, will reflect accordingly in the next update.

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| 7.3.1.2.2 Format 1\_1- TCI ~~states~~ selection – 0 bit if higher layer parameter *tciSelection-PresentInDCI* is not enabled; otherwise 2 bits according to Table 7.3.1.2.2-11.  |

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| ZTE | Thanks for editor’s effort on this CR.**Comment#1**We share same view to QC that the new field in DCI format 1\_0 of the indication of PRACH triggering towards either serving cell or active additional PCI should be added in TS 38.212. Given that 1 bit is enough to fulfill this indication that CFRA configuration of PRACH triggering associated with CORESETPoolIndex of either serving cell PCI or the active additional PCI, one example is proposed as follows:--------------------------------------------------------- PRACH triggering indicator – 0 or 1 bit:- 1 bit if the higher layer parameter *[additionalCFRA-ToAddModList-r18]* is configured, where value 0 indicates that CFRA configuration of PRACH triggering associated with CORESETPoolIndex of serving cell PCI, and value 1 indicates that CFRA configuration of PRACH triggering associated with CORESETPoolIndex of the active additional PCI.- 0 bit otherwise.--------------------------------------------------------[Chengyan]: Please check my reply to Qualcomm above.  |
| Samsung2 | We agree with Qualcomm that the following agreement should be captured:**Agreement RAN1#114**For inter-cell multi-DCI based Multi-TRP operation with two TA enhancement, support indication of additionalPCI in the PDCCH order* as baseline capability: support PRACH triggering towards servingCell PCI or active additionalPCI.

The agreement says that the additionalPCI is indicated in the PDCCH order, so we prefer to include 3-bits for the additionalPCI, which is from 1 to 7. With a value “0” indicating the serving cell.[Chengyan]: Please check my reply to Qualcomm above. |
| NEC | **Comment 1**One typo in **section 7.3.1.1.3,** which should be DCI format 0\_2When the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for the first CORESETs, and is provided *coresetPoolIndex* with value 1 for the second CORESETs, and there are two SRS resource sets configured by *srs-ResourceSetToAddModListDCI-0-2* and associated with *usage* of value '*codebook*' or '*nonCodeBook*', the Precoding information and number of layers field is associated with the SRS resource set that is associated with the *coresetPoolIndex* value for the CORESET used for the PDCCH carrying the DCI format 0\_1.[Chengyan]: Thanks. Will reflect in the next update.  |
| Ericsson | Thank you for the draft CRSection 7.3.1.2.3: TCI selection – 0 bit if higher layer parameter *tciSelection-PresentInDCI* is not enabled; otherwise 2 bits according to Table 7.3.1.2.2-11. In RAN1#114, the following agreement was made**Agreement**Support joint configuration of the presence of “TCI states selection” field for DCI format 1\_1 and DCI format 1\_2 in the same DL BWPThere is thus no need for any further update. RAN1 agreed the same parameter is used for DCI format 1\_1 and DCI format 1\_2.[Chengyan]: Thanks. Will reflect in the next update.Section 7.3.1.2.1:We agree with Qualcomm and Samsung that the following agreement should be captured:**Agreement RAN1#114**For inter-cell multi-DCI based Multi-TRP operation with two TA enhancement, support indication of additionalPCI in the PDCCH order* as baseline capability: support PRACH triggering towards servingCell PCI or active additionalPCI.

The agreement is clear: additionalPci should be indicated in the PDCCH order. There is no agreement on how to facilitate legacy operation, i.e., to trigger a PDCCH order towards serving cell. We note that this issue also exists for LTM.[Chengyan]: Please check my reply to Qualcomm above. |
| CATT | According to TS 38.214, on the presence of TCI selection field, the UE has to be configured with the higher layer parameter *tciSelection-PresentInDCI*. However, in TS 38.212, the presence of TCI selection field depends on whether the higher layer parameter *tciSelection-PresentInDCI* is enabled or not. There may be misunderstanding on the parameter. For alignment, we prefer to revise the description in TS 38.212 as follows:- TCI selection – 0 bit if higher layer parameter *tciSelection-PresentInDCI* is not ~~enabled~~ configured; otherwise 2 bits according to Table 7.3.1.2.2-11. [Chengyan]: It seems there should be no misunderstanding, but I am fine to update accordingly.  |

## CSI enhancements

Please provide your comments/suggestions on CSI enhancements here, including CSI enhancement for high/medium UE velocities and coherent JT (CJT).

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| *Company* | *View* |
| Editor | The changes are marked with author “Yan Cheng\_post RAN1#114” on top of the version R1-2306315 endorsed in RAN1#113, which are to reflect the agreements RAN1#114. |
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## Reference signal enhancement

Please provide your comments/suggestions on Reference signal enhancements here, including increased number of orthogonal DMRS ports and SRS enhancements.

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| *Company* | *View* |
| Editor | The changes are marked with author “Yan Cheng\_post RAN1#114” on top of the version R1-2306315 endorsed in RAN1#113, which are to reflect the agreements RAN1#114. |
| ZTE (DMRS) | Thanks for editor’s effort on this CR.**Comment#1**Similar to the title of Table 73112-25B, the condition “*maxRank>4*” should be added to keep alignment with the following agreement endorsed in RAN1#114 meeting.**Agreement (RAN1#114)**For partial/non-coherent PUSCH, if 2 port PTRS is configured in *maxNrofPorts* in *PTRS-UplinkConfig*, and if more than 4 layers is configured in *maxMIMO-Layers* [or *MaxMIMO-LayersDCI-0-2* in *PUSCH-ServingCellConfig],** + Alt.1: The size of PTRS-DMRS association field is 4-bit in DCI format 0\_1 [or DCI format 0\_2].

Table 1: PTRS-DMRS association for UL PTRS ports 0 and 1

|  |  |  |  |
| --- | --- | --- | --- |
| **Value of MSB** | **DMRS port** | **Value of LSB** | **DMRS port** |
| 0 | 1st DMRS port which shares PTRS port 0 | 0 | 1st DMRS port which shares PTRS port 1 |
| 1 | 2nd DMRS port which shares PTRS port 0 | 1 | 2nd DMRS port which shares PTRS port 1 |
| 2 | 3rd DMRS port which shares PTRS port 0 | 2 | 3rd DMRS port which shares PTRS port 1 |
| 3 | 4th DMRS port which shares PTRS port 0 | 3 | 4th DMRS port which shares PTRS port 1 |

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| **Proposed changed (Section 7.3.1.1.2)****Table 7.3.1.1.2-26A: PTRS-DMRS association for UL PTRS ports 0 and 1, *maxRank>4***

|  |  |  |  |
| --- | --- | --- | --- |
| **Value of 2 MSBs** | **DMRS port** | **Value of 2 LSBs** | **DMRS port** |
| 0 | 1st DMRS port which shares PTRS port 0 | 0 | 1st DMRS port which shares PTRS port 1 |
| 1 | 2nd DMRS port which shares PTRS port 0 | 1 | 2nd DMRS port which shares PTRS port 1 |
| 2 | 3rd DMRS port which shares PTRS port 0 | 2 | 3rd DMRS port which shares PTRS port 1 |
| 3 | 4th DMRS port which shares PTRS port 0 | 3 | 4th DMRS port which shares PTRS port 1 |

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[Chengyan]: Thanks. Will reflect in the next update. **Comment#2**The indexes of several DMRS indication rows should be reordered as listed as following:* In Table 7.3.1.2.2-9, rows 35-55 should be reordered as rows 33-53.
* In Table 7.3.1.2.2-9A, rows 35-56 should be reordered as rows 33-54.
* In Table 7.3.1.2.2-10, rows 129-136 should be reordered as rows 128-137.
* In Table 7.3.1.2.2-10A, rows 129-137 should be reordered as rows 128-136, respectively.

[Chengyan]: Thanks. Will reflect in the next update.  |
| QC | Thank editor for the great effort to put together the CR. We have the following feedback for editor to consider. Agree with ZTE comment 2, expect the following typo. The indexes of several DMRS indication rows should be reordered as listed as following:* In Table 7.3.1.2.2-9, rows 35-55 should be reordered as rows 33-53.
* In Table 7.3.1.2.2-9A, rows 35-56 should be reordered as rows 33-54.
* In Table 7.3.1.2.2-10, rows 129-136 should be reordered as rows 128-135.
* In Table 7.3.1.2.2-10A, rows 129-137 should be reordered as rows 128-136, respectively.

[Chengyan]: Thanks. Will reflect in the next update. |
| vivo | Thanks a lot for editor’s effort.[Chengyan]: It looks to me the current version is clear enough, and there should be no other misunderstanding. Let’s keep it as it for now, and if later any issue identified then we can update. **Comment (section 7.3.1.1.2)**“where the selected codeword is the codeword with higher MCS for the initial PUSCH if the MCS indices of the two codewords are different for the initial PUSCH” is not very accurate. There are cases that the exactly selected codeword is the codeword for retransmitted PUSCH when only one codeword is retransmitted. For example, the first CW is for PUSCH retransmission and the second CW is for a new initial PUSCH, where the MCS of the first CW is higher than the second CW. Thus, what needed to be emphasized is the MCS obtained from the initial PUSCH, instead of the codeword for the initial PUSCH. There is a similar description in section 6.2.3 in CR of TS 38.214, using a similar wording would be fine.**Proposed changed (section 7.3.1.1.2)**2 bits when one PTRS port is configured by *maxNrofPorts* in *PTRS-UplinkConfig*, the SRS resource set indicator field is absent, *maxRank>4* and *multipanelScheme* is not configured, this field indicates the association between PTRS port and DMRS port(s) corresponding to the selected codeword according to Table 7.3.1.1.2-25B, where the selected codeword is the codeword with higher MCS ~~for the initial PUSCH~~ if the MCS indices of the two codewords are different ~~for the initial PUSCH~~, or codeword 0 otherwise. When a codeword is scheduled for PUSCH retransmission, the MCS for determining PT-RS association to codeword is obtained from the DCI for the same transport block for the initial PUSCH. |

## Enhanced uplink transmission

Please provide your comments/suggestions on enhanced uplink transmission here, including UL precoding indication for multi-panel transmission and SRI/TPMI enhancement for enabling 8TX UL transmission.

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| *Company* | *View* |
| Editor | The changes are marked with author “Yan Cheng\_post RAN1#114” on top of the version R1-2306315 endorsed in RAN1#113, which are to reflect the agreements RAN1#114. |
| QC (STxMP) | **Comment 1**: Based on the following agreement in RAN1 #114, the multi-DCI based STxMP PUSCH+PUSCH is enabled by a new RRC configuration (“enableSTx2PofmDCI”) in addition to configurations of two coresetPoolIndex values and two SRS resource sets. We suggest to also add this condition in various places where multi-DCI based STxMP PUSCH+PUSCH is discussed.**Agreement*** Regarding how to configure multi-DCI based STxMP PUSCH+PUSCH in RRC,
* Introduce a new RRC parameter to indicate the multi-DCI based STxMP PUSCH+PUSCH. The multi-DCI based STxMP PUSCH+PUSCH is configured when the new RRC parameter is configured, two different *coresetPoolIndex* values are configured and two SRS resource sets for CB/NCB are configured.

When multi-DCI based STxMP PUSCH+PUSCH is configured, the DCI field SRS resource set indicator is not present.[Chengyan]: Thanks. Will reflect in the next update. **Comment 2**: The last codepoint of SRS resource set indicator in Table 7.3.1.1.2-36 should be reserved / not used for SDM/SFN schemes based on the following agreement. A note can be added to the Table to capture this.**Agreement**When the single-DCI based PUSCH SDM/SFN is configured, the codepoint ‘11’ of the DCI field SRS resource set indicator is reserved.[Chengyan]: Thanks. Will reflect in the next update. **Comment 3**: In Section 7.3.1.1.3 (DCI format 0\_2), there are a couple of instances (copied below), where instead of DCI format 0\_2, DCI format 0\_1 is mentioned (typo):- $N\_{SRS}$ is the number of configured SRS resources in the SRS resource set associated with the *coresetPoolIndex* value for the CORESET used for the PDCCH carrying the DCI format 0\_1, if the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for the first CORESETs, and is provided *coresetPoolIndex* with value 1 for the second CORESETs,**…**When the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for the first CORESETs, and is provided *coresetPoolIndex* with value 1 for the second CORESETs, and there are two SRS resource sets configured by *srs-ResourceSetToAddModListDCI-0-2* and associated with *usage* of value '*codebook*' or '*nonCodeBook*', the Precoding information and number of layers field is associated with the SRS resource set that is associated with the *coresetPoolIndex* value for the CORESET used for the PDCCH carrying the DCI format 0\_1.[Chengyan]: Thanks. Will reflect in the next update. **Comment 4**: Some of the editor’s notes may not be needed anymore given the outcome of RAN1 #114, like the followings notes:“Editor’s note: No agreement on “11” yet, will further update later if needed depending on further agreement”“Editor’s note: There is no agreement on what to do when *multipanelScheme* is configured to *sfnScheme. Further update will be done once there is further agreement.*”[Chengyan]: Thanks. Will reflect in the next update. |
| MediaTek (STxMP) | Thanks for your great effort on the draft CR. Please find our comments bellow.[Chengyan]: In my understanding, when *enableSTx2PofmDCI* is configured, the condition for the 2 bits case will not be met, therefore there is no need to further clarify that 2 bits is applied only when the RRC parameter *enableSTx2PofmDCI* is not configured. 7.3.1.1.2 Format 0\_1& 7.3.1.1.3 Format 0\_2**Comment:** Based on RAN1 agreement, multi-DCI based STxMP PUSCH+PUSCH is configured/enabled by the new RRC parameter. Therefore, the presence of SRS resource set indicator should depend on not only the configuration of *coresetPoolIndex* but also the new RRC parameter.Thus, we suggest the following changes to DCI format 0\_1 and 0\_2:

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| - SRS resource set indicator – 0 or 2 bits- 2 bits according to Table 7.3.1.1.2-36 if - *txConfig = nonCodeBook*, and there are two SRS resource sets configured by *srs-ResourceSetToAddModList* and associated with the *usage* of value '*nonCodeBook*', and is not configured with *coresetPoolIndex* or the value of *coresetPoolIndex* is the same for all CORESETs if *coresetPoolIndex* is provided, and the higher layer parameter *enableSTx2PofmDCI* is not configured or- *txConfig*=*codebook*, and there are two SRS resource sets configured by *srs-ResourceSetToAddModList* and associated with *usage* of value '*codebook*', and is not configured with *coresetPoolIndex* or the value of *coresetPoolIndex* is the same for all CORESETs if *coresetPoolIndex* is provided, and the higher layer parameter *enableSTx2PofmDCI* is not configured;- 0 bit otherwise. |

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| ZTE (STxMP) | Thanks for editor’s effort on this CR.**Comment#1**In section 7.3.1.1.3, “DCI format 0\_1” should be changed to “DCI format 0\_2”. Hence we have the following suggestion.[Chengyan]: Thanks. Will reflect in the next update.

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| **Proposed change (section 7.3.1.1.3) :**...- $\left⌈log\_{2}N\_{SRS, 0\\_2}\right⌉ $ bits according to Tables 7.3.1.1.2-32 if the higher layer parameter *txConfig = codebook*, where- $N\_{SRS, 0\\_2}$ is the number of configured SRS resources in the SRS resource set indicated by SRS resource set indicator field if present,- $N\_{SRS}$ is the number of configured SRS resources in the SRS resource set associated with the *coresetPoolIndex* value for the CORESET used for the PDCCH carrying the DCI format 0\_2~~1~~, if the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for the first CORESETs, and is provided *coresetPoolIndex* with value 1 for the second CORESETs, - otherwise $N\_{SRS, 0\\_2}$ is the number of configured SRS resources in the SRS resource set configured by higher layer parameter *srs-ResourceSetToAddModListDCI-0-2* and associated with the higher layer parameter *usage* of value '*codeBook*', where the SRS resource set is composed of the first $N\_{SRS, 0\\_2}$ SRS resources together with other configurations in the SRS resource set configured by higher layer parameter *srs-ResourceSetToAddModList*, if any, and associated with the higher layer parameter *usage* of value '*codeBook*', except for the higher layer parameters *'srs-ResourceSetId' and 'srs-ResourceIdList'*....When the UE is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with value 0 for the first CORESETs, and is provided *coresetPoolIndex* with value 1 for the second CORESETs, and there are two SRS resource sets configured by *srs-ResourceSetToAddModListDCI-0-2* and associated with *usage* of value '*codebook*' or '*nonCodeBook*', the Precoding information and number of layers field is associated with the SRS resource set that is associated with the *coresetPoolIndex* value for the CORESET used for the PDCCH carrying the DCI format 0\_2~~1~~.... |

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| ZTE (8Tx) | Thanks for editor’s effort on this CR.**Comment #1**In section 7.3.1.1.2 for DCI Format 0\_1 of the draft CR, there are several descriptions on transform precoder is enabled for 8Tx as shown below.

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| - Precoding information and number of layers – number of bits determined by the following:- 0 bits if the higher layer parameter *txConfig = nonCodeBook*;- 0 bits for 1 antenna port and if the higher layer parameter *txConfig = codebook*;...- 7 bits according to Table 7.3.1.1.2-5B for 8 antenna ports, if *CodebookType*=*Codebook1,* transform precoder is disabled, *maxRank* = *8*, and according to *ULcodebookFC-N1N2*;- 7 bits according to Table 7.3.1.1.2-5C for 8 antenna ports, if *CodebookType*=*Codebook1*, transform precoder is disabled, *maxRank* =7, and according to *ULcodebookFC-N1N2;*- 7 bits according to Table 7.3.1.1.2-5D for 8 antenna ports, if *CodebookType*=*Codebook1*, transform precoder is disabled, *maxRank* =4, 5 or 6, and according to *maxRank;*- 4, 6 or 7 bits according to Table 7.3.1.1.2-5E for 8 antenna ports, if *CodebookType*=*Codebook1*, transform precoder is enabled or *maxRank* =2 or 3 if transform precoder is disabled, and according to transform precoder and *maxRank*;- 8 bits according to Table 7.3.1.1.2-5F for 8 antenna ports, if *CodebookType*=*Codebook4,* transform precoder is disabled, *maxRank*=5, 6, 7 or 8, and according to *maxRank;*- 6 or 7 or 8 bits according to Table 7.3.1.1.2-5G for 8 antenna ports, if *CodebookType*=*Codebook4,* transform precoder is disabled, *maxRank*=2, 3 or 4, and according to *maxRank;*- 3 bits according to Table 7.3.1.1.2-5H for 8 antenna ports, if *CodebookType*=*Codebook4,* transform precoder is enabled....**Table 7.3.1.1.2-5E: Precoding information and number of layers, for 8 antenna ports, if transform precoder is enabled or *maxRank*=2 or 3 if transform precoder is disabled, *CodebookType=Codebook1, ULcodebookFC-N1N2 = (4,1) or (2,2)***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Bit field mapped to index | transform precoder is disabled or enabled, *maxRank*=1 | Bit field mapped to index | transform precoder is ~~enabled~~disabled, and *maxRank*=2 | Bit field mapped to index | transform precoder is ~~enabled~~disabled, and *maxRank=3* |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| 1 | 1 layer: TPMI=1 | 1 | 1 layer: TPMI=1 | 1 | 1 layer: TPMI=1 |
| … | … | … | … | … | … |
| 15 | 1 layer: TPMI=15 | 15 | 1 layer: TPMI=15 | 15 | 1 layer: TPMI=15 |
|  |  | 16 | 2 layer2: TPMI=0 | 16 | 2 layer2: TPMI=0 |
|  |  | 17 | 2 layer2: TPMI=1 | 17 | 2 layer2: TPMI=1 |
|  |  | … | … | … | … |
|  |  | 47 | 2 layers: TPMI=31 | 47 | 2 layers: TPMI=31 |
|  |  | 48-63 | reserved | 48 | 3 layers: TPMI=0 |
|  |  |  |  | 49 | 3 layers: TPMI=1 |
|  |  |  |  | … | … |
|  |  |  |  | 71 | 3 layers: TPMI=23 |
|  |  |  |  | 72-127 | reserved |

**...****Table 7.3.1.1.2-5H: Precoding information and number of layers, for 8 antenna ports, if transform precoder is enabled or disabled, and *CodebookType=Codebook4***

|  |  |
| --- | --- |
| Bit field mapped to index | Precoding information and number of layers |
| 0 | 1 layer: TPMI=0 |
| … | … |
| 7 | 1 layer: TPMI=7 |

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To our understanding, it has not been discussed 8Tx precoder when transform precoding is enabled. According to the current draft CR for 38.211 as shown below, it was assumed that:* single layer precoder of Ng=1 and Ng=8 can be supported when transform precoding is enabled or disabled with same set of precoders,
* for more than one layer, only disabled transform precoding is supported, as in legacy.

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| Table 6.3.1.5-9: Precoding matrix $W$ type (4,1) with one antenna group for single-layer transmission using eight antenna ports....Table 6.3.1.5-10: Precoding matrix $W$ type (4,1) with one antenna group for two-layer transmission using eight antenna ports with transform precoding disabled....Table 6.3.1.5-16: Precoding matrix $W$ type (4,1) with one antenna group for eight-layer transmission using eight antenna ports with transform precoding disabled. ...Table 6.3.1.5-47: Precoding matrix $W$ with 8 antenna groups for transmission using eight antenna ports. Up to 8 layers are supported with transform precoding disabled and up to one layer with transform precoding enabled.... |

So we suggest to modify the above mentioned parts to reflect same principles (red text above) as in 38.211 for the case when transform precoding enabled. [Chengyan]: Good comments. Will reflect in the next update following legacy behavior. **Comment #2**In section 7.3.1.1.2 for DCI Format 0\_1 of the draft CR, it seems that the scheme highlighted below as defined in Table 7.3.1.1.2-29B cannot match the legacy scheme, so it is not directly extended based on legacy scheme.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| Table 7.3.1.1.2-29B: SRI indication, for non-codebook based PUSCH transmission, $N\_{SRS}>4$, $L\_{max}=2$

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Bit field mapped to index | SRI(s), $N\_{SRS}=5$ | Bit field mapped to index | SRI(s), $N\_{SRS}=6$ | Bit field mapped to index | SRI(s), $N\_{SRS}=7$ | Bit field mapped to index | SRI(s), $N\_{SRS}=8$ |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| 5 | $$s\_{0}^{5},s\_{1}^{5}$$ | 5 | 5 | 5 | 5 | 5 | 5 |
| … | … | 6 | $$s\_{0}^{6},s\_{1}^{6}$$ | 6 | 6 | 6 | 6 |
| 14 | $$s\_{0}^{14},s\_{1}^{14}$$ | … | … | 7 | $$s\_{0}^{7},s\_{1}^{7}$$ | 7 | 7 |
| 15 | reserved | 20 | $$s\_{0}^{20},s\_{1}^{20}$$ | … | … | 8 | $$s\_{0}^{8},s\_{1}^{8}$$ |
|  |  | 21-31 | reserved | 27 | $$s\_{0}^{27},s\_{1}^{27}$$ | … | … |
|  |  |  |  | 28-31 | reserved | 35 | $$s\_{0}^{35},s\_{1}^{35}$$ |
|  |  |  |  |  |  | 36-63 | reserved |
| where a bit field value (B) is mapped to SRIs $\left\{s\_{i}^{B}\right\},i\in \{0,1,…,υ-1\}$ by the following, where $υ$ is the number of layers: $k\_{-1}=0$ For $i=0,1,…,υ-1$ Find the largest $x^{\*}\in \left\{0,…,N\_{SRS}-1\right\}$ in Table 5.2.2.2.5-4 of [6, TS 38.214] such that $B-\sum\_{j=1}^{υ-1}C(N\_{SRS},j)-k\_{i-1}\geq C(x^{\*}, υ-i)$ $k\_{i}=k\_{i-1}+C(x^{\*},υ-i)$  $s\_{υ-1-i}^{B}=x^{\*}$ |

 |

[Chengyan]: As shown in the editor’s note, if there is any bug we can update accordingly. It seems I didn’t see any bug from your comments above. Personally I really don’t understand why we cannot take this concise way. Anyway, it seems you have strong concern on it, and considering that we don’t think we have sufficient time to discuss more here, I am fine to update to put the tables here directly instead, please check the updated CR. By the way, the tables you provided below is not clear for some cases. For Nsrs = 4, Lmax = 4, the orders are different between the legacy scheme and the one in draft CR. For other Nsrs > 4, e.g, Nsrs =5, So we suggest to adopt an enumerated scheme for mapping SRI to the SRS resource combinations in TS 38.212 on the top of the endorsed CR, instead of an explicit formula which has not been agreed. E.g., as follows. Likewise, other cases can take the same formula to the indicated SRS combinations for NCB PUSCH in Table 7.3.1.1.2-29B/29C/30B/30C/31B/31C/31D/31E/31F/31G/31H/31I/31J/31K.**Table 1** Enumerated SRS resource combinations for each SRI value

|  |  |
| --- | --- |
| Bit field mapped to index | SRS resource index(es), $N\_{SRS}=8$ |
| 0 | 0 |
| 1 | 1 |
| ... | ... |
| 7 | 7 |
| 8 | 0, 1 |
| 9 | 0, 2 |
| ... | ... |
| 14 | 0, 7 |
| ... | ... |
| 35 | 6,7 |
| 36 | 0, 1, 2 |
| 37 | 0, 1, 3 |
| ... | ... |
| 41 | 0, 1, 7 |
| 42 | 0, 2, 3 |
| 43 | 0, 2, 4 |
| ... | ... |
| 46 | 0, 2, 7 |
| ... | ... |
| 91 | 5, 6, 7 |
| 92 | 0, 1, 2, 3 |
| 93 | 0, 1, 2, 4 |
| ... | ... |
| 161 | 4, 5, 6, 7 |
| 162 | 0, 1, 2, 3, 4 |
| 163 | 0, 1, 2, 3, 5 |
| ... | ... |
| 217 | 3, 4, 5, 6, 7 |
| 218 | 0, 1, 2, 3, 4, 5 |
| 219 | 0, 1, 2, 3, 4, 6 |
| ... | ... |
| 245 | 2, 3, 4, 5, 6, 7 |
| 246 | 0, 1, 2, 3, 4, 5, 6 |
| 247 | 0, 1, 2, 3, 4, 5, 7 |
| ... | ... |
| 253 | 1, 2, 3, 4, 5, 6, 7 |
| 254 | 0-7 |
| 255 | reserved |

 |
| CATT (STxMP) | Thanks for editor’s great effort. Below please find a few comments.**Comment 1:** We prefer to remove bitwidth calculation for the second SRS resource indicator field until an agreement is sealed. Currently, there is no explicit agreement on how to determine *Lmax*. Thus, followings are suggested, i. e.:$\left⌈log\_{2}(\max\_{k\in \{1,2,…,min⁡\{L\_{max},N\_{SRS}\}\}}\left(\genfrac{}{}{0pt}{}{N\_{SRS}}{k}\right))\right⌉$ bits according to Tables 7.3.1.1.2-28/29A/30A/31A with the same number of layers indicated by SRS resource indicator field if the higher layer parameter *txConfig = nonCodebook*, the higher layer paramtere *maxMIMO-LayersforSdm* is not configured, and SRS resource set indicator field is present, where $N\_{SRS}$ is the number of configured SRS resources in the second SRS resource set, and - if UE supports operation with *maxMIMO-Layers* and the higher layer parameter *maxMIMO-Layers* of *PUSCH-ServingCellConfig* of the serving cell is configured. e- otherwise, *Lmax* is given by the maximum number of layers for PUSCH supported by the UE for the serving cell for non-codebook based operation.[Chengyan]: Yes as shown in the editor’s note, there is no explicit agreement on how to determine *Lmax*, but editor feels that this is the most straightforward way to do it. If there is no error identified, I think we can just keep it as it is.**Comment 2:** Similar as QC’s comment 1, following modifications are suggested in section 7.3.1.1.3:SRS resource set indicator – 0 or 2 bits- 2 bits according to Table 7.3.1.1.2-36 if - *txConfig = nonCodeBook*, and there are two SRS resource sets configured by *srs-ResourceSetToAddModListDCI-0-2* and associated with the *usage* of value '*nonCodeBook*', and is not configured with *coresetPoolIndex* or the value of *coresetPoolIndex* is the same for all CORESETs if *coresetPoolIndex* is provided, or *enableSTx2PofmDCI* is no configured, or- *txConfig*=*codebook*, and there are two SRS resource sets configured by *srs-ResourceSetToAddModListDCI-0-2* and associated with *usage* of value '*codebook*', and is not configured with *coresetPoolIndex* or the value of *coresetPoolIndex* is the same for all CORESETs if *coresetPoolIndex* is provided or *enableSTx2PofmDCI* is no configured[Chengyan]: Please check my reply to MTK. **Comment 3:** Agree with QC’s comment 4. |
| CATT (8TX) | **Comment 1**: How to determine the TPMI for UL 8Tx with maxRank =1 under CP-OFDM waveform are missing in Section 7.3.1.1.2 and 7.3.1.1.3.In Section 7.3.1.1.2 and 7.3.1.1.3, it should be clarified that Table 7.3.1.1.2-5E is also used for UL 8Tx with *CodebookType*=*Codebook1*, *maxRank* = 1 and transform precoder disabled, and Table 7.3.1.1.2-5H is also used for UL 8Tx with *CodebookType*=*Codebook4*, *maxRank* = 1 and transform precoder disabled. [Chengyan]: Thanks. Will reflect in the next update.  |
| QC (8Tx) | We thank editor for great effort to put together the CR. We have the following comments for editor to consider. Comment 1: Similar comments as ZTE and CATT about max rank =1 for CP-OFDM and DFT-S-OFDM based PUSCH. Table 7.3.1.1.2-5E and Table 7.3.1.1.2-5H can be updated to capture both. [Chengyan]: Thanks. Will reflect in the next update.Comment 2: Similar view as ZTE comment 2. We don’t agree with current Pseudo code to enumerate combinations of SRS resource indices, as there is no agreement on such Pseudo code. [Chengyan]: Please see my reply to ZTE above. Comment 3: maybe I missed it in the CR. Did we capture the TPMI and layer splitting for codebook 2 and 3 in the CR? [Chengyan]: Originally I planned not to capture it this time, since there is FFS on the mapping in the agreement and also it depends on how 38.211 will capture the partial coherent precoders. Now based on the draft 38.211 CR, we can do something accordingly. Please check the update in the latest version.  |
| NEC | **Comment 1 (8Tx)**Similar comments as ZTE, CATT and QC about max rank =1 for CP-OFDM and DFT-S-OFDM based PUSCH.For TPMI indication of 8Tx with one layer, the condition should be “if transform precoder is enabled” or “if transform precoder is disabled and maxRank = 1”, and in current document, only “if transform precoder is enabled” is mentioned, the related parts are “Precoding information and number of layers” for DCI format 0-1 and for DCI format 0-2, Table 7.3.1.1.2-5E, Table 7.3.1.1.2-5H. And also the description of Table 7.3.1.1.2-5E is not accurate.**Table 7.3.1.1.2-5E: Precoding information and number of layers, for 8 antenna ports, if transform precoder is enabled or *maxRank*= 1 or 2 or 3 if transform precoder is disabled, *CodebookType=Codebook1, ULcodebookFC-N1N2 = (4,1) or (2,2)*****Table 7.3.1.1.2-5H: Precoding information and number of layers, for 8 antenna ports, if transform precoder is enabled or maxRank= 1 if transform precoder is disabled, and CodebookType=Codebook4**In addition to the update of the Table, the description in 7.3.1.1.2 and 7.3.1.1.3 needs some update too, for example, as the following.***7.3.1.1.2 Format 0\_1***…- Precoding information and number of layers – number of bits determined by the following:…- 4, 6 or 7 bits according to Table 7.3.1.1.2-5E for 8 antenna ports, if *CodebookType*=*Codebook1*, transform precoder is enabled or *maxRank* = 1 or 2 or 3 if transform precoder is disabled, and according to transform precoder and *maxRank*;- 8 bits according to Table 7.3.1.1.2-5F for 8 antenna ports, if *CodebookType*=*Codebook4,* transform precoder is disabled, *maxRank*=5, 6, 7 or 8, and according to *maxRank;*- 6 or 7 or 8 bits according to Table 7.3.1.1.2-5G for 8 antenna ports, if *CodebookType*=*Codebook4,* transform precoder is disabled, *maxRank*=2, 3 or 4, and according to *maxRank;*- 3 bits according to Table 7.3.1.1.2-5H for 8 antenna ports, if *CodebookType*=*Codebook4,* transform precoder is enabled or maxRank= 1 if transform precoder is disabled.***7.3.1.1.3 Format 0\_2***…- Precoding information and number of layers – number of bits determined by the following: …- 4, 6 or 7 bits according to Table 7.3.1.1.2-5E for 8 antenna ports by replacing *maxRank* with *maxRankDCI-0-2*, if *CodebookType*=*Codebook1*, transform precoder is enabled or *maxRankDCI-0-2* =1 or 2 or 3 if transform precoder is disabled, and according to transform precoder and *maxRankDCI-0-2*;- 6 or 7 or 8 bits according to Table 7.3.1.1.2-5G for 8 antenna ports by replacing *maxRank* with *maxRankDCI-0-2*, if *CodebookType*=*Codebook4,* transform precoder is disabled, *maxRankDCI-0-2*=2, 3 or 4, and according to *maxRankDCI-0-2;**-* 3 bits according to Table 7.3.1.1.2-5H for 8 antenna ports, if *CodebookType*=*Codebook4,* transform precoder is enabledor maxRank= 1 if transform precoder is disabled.[Chengyan]: Thanks. Will reflect in the next update.**Comment 2 (STxMP)**[Chengyan]: Thanks. Will reflect and please check the latest draft CR. **Table 7.3.1.1.2-36: SRS resource set indication, row “3”**

|  |
| --- |
| SRS resource indicator field and Precoding information and number of layers field are associated with the first SRS resource set;Second SRS resource indicator field and Second Precoding information field are associated with the second SRS resource set;If there are two indicated joint/UL TCI states and *multipanelScheme* is not configured, the first indicated joint/UL TCI state is applied to the PUSCH transmission occasions associated with the first SRS resource set, and the second indicated joint/UL TCI state is applied to the PUSCH transmission occasions associated with the second SRS resource set. |

Since codepoint “11” is reserved for STxMP, which means that SRI/TPMI association with SRS resource set is also not applied for codepoint “11” for STxMP. The highlighted part should be in the beginning of the first paragraph. The suggested change is as follows.

|  |
| --- |
| If there are two indicated joint/UL TCI states and *multipanelScheme* is not configured, SRS resource indicator field and Precoding information and number of layers field are associated with the first SRS resource set;Second SRS resource indicator field and Second Precoding information field are associated with the second SRS resource set;~~If there are two indicated joint/UL TCI states and~~ *~~multipanelScheme~~* ~~is not configured, t~~The first indicated joint/UL TCI state is applied to the PUSCH transmission occasions associated with the first SRS resource set, and the second indicated joint/UL TCI state is applied to the PUSCH transmission occasions associated with the second SRS resource set. |

 |
| OPPO(STxMP) | Thanks for your great efforts. Please find our comment:**Comment:** For single-DCI based PUSCH SDM/SFN, it is agreed that the codepoint ‘11’ of SRS resource set indicator field is reserved. Suggest to capture the agreement in Table 7.3.1.1.2-36.[Chengyan]: Thanks. Will reflect and please check the latest draft CR. **Agreement**When the single-DCI based PUSCH SDM/SFN is configured, the codepoint ‘11’ of the DCI field SRS resource set indicator is reserved.

|  |
| --- |
| SRS resource indicator field and Precoding information and number of layers field are associated with the first SRS resource set;Second SRS resource indicator field and Second Precoding information field are associated with the second SRS resource set;If there are two indicated joint/UL TCI states and *multipanelScheme* is not configured, the first indicated joint/UL TCI state is applied to the PUSCH transmission occasions associated with the first SRS resource set, and the second indicated joint/UL TCI state is applied to the PUSCH transmission occasions associated with the second SRS resource set.If *multipanelScheme* is configured to *sdmScheme* or *sfnScheme*, the codepoint is reserved. |

 |
| Fujitsu (8Tx) | Thanks editor for the great efforts.Comment #1: Same view as other companies regarding maxRank=1 for CP-OFDM and DFT-s-OFDM based PUSCH.[Chengyan]: Thanks. Will reflect in the next update.Comment #2: Looks Codebook2 and Codebook3 is missing in the CR for the TPMI indication for 8Tx.Comment #3: Similar view as ZTE and QC regarding the pseudo code for SRI indication for non-Codebook. Such pseudo code may need additional agreement.[Chengyan]: Please see my reply to ZTE above.  |
| Sharp | Thank editor for the great effort.[Chengyan]: Thanks. But I think it is fine to keep it as it is, since it should be well known that dual CWs only applies to more than 4 layer and gNB won’t do this kind of scheduling. In addition, this kind of restriction should be already captured in other spec, e.g. 38.211, then no need to repeat it in 38.212 here to make the spec concise, which can save a large number of additional Tables. Of course, later if companies prefer to separate the tables, then we can update accordingly. Now the deadline is coming, we don’t have time to check other companies views. **Comment**: Table of Precoding information and number of layers should be separated into two Tables for 1-4 layers and 5-8 layers. This is because, for the UL transmission with rank <= 4, dual CWs are not supported.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Table 7.3.1.1.2-5B: Precoding information and number of layers, for 8 antenna ports, if transform precoder is disabled, *maxRank* = 8, and *CodebookType*=*Codebook1***

|  |  |  |  |
| --- | --- | --- | --- |
| Bit field mapped to index | *ULcodebookFC-N1N2* = (4, 1) | Bit field mapped to index | *ULcodebookFC-N1N2 = (2, 2)* |
| 0 | 1 layer: TPMI=0 | 0 | 1 layer: TPMI=0 |
| 1 | 1 layer: TPMI=1 | 1 | 1 layer: TPMI=1 |
| … | … | … | … |
| 15 | 1 layer: TPMI=15 | 15 | 1 layer: TPMI=15 |
| 16 | 2 layers: TPMI=0 | 16 | 2 layer2: TPMI=0 |
| 17 | 2 layers: TPMI=1 | 17 | 2 layer2: TPMI=1 |
| … | … | … | … |
| 47 | 2 layers: TPMI=31 | 47 | 2 layers: TPMI=31 |
| 48 | 3 layers: TPMI=0 | 48 | 3 layers: TPMI=0 |
| 49 | 3 layers: TPMI=1 | 49 | 3 layers: TPMI=1 |
| … | … | … | … |
| 71 | 3 layers: TPMI=23 | 71 | 3 layers: TPMI=23 |
| 72 | 4 layers: TPMI=0 | 72 | 4 layers: TPMI=0 |
| 73 | 4 layers: TPMI=1 | 73 | 4 layers: TPMI=1 |
| … | … | … | … |
| 95 | 4 layers: TPMI=23 | 95 | 4 layers: TPMI=23 |
| ~~96~~0 | 5 layers: TPMI=0 | 96 | 5 layers: TPMI=0 |
| ~~97~~1 | 5 layers: TPMI=1 | 97 | 5 layers: TPMI=1 |
| … | … | … | … |
| ~~103~~7 | 5 layers: TPMI=7 | 103 | 5 layers: TPMI=7 |
| ~~104~~8 | 6 layers: TPMI=0 | 104 | 6 layers: TPMI=0 |
| ~~105~~9 | 6 layers: TPMI=1 | 105 | 6 layers: TPMI=1 |
| … | … | … | … |
| ~~111~~15 | 6 layers: TPMI=7 | 111 | 6 layers: TPMI=7 |
| ~~112~~16 | 7 layers: TPMI=0 | 112 | 7 layers: TPMI=0 |
| ~~113~~17 | 7 layers: TPMI=1 | 113 | 7 layers: TPMI=1 |
| … | … | … | … |
| ~~115~~19 | 7 layers: TPMI=3 | 119 | 7 layers: TPMI=7 |
| ~~116~~20 | 8 layers: TPMI=0 | 120 | 8 layers: TPMI=0 |
| ~~117~~21 | 8 layers: TPMI=1 | 121 | 8 layers: TPMI=1 |
| … | … | … | … |
| ~~119~~23 | 8 layers: TPMI=3 | 127 | 8 layers: TPMI=7 |
| 120-127 | reserved |  |  |

 |

In Table 7.3.1.1.2-5B, it is possible to indicate 1-4 layers even if dual CW are enabled. However, it is not supported according to the following agreement.

|  |
| --- |
| **Agreement**Support up to X layers for codebook and non-codebook UL transmission for 8TX UE where X=4, 8 is determined based on separate UE capability* For uplink transmission with rank<=4, single CW is supported
* For uplink transmission with rank>4, whether single or dual CW is used will be decided in RAN1 meeting #110b-e

The above applies only with regards to the work scope of this agenda item. |

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# Second round discussions

Please find the updated [draft CR v2](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_114/Inbox/drafts/9.17%28Other%29/38.212%20draft%20CRs/%5BPost114-38.212-NR_MIMO_evo_DL_UL%5D/R1-23xxxxx%20Introduction%20of%20Rel-18%20MIMO%20Evolution%20for%20Downlink%20and%20Uplink_post%20RAN1%23114%20v2.docx) based on inputs from the first round. Companies are encouraged to provide the second round views ASAP, the latest by 09/07 (Thursday), 6:00am UTC if any.

|  |  |
| --- | --- |
| *Company* | *View* |
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