**3GPP TSG RAN WG1 Meeting #114 R1-230xxxx**

Toulouse, France, August 21st – 25th, 2023

**Agenda item: 9.17**

**Source: Nokia, Nokia Shanghai Bell**

**Title: Summary of email discussion on NR\_MIMO enhancements on uTCI\_STxMP\_DMRS\_SRS\_8Tx\_2TA**

**Document for: Discussion and Decision**

# 1 Introduction

This thread will discuss the draft CR to 38.214 for NR MIMO: uTCI, STxMP, DMRS, SRS, 8TX, 2TA

First checkpoint for this discussion: **September 5, 6:00am UTC!**

# 2 Discussion – first round

The comments in this section are based on version 0 of the the draft CR available in the **Post RAN1#114 discussion.**

### 2.1 uTCI

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| Company | Comments | Editor reply/Notes |
| Samsung | Comment 1: Based on the following agreement made in RAN1#114, we would like to suggest the following text updates for the configuration of the [TCI selection field].**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 BWP

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| - When the UE is configured with *tciSelection-PresentInDCI* jointly for both DCI formats 1\_1 and 1\_2 in the same DL BWP, and when the UE receives a DCI format 1\_1/1\_2 that schedules or activates PDSCH reception, the UE shall determine the indicated joint/DL TCI state(s) for the PDSCH reception according to the following: |

Comment 2: for aperiodic CSI-RS reception in both S-DCI and M-DCI, we do not think the texts “If the UE reports its capability of [two default beams for S-DCI based MTRP] in frequency range 2, the UE uses both indicated joint/DL TCI states to buffer the received signal before a threshold.” are needed. To our understanding, (1) the note in the corresponding agreement is only for clarification purpose, (2) similar UE assumptions were in Rel-15/16, but were not captured in the specifications, (3) “buffer” is unclear. Hence, we suggest the following modifications for both SDCI and MDCI.

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| -if the UE is in frequency range 1, or the UE reports its capability of [two default beams for S-DCI based MTRP] in frequency range 2, the UE shall apply the first or the second indicated joint/DL TCI state to the aperiodic CSI-RS according to the higher layer configuration(s) provided to the aperiodic CSI-RS resource or to the aperiodic CSI-RS resource set. ~~If the UE reports its capability of [two default beams for S-DCI based MTRP] in frequency range 2, the UE uses both indicated joint/DL TCI states to buffer the received signal before a threshold.~~ |

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| -if the UE is in frequency range 1, or the UE reports its capability of [default beam per *coresetPoolIndex* for M-DCI based MTRP] in frequency range 2, the UE shall apply the first or the second indicated joint/DL TCI state to the aperiodic CSI-RS according to the higher layer configuration(s) provided to the aperiodic CSI-RS resource or aperiodic CSI-RS resource set. ~~If the UE reports its capability of [default beam per coresetPoolIndex for M-DCI based MTRP] in frequency range 2, the UE uses both indicated joint/DL TCI states to buffer the received signal before a threshold.~~ |

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| ZTE | **Comment-1**Regarding group based reporting in Rel-18, we prefer to use the description for UL SRS (as we mentioned in June spec-review), and then we may need to clarifying that the spatial filter is applied to UL simultaneous transmission, rather than DL-RS(s) in the group based report. So, we have the following suggestion.**Proposed change** (Section 5.2.1.4.2 Report Quantity Configurations)------------------------------ if the UE is configured with the higher layer parameter *groupBasedBeamReporting-v18* set to *JointULandDL*, the UE is not required to update measurements for more than 64 CSI-RS and/or SSB resources, and the UE shall report in a single reporting instance *nrofReportedGroups-r18,* if configured, group(s) of two CRIs or SSBRIs selecting one CSI-RS or SSB from each of the two CSI Resource Sets for the report setting, where CSI-RS and/or SSB resources of each group can be received simultaneously for DL transmission(s) and applied as reference RSs used for determining simultaneous TX spatial filters for UL transmission by the UE subject to UE capability.- if the UE is configured with the higher layer parameter *groupBasedBeamReporting-v18* set to *ULOnly,* the UE is not required to update measurements for more than 64 CSI-RS and/or SSB resources, and the UE shall report in a single reporting instance *nrofReportedGroups-r18,* if configured, group(s) of two CRIs or SSBRIs selecting one CSI-RS or SSB from each of the two CSI Resource Sets for the report setting, where CSI-RS and/or SSB resources of each group can be applied as reference RSs used for determining simultaneous TX spatial filters for UL transmission by the UE subject to UE capability.<omitted text>----------------------------- |  |
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### 2.2 STxMP

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| Company | Comments | Editor reply/Notes |
|  | Thank you, Mihai, for the great efforts. Please see some initial comments from our side:**Comment 1**: For all cases where two SRS resource sets can be configured (including Rel-17 single-DCI based TDM scheme, Rel-18 single-DCI based STxMP SDM/SFN schemes, and Rel-18 multi-DCI based STxMP PUSCH+PUSCH), it is already agreed that the two SRS resource sets have the same number of SRS resources. This condition is currently captured for all cases above except for Rel-18 multi-DCI based STxMP PUSCH+PUSCH. Hence, we suggest the following change in Section 6.1, which in addition to addressing this, also makes the description more clear (and removes some redundancy as well).~~When~~ If a UE - is configured with two SRS resource sets ~~are configured~~ in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook' or 'nonCodebook' and - is configured with the higher layer parameter *enableSTx2PofmDCI* ~~is configured~~*-* is configured with *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet* for the active BWP of a serving cell, the UE- ~~and PDCCHs that~~ can be scheduled/configured to transmit two fully/partially overlapping PUSCHs in time domain and fully/partially/non-overlapping in frequency domain, where the two PUSCHs- are associated with ~~to different~~ *~~ControlResourceSets~~* ~~having~~ different values of *coresetPoolIndex*~~.~~, and- ~~Two fully/partially overlapping PUSCH transmissions~~ can be dynamically scheduled by UL grant(s) in DCI(s) and/or transmission(s) corresponding to configured grant(s) Type 1 or Type 2. *-* is not expected to be configured with different number of SRS resources in the two SRS resource sets.*-* the DCI codepoint SRS Resource Set Indicator is not present.**Comment 2**: Section 6.1.1.1 / 6.1.1.2: The following condition for SFN, should be captured under the bullet that is only specific to SFN (When codepoint “10” of *SRS Resource Set* *indicator* is indicated …) since this condition is not applicable to sTRP (e.g., when codepoint 00 or 01 are indicated).- maximum number of layers is up to 2.**Comment 3**: Section 6.2.3.1: The following (newly) added texts seem to belong to 38.212, and our understanding is that the corresponding agreements are already captured by the editor of 38.212 in the draft spec:When the higher layer parameter *multipanelScheme* is set to ‘sdmscheme’ and two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook'/’nonCodebook’ and the higher layer parameter *maxNrofPorts* in *PTRS-UplinkConfig* is set to *n1*, the association between UL PT-RS port(s) and DM-RS port(s) is signalled by *PTRS-DMRS association* field(s) in DCI format 0\_1 and DCI format 0\_2 according to Table 7.3.1.1.2-25 described in Clause 7.3.1.1.2 [TS 38.212].… When the number of UL PT-RS port(s) is one, the association between UL PT-RS port(s) and DM-RS port(s) is signalled by *PTRS-DMRS association* field(s) in DCI format 0\_1 and DCI format 0\_2 according to Table 7.3.1.1.2-25 described in Clause 7.3.1.1.2 of [5, TS 38.212]. When the number of UL PT-RS port(s) is two, the association between UL PT-RS port(s) and DM-RS port(s) is signalled by *PTRS-DMRS association* field(s) in DCI format 0\_1 and DCI format 0\_2 according to Table 7.3.1.1.2-26 described in Clause 7.3.1.1.2 of [5, TS 38.212].When the higher layer parameter *multipanelScheme* is set to ‘SFNscheme’ and two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook'/’nonCodebook’ and the higher layer parameter *maxNrofPorts* in *PTRS-UplinkConfig* is set to *n1*, the association between UL PT-RS port(s) and DM-RS port(s) is signalled by *PTRS-DMRS association* field(s) in DCI format 0\_1 and DCI format 0\_2 according to Table 7.3.1.1.2-25 described in Clause 7.3.1.1.2 of [5, TS 38.212].**Comment 4**: Section 6.1: We suggest the following change to capture the agreement copied below:**Agreement**When multi-DCI based STxMP PUSCH+PUSCH is configured, the existing rules for resolving overlapping PUSCH for the cases of one PUSCH overlapping with another PUSCH in time in one serving cell specified in legacy specifications ~~at least for CG+DG overlap, CG+CG overlap, CG+PUSCH with SP-CSI overlap, or PUSCH with SP-CSI + PUSCH with SP-CSI overlap~~ are performed separately for each coresetPoolIndex value. A UE is not expected to be scheduled by a PDCCH ending in symbol $i$ to transmit a PUSCH on a given serving cell overlapping in time with a transmission occasion, where the UE is allowed to transmit a PUSCH with configured grant according to [10, TS38.321], starting in a symbol $j$ on the same serving cell if the end of symbol $i$ is not at least $N\_{2}$ symbols before the beginning of symbol $j$, if - the UE is not provided *prioLowDG-HighCG* or *prioHighDG-LowCG*, or the UE is provided *prioLowDG-HighCG* or *prioHighDG-LowCG* and the two PUSCHs have the same priority index as described in Clause 9 of [6, TS 38.213]~~.~~, and- the UE is not provided *enableSTx2PofmDCI*, or is provided *enableSTx2PofmDCI* and the two PUSCHs are associated with the same *coresetPoolIndex* value.The value $N\_{2}$ in symbols is determined according to the UE processing capability defined in Clause 6.4, and $N\_{2} $and the symbol duration are based on the minimum of the subcarrier spacing corresponding to the PUSCH with configured grant and the subcarrier spacing of the PDCCH scheduling the PUSCH.  |  |
| CATT | We thank the editor for the great effort and nice work. Some comments follow.**Comment 1:** Section 6.1.1.1: When codepoint “10” of *SRS Resource Set* *indicator* is indicated, the correspondence between TPMI fields and layers are described twice. Therefore, the following modification is suggested:

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| When the higher layer parameter *multipanelScheme* is set to ‘SDMScheme’ and two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook', two SRI(s), and two TPMI(s) are given by the DCI fields of two SRS resource indicator and two Precoding information and number of layers in clause 7.3.1.1.2 and 7.3.1.1.3 of [5, TS 38.212] for DCI format 0\_1 and 0\_2: - When codepoint “10” of *SRS Resource Set* *indicator* is indicated*,* the first TPMI is used to indicate the precoder to be applied over layers {0…v1-1}, where v1 is the number of layers indicated by the first TPMI, that corresponds to the SRS resource selected by the corresponding SRI when multiple SRS resources are configured for the applicable SRS resource set or if single SRS resource is configured for the applicable SRS resource set, ~~the first TPMI is used to indicate precoder to be applied over layers {0…v~~~~1~~~~-1}~~ the second TPMI is used to indicate the precoder to be applied over layers {v1…. v2+v1-1}, where v2 is the number of layers indicated by the second TPMI, that corresponds to the SRS resource selected by the corresponding SRI when multiple SRS resources are configured for the applicable SRS resource set or if single SRS resource is configured for the applicable SRS resource set ~~the second TPMI is used to indicate precoder to be applied over layers {v~~~~1~~~~….v~~~~2~~~~+v~~~~1~~~~-1}~~, v1 ≤ *maxRankSdm* andv2 ≤ *maxRankSdm* or *maxRankSdmDCI-0-2* is defining the maximum number of layers applied over the first and the second SRS resource sets, separately.~~.~~  |

**Comment 2:** Section 6.2.3.1: According to the agreement, the following text is related to SDM scheme not SFN scheme, which is not captured correctly.**Agreement**· For single-DCI based STxMP PUSCH SFN transmission, reuse Table 7.3.1.1.2-25 and Table 7.3.1.1.2-26 of 38.212 to indicate the association between PTRS port(s) and DMRS port(s) when one PTRS port and two PTRS ports are configured for the SFN scheme, respectively.· For single-DCI based STxMP PUSCH SDM scheme, when maxNrofPortsforSdm = 1, the 2-bit “PTRS-DMRS association” DCI field indicates the association between PTRS-DMRS port and the DMRS port according to the existing Table 7.3.1.1.2-25 in 38.212.

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| When the higher layer parameter *multipanelScheme* is set to ‘~~SFNscheme~~SDMscheme’ and two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook'/’nonCodebook’ and the higher layer parameter *maxNrofPorts* in *PTRS-UplinkConfig* is set to *n1*, the association between UL PT-RS port(s) and DM-RS port(s) is signalled by *PTRS-DMRS association* field(s) in DCI format 0\_1 and DCI format 0\_2 according to Table 7.3.1.1.2-25 described in Clause 7.3.1.1.2 of [5, TS 38.212]. |

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| ZTE | Thanks Mihai so much for your great effort on this CR, we have five comments as follows, in which the suggested changes are highlighted as this.**Comment#1**Regarding the newly introduced RRC parameter to indicate the multi-DCI based STxMP PUSCH+PUSCH (as agreed in RAN1#114), it should be noted that the scheduled two PUSCHs can be either overlapped or non-overlapped in time domain even though this RRC parameter is configured, due to gNB cannot guarantee ideal backhaul between two TRPs in terms of PUSCHs overlapped in time domain in any time. Besides, the paragraph of the absence of SRS resource set indicator field in DCI can be merged in the former paragraph for readability. **Agreement (RAN1#114)**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.Hence we have the following suggestion:

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| **Proposed change (Section 6.1):**When two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook' or 'nonCodebook' and higher layer parameter *enableSTx2PofmDCI* is configured and *PDCCH-Config* contains two different values of *coresetPoolIndex* in *ControlResourceSet* for the active BWP of a serving cell, ~~and~~ PDCCHs ~~that~~can schedule two PUSCHs that fully/partially overlapping ~~PUSCHs~~ in time domain and fully/partially/non-overlapping in frequency domain, where the DCI field *SRS Resource Set Indicator* is not present in each of PDCCH and the scheduled two PUSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex.* ~~When two SRS resource sets are configured in~~ *~~srs-ResourceSetToAddModList~~* ~~or~~ *~~srs-ResourceSetToAddModListDCI-0-2~~* ~~with higher layer parameter~~ *~~usage~~* ~~in~~ *~~SRS-ResourceSet~~* ~~set to 'codebook' or 'nonCodebook' and higher layer parameter~~ *~~enableSTx2PofmDCI~~* ~~is configured and~~ *~~PDCCH-Config~~* ~~contains two different values of~~ *~~coresetPoolIndex~~* ~~in~~ *~~ControlResourceSet~~* ~~for the active BWP of a serving cell, the DCI codepoint~~ *~~SRS Resource Set Indicator~~* ~~is not present.~~ Two fully/partially overlapping PUSCH transmissions can be dynamically scheduled by UL grant(s) in DCI(s) and/or transmission(s) corresponding to configured grant(s) Type 1 or Type 2.  |

**Comment#2**For single DCI based STxMP PUSCH in SDM scheme, it was clearly specified in RAN1#109-e that different layers/DMRS ports of one PUSCH are separately precoded and transmitted from different UE panels simultaneously. In addition to the description of different layers of PUSCH (i.e., layers {0…v1-1} and layers {v1….v2+v1-1}) are respectively precoded by precoders indicated by the first and second TPMIs, we suggest to capture the description of different antenna ports of PUSCH (e.g., antenna ports {0, …, 0+p1-1} and antenna ports {0+p1, ..., 0+p1+p2-1}, where the port index is based on the description in TS 38.211 as follows) are respectively precoded by precoders indicated by the first and second TPMIs as well, where p1 is the number of SRS ports indicated by the first SRI and p2 is the number of SRS ports indicated by the second SRI.In light of the above, it is worth noting that if the above change was not adopted, the following newly added part of the mapping between TCI states and PUSCH antenna ports in clause 6.1.2.1 will be unclear though.**Agreement (RAN1#109-e)**For STxMP PUSCH in single-DCI based mTRP system, study and evaluate the following schemes for PUSCH:* SDM scheme: different layers/DMRS ports of one PUSCH are separately precoded and transmitted from different UE panels simultaneously.
	+ Study and evaluate whether to support 2 CWs in SDM manner and transmitted from two different panel simultaneously.
* FDM-B scheme: two PUSCH transmission occasions with same/different RV of the same TB are transmitted from different UE panels on non-overlapped frequency domain resources and the same time domain resources.
* FDM-A scheme: different parts of the frequency domain resource of one PUSCH transmission occasion are transmitted from different UE panels.
* SFN-based transmission scheme: all of the same layers/DMRS ports of one PUSCH are transmitted from two different UE panels simultaneously.
* SDM repetition scheme: two PUSCH transmission occasions with different RV of the same TB are transmitted from two different UE panels simultaneously.

Note: Companies are encouraged to evaluate the different schemes for possible down-selection in RAN1#110.Note: other schemes are not precluded----------------------------------------------------**TS 38.214, Section 6.1.2.1:**- if a DCI format 0\_1 or DCI format 0\_2 indicates codepoint “10” for the *SRS resource set indicator* and the higher layer parameters *multipanelScheme* is configured and set to ‘SDMscheme’ or ‘SFNscheme’,- the first indicated TCI state is applied to the PUSCH antenna port(s), of corresponding PUSCH transmission occasion, associated with the first SRS resource set, and the second indicated TCI state is applied to the PUSCH antenna port(s), of corresponding PUSCH transmission occasion, associated with the second SRS resource set, where the association of PUSCH antenna ports to SRS resource sets is determined according to Clauses 6.1.1.1 and 6.1.1.2.--------------------------------------------------------------------------------------------------------**TS 38.214, Section 6.2:**The frame structure and physical resources the UE shall use when transmitting in the uplink transmissions are defined in Clause 4.The following antenna ports are defined for the uplink:- Antenna ports starting with 0 for demodulation reference signals for PUSCH- Antenna ports starting with 1000 for SRS, PUSCH- Antenna ports starting with 2000 for PUCCH- Antenna port 4000 for PRACH----------------------------------------------------

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| **Proposed change (Section 6.1.1.1):**When the higher layer parameter *multipanelScheme* is set to ‘SDMScheme’ and two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook', two SRI(s), and two TPMI(s) are given by the DCI fields of two SRS resource indicator and two Precoding information and number of layers in clause 7.3.1.1.2 and 7.3.1.1.3 of [5, TS 38.212] for DCI format 0\_1 and 0\_2: - When codepoint “10” of *SRS Resource Set* *indicator* is indicated*,* the first TPMI is used to indicate the precoder to be applied over layers {0…v1-1}, where v1 is the number of layers indicated by the first TPMI, that corresponds to the SRS resource selected by the corresponding SRI when multiple SRS resources are configured for the applicable SRS resource set or if single SRS resource is configured for the applicable SRS resource set the first TPMI is used to indicate precoder to be applied over layers {0…v1-1} and the second TPMI is used to indicate the precoder to be applied over layers {v1…. v2+v1-1}, where v2 is the number of layers indicated by the second TPMI, that corresponds to the SRS resource selected by the corresponding SRI when multiple SRS resources are configured for the applicable SRS resource set or if single SRS resource is configured for the applicable SRS resource set the second TPMI is used to indicate precoder to be applied over layers {v1….v2+v1-1}, v1 ≤ *maxRankSdm* andv2 ≤ *maxRankSdm* or *maxRankSdmDCI-0-2* is defining the maximum number of layers applied over the first and the second SRS resource sets, separately.. - When codepoint “00” or “01” of *SRS Resource Set* *indicator* is indicated*,* the second SRI and second TPMI are reserved, the first TPMI is used to indicate the precoder to be applied over layers {0…v-1}, where v ≤ *maxRank,* where *maxRank* is defining the maximum number of layers. - Codepoint “11” of *SRS Resource Set indicator* is reserved. - For one or two TPMI(s), the transmission precoder is selected from the uplink codebook that has a number of antenna ports equal to the higher layer parameter *nrofSRS-Ports* in *SRS-Config* for the indicated SRI(s), as defined in Clause 6.3.1.5 of [4, TS 38.211]. When codepoint “10” of *SRS Resource Set* *indicator* is indicated*,* the first and second TPMIs are used to indicate the precoders to be applied over antenna ports {0, ..., 0+p1-1} and antenna ports {0+p1, ..., 0+p1+p2-1}, respectively. Where p1 is equal to the number of SRS ports of the SRS resource selected by the first SRI when multiple SRS resources are configured for the applicable SRS resource set or if single SRS resource is configured for the applicable SRS resource set, and p2 is equal to the number of SRS ports of the SRS resource selected by the second SRI when multiple SRS resources are configured for the applicable SRS resource set or if single SRS resource is configured for the applicable SRS resource set.- When two SRIs are indicated, the UE shall expect that the number of SRS antenna ports associated with two indicated SRIs would be the same. When the UE is configured with the higher layer parameter *txConfig* set to 'codebook', the UE is configured with at least one SRS resource. Each of the indicated one or two SRI(s) in slot *n* is associated with the most recent transmission of SRS resource of associated SRS resource set identified by the SRI, where the SRS resource is prior to the PDCCH carrying the SRI. When two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook', the UE is not expected to be configured with different number of SRS resources in the two SRS resource sets. |

**Comment#3*** First, similar to the suggested change in comment#2, it is also needed to single DCI based STxMP PUSCH in SFN scheme to capture that the description of antenna ports of PUSCH (e.g., antenna ports {0, …, 0+p-1}) are respectively precoded by precoders indicated by the first and second TPMIs, wherein p is the number of SRS ports indicated by the first SRI only.
* Second, the newly added bullet “maximum number of layers is up to 2” is not needed, due to the value of both *maxRankSfn* and *maxRankSfnDCI-0-2* cannot be larger than 2 as agreed in RRC parameter discussion.
* Third, the editorial change of the wording “definining” is proposed.

**Agreement (RAN1#109-e)**For STxMP PUSCH in single-DCI based mTRP system, study and evaluate the following schemes for PUSCH:* SDM scheme: different layers/DMRS ports of one PUSCH are separately precoded and transmitted from different UE panels simultaneously.
	+ Study and evaluate whether to support 2 CWs in SDM manner and transmitted from two different panel simultaneously.
* FDM-B scheme: two PUSCH transmission occasions with same/different RV of the same TB are transmitted from different UE panels on non-overlapped frequency domain resources and the same time domain resources.
* FDM-A scheme: different parts of the frequency domain resource of one PUSCH transmission occasion are transmitted from different UE panels.
* SFN-based transmission scheme: all of the same layers/DMRS ports of one PUSCH are transmitted from two different UE panels simultaneously.
* SDM repetition scheme: two PUSCH transmission occasions with different RV of the same TB are transmitted from two different UE panels simultaneously.

Note: Companies are encouraged to evaluate the different schemes for possible down-selection in RAN1#110.Note: other schemes are not precluded**Agreement (RAN1#111)**For the SFN scheme of single-DCI based STxMP PUSCH:* Configure two SRS resource sets for CB or NCB.
	+ FFS: Number of SRS resources of SRS resource set, and number of SRS ports of SRS resource
* The DCI indicates two SRI fields and TPMI fields for SFN transmission,
* On the indication of number of layers for CB and NCB PUSCH:
	+ Alt1: Similar to rel-17 mTRP TDM scheme, the number of layers is indicated by the first SRI field (for NCB PUSCH) or the first TPMI field (for CB PUSCH)

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| **Proposed change (Section 6.1.1.1):**When higher layer parameter *multipanelScheme* set to ‘SFNscheme’ and two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook', two SRI(s), and two TPMI(s) are given by the DCI fields of two SRS resource indicator and two Precoding information and number of layers in clause 7.3.1.1.2 and 7.3.1.1.3 of [5, TS 38.212] for DCI format 0\_1 and 0\_2. - When codepoint “10” of *SRS Resource Set* *indicator* is indicated*,* the first TPMI is used to indicate precoder to be applied over layers {0…v-1} and the second TPMI is used to indicate the precoder to be applied over layers {0…v-1}, where v ≤ *maxRankSfn* or *maxRankSdmDCI-0-2* ~~definining~~defining the maximum number of layers applied over the first SRS resource set and over the second SRS resource set separately. - When codepoint “00” or “01” of *SRS Resource Set* *indicator* is indicated*,* the second SRI and second TPMI are reserved, the first TPMI is used to indicate precoder to be applied over layers {0…v-1}, where v ≤ *maxRank* and where *maxRank* is defining the maximum number of layers applied over the first SRS resource set or the seoncd SRS resource. - Codepoint “11” of *SRS Resource Set indicator* is reserved. ~~- maximum number of layers is up to 2.~~- For one or two TPMI(s), the transmission precoder is selected from the uplink codebook that has a number of antenna ports equal to *nrofSRS-Ports* in *SRS-Config* for the indicated SRI(s), as defined in Clause 6.3.1.5 of [4, TS 38.211]. When codepoint “10” of *SRS Resource Set* *indicator* is indicated*,* the first and second TPMIs are used to indicate the precoders to be applied over antenna ports {0, ..., 0+p}, respectively. Where p is equal to the number of SRS ports of the SRS resource selected by the first SRI when multiple SRS resources are configured for the applicable SRS resource set or if single SRS resource is configured for the applicable SRS resource set.- When two TPMIs are indicated, the UE shall expect that the number of SRS antenna ports associated with two indicated SRIs to be the same. When the UE is configured with the higher layer parameter *txConfig* set to 'codebook', the UE is configured with at least one SRS resource. Each of the indicated one or two SRI(s) in slot *n* is associated with the most recent transmission of SRS resource of associated SRS resource set identified by the SRI, where the SRS resource is prior to the PDCCH carrying the SRI. When two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook', the UE is not expected to be configured with different number of SRS resources in the two SRS resource sets. |

**Comment#4*** First, similar to the second change in comment#3, the newly added bullet “maximum number of layers is up to 2” is not needed, due to the value of both *maxRankSfn* and *maxRankSfnDCI-0-2* cannot be larger than 2 as agreed in RRC parameter discussion.
* Second, the last paragraph with respect to the validity of SRI should be able to both SDM scheme and SFN scheme, hence its order should be moved forward.

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| **Proposed change (Section 6.1.1.2):**When the higher layer parameter *multipanelScheme* is set to ‘SDMScheme’ and two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'nonCodebook', SRIs are given by the DCI fields of two SRS resource indicators in clause 7.3.1.1.2 and 7.3.1.1.3 of [5, TS 38.212] for DCI format 0\_1 and 0\_2. - When codepoint “10” of *SRS Resource Set* *indicator* is indicated*,* the first SRI is used to indicate resource(s) to be associated with layer(s) {0…v1-1}}, where v1 being the number of layers indicated by the first SRI, and the second SRI is used to indicate resource(s) to be associated with layer(s) {v1…. v2+v1-1}, v1 ≤ *Lmax* andv2 ≤ *Lmax* where *Lmax* is defined is defined inclauses 7.3.1.1.2 and 7.3.1.1.3 of [5, TS 38.212]. - When codepoint “00” or “01” of *SRS Resource Set* *indicator* is indicated*,* the second SRI is reserved, the first SRI is used to indicate resource(s) to be associated with layers {0…v-1}, v ≤ *Lmax*.- Codepoint “11” of *SRS Resource Set indicator* is reserved. When the higher layer parameter *multipanelScheme* is set to ‘SFNscheme’ and two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'nonCodebook', two SRI(s) are given by the DCI fields of two SRS resource indicator and two Precoding information and number of layers in clause 7.3.1.1.2 and 7.3.1.1.3 of [5, TS 38.212] for DCI format 0\_1 and 0\_2. - When codepoint “10” of *SRS Resource Set* *indicator* is indicated*,* the first SRI is used to indicate resource(s) to be associated with layer(s) {0…v-1} and the second SRI is used to indicate resource(s) to be associated with layer(s) {0…v-1}, where v ≤ *Lmax* and where *Lmax* is defined in clauses 7.3.1.1.2 and 7.3.1.1.3 of [5, TS 38.212]. - When codepoint “00” or “01” of *SRS Resource Set* *indicator* is indicated*,* the second SRI is reserved, the first SRI is used to indicate resources(s) to be associated with layers {0…v-1}, where v ≤ *Lmax*. When two SRIs are indicated, the UE shall expect that the number of SRS antenna ports associated with two indicated SRIs to be the same. - Codepoint “11” of *SRS Resource Set indicator* is reserved. ~~- maximum number of layers is up to 2.~~- When the UE is configured with the higher layer parameter *txConfig* set to 'Noncodebook', the UE is configured with at least one SRS resource. Each of the indicated one or two SRI(s) in slot *n* is associated with the most recent transmission of SRS resource of associated SRS resource set identified by the SRI, where the SRS resource is prior to the PDCCH carrying the SRI. When two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'Noncodebook', the UE is not expected to be configured with different number of SRS resources in the two SRS resource sets. |

**Comment#5**As per the agreement endorsed in RAN1#114, it is clear enough that only Table 7.3.1.1.2-26 can be used if two PTRS ports are configured in SFN scheme, no matter the number of actual PTRS ports. Hence we have the following suggestion.**Agreement (RAN1#114)*** For single-DCI based STxMP PUSCH SFN transmission, reuse Table 7.3.1.1.2-25 and Table 7.3.1.1.2-26 of 38.212 to indicate the association between PTRS port(s) and DMRS port(s) when one PTRS port and two PTRS ports are configured for the SFN scheme, respectively.
* For single-DCI based STxMP PUSCH SDM scheme, when maxNrofPortsforSdm = 1, the 2-bit “PTRS-DMRS association” DCI field indicates the association between PTRS-DMRS port and the DMRS port according to the existing Table 7.3.1.1.2-25 in 38.212.

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| **Proposed change (Section 6.2.3.1):**When the higher layer parameter *multipanelScheme* is set to ‘SFNscheme’ and two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook'/’nonCodebook’ and the higher layer parameter *maxNrofPorts* in *PTRS-UplinkConfig* is set to *n2*, the actual number of UL PT-RS port(s) to transmit corresponding to each SRS resource set is determined based on 1st TPMI codepoint field for ‘codebook’ or 1st SRI(s) codepoint field for ‘nonCodebook’~~. When the number of UL PT-RS port(s) is one, the association between UL PT-RS port(s) and DM-RS port(s) is signalled by~~ *~~PTRS-DMRS association~~* ~~field(s) in DCI format 0\_1 and DCI format 0\_2 according to Table 7.3.1.1.2-25 described in Clause 7.3.1.1.2 of [5, TS 38.212]. When the number of UL PT-RS port(s) is two~~, and the association between UL PT-RS port(s) and DM-RS port(s) is signalled by *PTRS-DMRS association* field(s) in DCI format 0\_1 and DCI format 0\_2 according to Table 7.3.1.1.2-26 described in Clause 7.3.1.1.2 of [5, TS 38.212].When the higher layer parameter *multipanelScheme* is set to ‘SFNscheme’ and two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook'/’nonCodebook’ and the higher layer parameter *maxNrofPorts* in *PTRS-UplinkConfig* is set to *n1*, the association between UL PT-RS port(s) and DM-RS port(s) is signalled by *PTRS-DMRS association* field(s) in DCI format 0\_1 and DCI format 0\_2 according to Table 7.3.1.1.2-25 described in Clause 7.3.1.1.2 of [5, TS 38.212]. |

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### 2.3 DM-RS

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| Company | Comments | Editor reply/Notes |
| Huawei, HiSilicon | Thanks Mihai for the great effort! Regarding the modification, we have the following comments:Regarding the MU restriction for 1CW in section 5.1.6.2, we’d like to check whether MR. Editor plan to inherit the similar organisation logic (i.e., each sub-bullet represents either sTRP or mTRP case under a certain DMRS configuration type). Depending on Mr. Editor’s preference, the current version may need to be adjusted in different way. Furthermore, seems the indentation of the MU restriction for 2CWs can be cancelled. Regarding the PUSCH to PT-RS power ratio in section 6.2.3.1, seems the current version hasn’t entirely reflect the agreements. By the way, the yellow part (although agreed) is modified just for the correctness of grammar.- For partial coherent codebook for 8TX PUSCH transmission, *Lx* is the number of PUSCH layers in the antenna group ~~with~~ which are precoded coherently with the PUSCH layer/DMRS port ~~where~~ that PTRS port x is associated with, and *Qp* is the number of PTRS ports scheduled to the UE.**Table 6.2.3.1-3A: Factor related to PUSCH to PT-RS power ratio per layer per RE for 8TX PUSCH transmission**

|  |  |
| --- | --- |
| ***UL-PTRS-power /***  | **The number of PUSCH layers (**$n\_{layer}^{PUSCH}$**)** |
| **1-8** |
| Full coherent | Partial coherent | Non-coherent and non-codebook based |
| 00 | $$10log\_{10}\left(n\_{layer}^{PUSCH}\right)$$ | $$10log\_{10}\left(L\_{x}\right)+ 10log\_{10}\left(Q\_{p}\right)$$ | $$10log\_{10}\left(Q\_{p}\right)$$ |
| 01 | $$10log\_{10}\left(n\_{layer}^{PUSCH}\right)$$ | $$10log\_{10}\left(n\_{layer}^{PUSCH}\right)$$ | $$10log\_{10}\left(n\_{layer}^{PUSCH}\right)$$ |
| 10 | Reserved |
| 11 | Reserved |

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| CATT(UL 8Tx) | We thank the editor for the great effort and nice work. Some comments follow.**Comment 1**: We suggest to capture the following agreement on PTRS power boosting for UL 8Tx in RAN1 #114 meeting in Table 6.2.3.1-3A:

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| **Agreement**For 8Tx PUSCH, when the *ptrs-Power* configures 00, Alt.2 is supported for the factor () for partial coherent TPMIs:* + Alt.2:$10 log10(L\_{x}) +10 log10(Q\_{p})$, where $L\_{x}$ is the number of PUSCH layers in the antenna group which are precoded coherently with the PUSCH layer / DMRS port where PTRS port *x* is associated with, and *Qp* is the number of PTRS ports scheduled to the UE.
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| ZTE | Thanks Mihai so much for your great effort on this CR, we have one comment as follows, in which the suggested changes are highlighted as this.**Comment#1**As per the following agreement endorsed in RAN1#114 meeting, it should be completely captured in the specification. Besides, to be aligned with the specification from Rel-15 (i.e., the formulation in Table 6.2.3.1-3), the formula in Alt.2 is to described as 10*log*10(*Lx*) + 3*Qp*- 3.**Agreement (RAN1#114)**For 8Tx PUSCH, when the *ptrs-Power* configures 00, Alt.2 is supported for the factor () for partial coherent TPMIs:* + Alt.2:, where is the number of PUSCH layers in the antenna group which are precoded coherently with the PUSCH layer / DMRS port where PTRS port *x* is associated with, and *Qp* is the number of PTRS ports scheduled to the UE.

In light of the above, we have the following suggestion:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Proposed change (Section 6.2.3.1):**When the UE is scheduled with *Qp*={1,2} PT-RS port(s) in uplink and the number of scheduled layers is ,- If the UE is configured with higher layer parameter *ptrs-Power*, the PUSCH to PT-RS power ratio per layer per RE  is given by , where  is shown in the Table 6.2.3.1-3 and Table 6.2.3.1-3A according to the higher layer parameter *ptrs-Power*, the PT-RS scaling factor  specified in clause 6.4.1.2.2.1 of [4, TS 38.211] is given by and also on the '*Precoding Information and Number of Layers'* field in DCI.- The UE shall assume *ptrs-Power* in *PTRS-UplinkConfig* is set to state "00" in Table 6.2.3.1-3 if not configured or in case of non-codebook based PUSCH.- For partial coherent codebook for 8TX PUSCH transmission, *Lx* is the number of PUSCH layers in the antenna group with are precoded coherently with the PUSCH layer/DMRS port where PTRS port x is associated with, and *Qp* is the number of PTRS ports scheduled to the UE.Table 6.2.3.1-3: Factor related to PUSCH to PT-RS power ratio per layer per RE other than 8TX PUSCH transmission

|  |  |  |
| --- | --- | --- |
| *UL-PTRS-power /*  |  | The number of PUSCH layers ( ) |
| 1 | 2 | 3 | 4 |
| All cases | Full coherent | Partial and non- coherent and non-codebook based | Full coherent | Partial and non- coherent and non-codebook based | Full coherent | Partial coherent | Non-coherent and non-codebook based |
| 00 | 0 | 3 | 3*Qp*-3 | 4.77 | 3*Qp*-3 | 6 | 3*Qp* | 3*Qp*-3 |
| 01 | 0 | 3 | 3 | 4.77 | 4.77 | 6 | 6 | 6 |
| 10 | Reserved |
| 11 | Reserved |

Table 6.2.3.1-3A: Factor related to PUSCH to PT-RS power ratio per layer per RE for 8TX PUSCH transmission

|  |  |
| --- | --- |
| *UL-PTRS-power /*  | The number of PUSCH layers ($n\_{layer}^{PUSCH}$) |
| 1-8 |
| Full coherent | Partial coherent | Non-coherent and non-codebook based |
| 00 | $$10log\_{10}\left(n\_{layer}^{PUSCH}\right)$$ | ~~TBD~~10*log*10(*Lx*) + 3*Qp*- 3 | $$10log\_{10}\left(Q\_{p}\right)$$ |
| 01 | $$10log\_{10}\left(n\_{layer}^{PUSCH}\right)$$ | $$10log\_{10}\left(n\_{layer}^{PUSCH}\right)$$ | $$10log\_{10}\left(n\_{layer}^{PUSCH}\right)$$ |
| 10 | Reserved |
| 11 | Reserved |

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| QC | We thank editor very much for great effort to put together the CR. We have the following feedback for editor to consider. Issue 1: For the following in section 5.1.6.2, we assume the following:Table 7.3.1.2.2-1B is for eType 1 with maxLength =1 for S-TRPTable 7.3.1.2.2-2B is for eType 1 with maxLength =1 for M-TRPTable 7.3.1.2.2-1C is for eType 1 with maxLength=2 for S-TRPTable 7.3.1.2.2-2C is for eType 1 with maxLength=2 for M-TRPIf the above assumption is aligned with what editor had in mind, we suggest the following changes to align with 38.212 Table index and row index (some row index changed in 38.212 before several rows were removed in agreements which changed row index in tables, such as 30->27, 68->66). For DM-RS configuration enhanced type 1,- if a UE is scheduled with one codeword and assigned with the antenna port mapping with indices of [{9, 10, 11 or ~~30~~ 27} in Table 7.3.1.2.2-~~1B~~7 and Table 7.3.1.2.2-~~2B~~7A] of Clause 7.3.1.2 of [5, TS 38.212], or - if a UE is scheduled with one codeword and assigned with the antenna port mapping with indices of [{9, 10, 11, 24, 25, 26, 27, 28, 29, 30 or ~~68~~ 66} in Table 7.3.1.2.2-~~1C~~8 and Table 7.3.1.2.2-~~2C~~8A] of Clause 7.3.1.2 of [5, TS 38.212], orSimilarly, we suggest the following changes for eType 2. For DM-RS configuration enhanced type 2, - if a UE is scheduled with one codeword and assigned with the antenna port mapping with indices of [{9, 10, 20, 21, 22, 23 or ~~60~~ 56} in Table 7.3.1.2.2-~~3B~~9 and Table 7.3.1.2.2-~~4B~~9A] of Clause 7.3.1.2 of [5, TS38.212], or- if a UE is scheduled with one codeword and assigned with the antenna port mapping with indices of [{9, 10, 20, 21, 22, 23, 42, 43, 44, 45, 46, 47 or ~~128~~ 137} in Table 7.3.1.2.2-~~3C~~10 and in Table 7.3.1.2.2-~~4C~~10A] of Clause 7.3.1.2 of [5, TS 38.212], orBy the way, in Table 7.3.1.2.2-10 and Table 7.3.1.2.2-10A of 38.212, row index 128 is missing (should be a typo). If 212 editor fix this typo, the last index of MU restriction for M-TPR should be 136, not 137. But I will leave this to two editors to fix. Issue 2: Regarding MU with 2 CWs, RAN1 #114 already conclude not supporting this feature. Therefore, we suggest to remove the “[]” in the below. ~~[~~- if a UE is scheduled with two codewords, the UE may assume that all the remaining orthogonal antenna ports are not associated with transmission of PDSCH to another UE.~~]~~Issue 3: Very minor comment. Suggest to align the table indices with 38.212 in the following paragraph. When receiving PDSCH scheduled by DCI format 1\_1, the UE shall assume that the CDM groups indicated in the configured index from Tables 7.3.1.2.2-1, 7.3.1.2.2-1A,[ 7.3.1.2.2-1B, 7.3.1.2.2-1C ], 7.3.1.2.2-2, 7.3.1.2.2-2A,[ 7.3.1.2.2-2B, 7.3.1.2.2-2C ], 7.3.1.2.2-3, 7.3.1.2.2-3A, [ 7.3.1.2.2-3B, 7.3.1.2.2-3C ], 7.3.1.2.2-4, 7.3.1.2.2-4A, [ 7.3.1.2.2-4B, 7.3.1.2.2-4C ] of [5, TS. 38.212] contain potential co-scheduled downlink DM-RS and are not used for data transmission, where "1", "2" and "3" for the number of DM-RS CDM group(s) in Tables 7.3.1.2.2-1, 7.3.1.2.2-1A ,[ 7.3.1.2.2-1B, 7.3.1.2.2-1C ], 7.3.1.2.2-2, 7.3.1.2.2-2A,[ 7.3.1.2.2-2B, 7.3.1.2.2-2C ]7.3.1.2.2-3, 7.3.1.2.2-3A, 7.3.1.2.2-4, 7.3.1.2.2-4A, [ 7.3.1.2.2-4B, 7.3.1.2.2-4C ] of [5, TS. 38.212] correspond to CDM group 0, {0,1}, {0,1,2}, respectively.Issue 4: Maybe I oversighted them in the CR. Did we capture the following two agreement about MU-MIMO in the CR?**Agreement (in RAN1 113)**The following MU-MIMO within a CDM group between Rel.15 DMRS ports and Rel.18 DMRS ports is not supported:* 3) For PDSCH, between Rel.18 UE1 indicated with Rel-18 New ports (eType1: ports 1008-1015, eType2: ports 1012-1023) and Rel.15-17 UE2 indicated with Rel.15 DMRS ports in a CDM group.
	+ UE does not expect such MU-MIMO within a CDM group
* FFS: 4) For PDSCH, between Rel.18 UE1 indicated with Rel-18 New ports (eType1: ports 1008-1015, eType2: ports 1012-1023) and Rel.18 UE2 indicated with Rel.15 DMRS ports in a CDM group.
	+ UE does not expect such MU-MIMO within a CDM group

**Agreement (In Ran1 114)*** The following MU-MIMO within a CDM group between Rel.15 DMRS ports and Rel.18 DMRS ports is not supported:
	+ For PDSCH, between Rel.18 UE1 indicated with Rel-18 New ports (eType1: ports 1008-1015, eType2: ports 1012-1023) and Rel.18 UE2 indicated with Rel.15 DMRS ports in a CDM group.
		- UE does not expect such MU-MIMO within a CDM group

Issue 5: This is minor as well. The highlighted part seems follow the convention of Rel-15 4Tx. It might be fine. But strictly speaking, we don’t have agreement yet on this (others please correct me if I missed any agreement). It is better to put this sentence into square bracket and confirm in next meeting with a explicit agreement. - if the UE is configured with the higher layer parameter *maxNrofPorts* in *PTRS-UplinkConfig* set to 'n2', each PT-RS port is associated with the one of DM-RS pors indicated by DCI field PTRS-DMRS association. PUSCH antenna port 1000, 1001, 1004 and 1005 share PT-RS port 0, and PUSCH antenna port 1002, 1003, 1006 and 1007 share PT-RS port 1.Issue 6: About Table 6.2.3.1-3A, agree with Huawei’s comment/suggested wording update. In the table, TBD can be replaced by “$10log\_{10}\left(L\_{x}\right)+ 10log\_{10}\left(Q\_{p}\right)$” to align with the agreement. We don’t prefer ZTE suggested equation “10log10(Lx) + 3Qp - 3”, as it is in different form than the agreement. These two equation might be mathematically equivalent. But we prefer capture the same equation as agreed.  |   |
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### 2.4 SRS

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| Company | Comments | Editor reply/Notes |
| Futurewei | We thank the editor for the great effort and nice work. Some comments follow.**Comment 1**: The current draft CR 38.214 describes the TDM can be supported. It does not specify that TDM can only be supported for 8-port SRS with usage CB/AS. In fact, it seems no RAN1 specification clearly specifies this restriction. Therefore, we suggest that this be captured in 38.214.*Agreement**For an 8-port SRS resource in a SRS resource set with usage ‘codebook’ or ‘antennaSwitching’ and resource mapping based on TDM onto m ≥ 2 OFDM symbols in a slot and with TDM factor s, support the 8 ports equally partitioned into s subsets with each subset having 8/s different ports.*- Support of time division mapping subsets of ports of ~~the~~ an 8-port SRS resource in an SRS resource set with the usage configured as ‘codebook’ or ‘*antennaSwitching’*, into *S* symbols (*S=2)*, as defined by the higher layer parameter [*tdm*], where the SRS ports are evenly distributed in two symbols.**Comment 2**: Clause 6.2.1.1 describes the SRS frequency hopping procedure. However, the description covers only the cases without TDM. It is suggested to either refer to 211 for the detailed behaviors/equations if TDM is configured, or add more descriptions as below examples:6.2.1.1 UE SRS frequency hopping procedureFor a given SRS resource, the UE is configured with repetition factor R∈{1,2,4} or R∈{1,2,3,4,5,6,7,8,10,12,14} by higher layer parameter *resourceMapping* in *SRS-Resource* where *R*≤*Ns/S*, where S=2 if the higher-layer parameter [*tdm*] is configured, otherwise S$=1$. When frequency hopping within an SRS resource in each slot is not configured and comb offset hopping is not configured and *S*=1 (*R=Ns*), each of the antenna ports of the SRS resource in each slot is mapped in all the  symbols to the same set of subcarriers in the same set of PRBs. When frequency hopping within an SRS resource in each slot is not configured and comb offset hopping is not configured and S=2 (*R=Ns*/S), antenna ports {1000, 1001, 1004, 1005} of the SRS resource in each slot is mapped in half of the  symbols and antenna ports {1000, 1002, 1004, 1006} of the SRS resource in each slot is mapped in the other half of the  symbols to the same set of subcarriers in the same set of PRBs according to clause 6.4.1.4.2 of [4, TS 38.211]. When frequency hopping within an SRS resource in each slot is not configured and comb offset hopping is configured and *S*=1 (*R=Ns*), each of the antenna ports of the SRS resource in each slot is mapped in all the  symbols to the subcarriers in the same set of PRBs according to clause 6.4.1.4.3 of [4, TS 38.211]. When frequency hopping within an SRS resource in each slot is configured without repetition (*R=1*), according to the SRS hopping parameters , and defined in clause 6.4.1.4 of [4, TS 38.211], each of the antenna ports of the SRS resource in each slot is mapped to different sets of subcarriers in each OFDM symbol, where the same transmission comb value is assumed for different sets of subcarriers. When both frequency hopping and repetition within an SRS resource in each slot are configured (*Ns*≥ *4, R* ≥ *2*), each of the antenna ports of the SRS resource in each slot is mapped to the same set of subcarriers within each set of SR adjacent OFDM symbols, and frequency hopping across the $\frac{N\_{s}}{SR}$ sets is according to the SRS hopping parameters , and , where $N\_{s}$ should be divisible by $SR$.For operation with shared spectrum channel access in FR1, the UE does not expect that multiple hops of an SRS resource transmission are in different RB sets.A UE may be configured $N\_{s}=2,4,8,10,12 or 14 $ adjacent symbol aperiodic SRS resource with intra-slot frequency hopping within a bandwidth part, where the full hopping bandwidth is sounded with an equal-size subband across  symbols when frequency hopping is configured with *R=1*. A UE may be configured *Ns*≥ *4* adjacent symbols aperiodic SRS resource with intra-slot frequency hopping within a bandwidth part, where the full hopping bandwidth is sounded with an equal-size subband across $\frac{N\_{s}}{SR}$ sets of S*R* adjacent OFDM symbols, when frequency hopping is configured with *R* ≥ *2, Ns*≥ *R* and *Ns*should be divisible by *SR*. Each of the antenna ports of the SRS resource is mapped to the same set of subcarriers within each set of SR adjacent OFDM symbols of the resource if comb offset hopping is not configured.A UE may be configured symbol periodic or semi-persistent SRS resource with inter-slot hopping within a bandwidth part, where the SRS resource occupies the same symbol location in each slot. A UE may be configured $N\_{s}=2,4,8,10,12 or 14$ symbol periodic or semi-persistent SRS resource with intra-slot and inter-slot hopping within a bandwidth part, where the SRS resource occupies the same symbol location(s) in each slot. For *Ns*≥ *4*, when frequency hopping is configured with *R* ≥ *2*, intra-slot and inter-slot hopping is supported with each of the antenna ports of the SRS resource mapped to different sets of subcarriers across $\frac{N\_{s}}{sR}$ sets of *SR* adjacent OFDM symbol(s) of the resource in each slot, where $N\_{s}$ should be divisible by *SR*. Each of the antenna ports of the SRS resource is mapped to the same set of subcarriers within each set of *SR* adjacent OFDM symbols of the resource in each slot. For *Ns= SR*, when frequency hopping is configured, inter-slot frequency hopping is supported with each of the antenna ports of the SRS resource mapped to the same set of subcarriers in *SR* adjacent OFDM symbol(s) of the resource in each slot if comb offset hopping is not configured. |  |
| Huawei, HiSilicon | Thanks Mihai for the great effort! Regarding the modification, we have the following comment:Agree with the comments proposed by Futurewei, while the detailed modification towards Comment 2 may need further discussion. |  |
| ZTE | Thanks Mihai so much for your great effort on this CR, we have two comments as follows, in which the suggested changes are highlighted as this.**Comment#1**Since TDM scheme is only supported for 8-port SRS, we propose the following change.

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| **Proposed change (section 6.2.1):**Support of time division mapping subsets of ports of an SRS resource with 8 ports into *S* symbols (S=2), as defined by the higher layer parameter [*tdm*], where the SRS ports are evenly distributed in two symbols. |

**Comment#2**We have the following agreement in RAN#113 meeting. To capture this point, we propose the following change.**Agreement (RAN1#113)**

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| SRS comb offset hopping and cyclic shift hopping can be configured for a SRS resource at the same time as a separate UE capability. No joint hopping scheme is supported. |

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| **Proposed change (section 6.2.1):**For the comb offset hopping, a UE can be configured with a subset of comb offsets by the higher layer parameter [c*ombOffsetHoppingSubset*], where the comb offset hopping is performed only across the comb offsets configured in the subset. The UE is not expecting that the comb offset hopping and the higher layer parameter [*tdm*] are configured simultaneously. The higher layer parameters [*cyclicShiftHopping*] and [*combOffsetHopping*] can be both configured subjective to UE capability. |

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| QC | We agree with FutureWei’s comment 1 to clarify the TDM SRS scope, which only applies to 8Tx SRS with usage codebook and antenna Switching. Regarding FutureWei’s comment 2, we suggest referring to 38.211 for frequency hopping procedure with TDM. The suggested wording update in comment seems too complicated. It is like a TP which needs more discussion in next RAN1 meeting, if we decided to update this paragraph in 38.214.  |  |
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### 2.5 8TX

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| Company | Comments | Editor reply/Notes |
| ZTE | **Comment #1 (Section 6.1.1.1)**The following description for codebookType seems wired: codebookType is up to the value of ULcodebookFC-N1N2. In logic, ULcodebookFC-N1N2 can be provided, if ‘codebook1 corresponding to Ng=11 is enabled by ‘CodebookType’. Please review the following RRC parameter as agreed.

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| ULcodebookFC-N1N2 | Supported combination of a pair of parameters (N1, N2Only applicable to CodebookType='Codebook1' | (4,1), (2,2) |
| CodebookType | Codebook typeCodebook1 corresponds to Ng=1Codebook2 corresponds to Ng=2Codebook3 corresponds to Ng=4Codebook4 corresponds to Ng=8Ng represents the number of antenna port-groups | {Codebook1, Codebook2, Codebook3, Codebook4} |

Then, based on the above RRC parameter, we have the following suggestion:

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| A UE does not expect to be configured by *CodebookType* with a value of *CodebookType* that does not correspond to one of the values of *UL\_8TX\_Ng* reported in its capability. A UE can be configured by *ULcodebookFC-N1N2* subjective to UE capability, when higher layer parameter *CodebookType* is set to 'Codebook1’ corresponding to Ng=1, where Ng represents the number of antenna port-groups. |

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### 2.6 2TA

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| Company | Comments | Editor reply/Notes |
| Samsung | **Comment 1:**The agreement made in RAN1#114 says: “when the PDCCH order is transmitted from a TRP associated with additionalPCI”, we prefer to use wording that is aligned with the agreement as follows:“when receiving a PDSCH scheduled with RA-RNTI in response to a random access procedure triggered by a PDCCH order which triggers contention-free random access procedure for the SpCell [10, TS 38.321], and if the ~~CORESET~~ TCI state used for the PDCCH order transmission is ~~not~~ associated with ~~the serving~~ additional PCI different from the serving PCI, ~~cell physical cell ID~~ **Comment 2:**We prefer to leave the QCL of PDCCH RAR for 38.213, as it is already described there for other use cases of the PDCCH order.“when receiving a PDSCH scheduled with RA-RNTI in response to a random access procedure triggered by a PDCCH order which triggers contention-free random access procedure for the SpCell [10, TS 38.321], and if the CORESET used for the PDCCH order transmission is not associated with the serving cell physical cell ID, the UE may assume that ~~the DM-RS port of the PDCCH that includes the DCI format 1\_0 and~~ the DM-RS ports of the received PDSCH are quasi co-located with the DM-RS antenna port associated with PDCCH receptions in the CORESET for Type1-PDCCH CSS set with respect to Doppler shift, Doppler spread, average delay, delay spread, and spatial RX parameters when applicable.” |  |
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