**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>----------------------------- |  |
| Huawei, HiSilicon | Thanks Mihai for all the efforts. **Comment #1 (Clause 5.1.5):**In Rel-18 SDI-based uTCI framework with joint DL/UL TCI states, MAC-CE activation command can have up to 8 sets of TCI states where each set is comprised of up to two TCI states each of which is for DL channel/signals AND uplink channels/signals (see the following agreement from RAN1 112b). Current CR texts mentions up to “8 pairs of TCI states”. However, as discussed above, the TCI states do not necessarily come as a pair and the codepoint of TCI field may be mapped to only one joint DL/UL TCI state.Also, in Rel-18 uTCI framework with separate DL/UL TCI states, each TCI codepoint can be associated with up to 4 TCI states (that is 0, 1, 2, 3, or 4 TCI states) among which up to 2 TCI states (that is 0 , 1, or 2) are for DL signals/channels and up to 2 TCI states are for UL signals/channels (see the same agreement below). Note that since “up to 2 TCI states” include the case of 0 TCI state, we don’t need “and/or” between DL TCI states and UL TCI states. It is sufficient to mention “up to 2 TCI state(s) for DL signals/channels and up to 2 TCI states for UL signals/channels”. Therefore, we suggest the following modification

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| The UE receives an activation command, as described in clause 6.1.3.14 of [10, TS 38.321], 6.1.3.47 of [10, TS 38.321] or 6.1.4.xx of [10, TS 38.321], used to map up to 8 TCI states and/or pairs of TCI states, with one TCI state for DL channels/signals and/or one TCI state for UL channels/signals to the codepoints of the DCI field *'Transmission Configuration Indication'* for one or for a set of CCs/DL BWPs, [and/] or up to 8 ~~pairs of TCI states or~~ sets of TCI states, where each set is comprised of up to two TCI state(s) for DL and UL signals/channels, or ~~one or~~ up to two TCI state(s) for DL channels/signals and~~/or one or~~  up to two TCI state(s) for UL channels/signals to the codepoints of the DCI field *'Transmission Configuration Indication'* for one or for a set of CCs/DL BWPs, and if applicable, for one or for a set of CCs/UL BWPs. |

**Agreement (112b)**On unified TCI framework extension for S-DCI based MTRP operation, support the followings:* For a serving cell configured with joint DL/UL TCI mode, a full-set or any sub-set of {first joint TCI state, second joint TCI state} can be mapped to a TCI codepoint of the existing TCI field in a DCI format 1\_1/1\_2 by TCI state activation command (MAC-CE)
* For a serving cell configured with separate DL/UL TCI mode, a full-set or any sub-set of {first DL TCI state, first UL TCI state, second DL TCI state, second UL TCI state} can be mapped to a TCI codepoint of the existing TCI field in a DCI format 1\_1/1\_2 by TCI state activation command (MAC-CE)
* TCI state activation command (MAC-CE) should indicate that each joint/DL/UL TCI state mapped to a TCI codepoint is the first or second joint/DL/UL TCI state (detail on how to indicate above is up to RAN2 design)
* The first/second indicated joint/DL/UL TCI state(s) is updated according to the corresponding first/second joint/DL/UL TCI state(s) mapped to the TCI codepoint received by the UE
	+ If the UE receives a TCI codepoint mapped with a sub-set of {first joint TCI state, second joint TCI state} or {first DL TCI state, first UL TCI state, second DL TCI state, second UL TCI state}, the UE shall update the first/second indicated joint/DL/UL TCI state(s) according to the first/second joint/DL/UL TCI state(s) in the subset and keep other indicated first/second joint/DL/UL TCI state(s) that is not updated by the received TCI codepoint

**Comment#2 (Clause 5.1.5).** Editorial

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| If the DCI format 1\_1/1\_2 indicates codepoint "00" for the [TCI selection field], the UE shall apply the first one of two indicated joint/DL TCI states to all PDSCH DM-RS port(s) of corresponding PDSCH transmission occasion~~s~~(s) scheduled or activated by the DCI format 1\_1/1\_2.- If the DCI format 1\_1/1\_2 indicates codepoint "01" for the [TCI selection field], the UE shall apply the second one of two indicated joint/DL TCI states to all PDSCH DM-RS port(s) of corresponding PDSCH transmission occasion~~s~~(s) scheduled or activated by the DCI format 1\_1/1\_2. |

**Comment#3 (Clause 5.2.1.5.1)**Suggest to remove the following sentences regarding the “buffering behaviour” from the CR. These two sentences correspond to the notes in Agreement A and B below. However, the same “note” and “buffering” behaviour also apply to PDSCH (see Agreement C). However, such “buffering behaviour” is not captured for PDSCH reception in the spec. Further, a similar “buffering behaviour” has been an underlying assumption for PDSCH reception from back in Rel-16 while it has never been captured in the spec. Therefore, for the sake of consistency, we suggest to remove these sentences from UE behaviour during CSI-RS reception.

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| correspond to the indicated TCI-States specific to coresetPoolIndex value 0 and value 1, respectively. When a UE is configured with *dl-OrJointTCI-StateList* and is having two indicated TCI states and if the offset between the last symbol of the PDCCH carrying the triggering DCI and the first symbol of the aperiodic CSI-RS resources in the aperiodic CSI-RS resource set is smaller than a threshold:-If there is no DL signal in the same symbols as the aperiodic CSI-RS-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.~~-Otherwise, the UE shall apply the first indicated joint/DL TCI state to the aperiodic CSI-RS.When a UE is configured with *dl-OrJointTCI-StateList*, is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in different *ControlResourceSets,* is having two indicated TCI states and if the offset between the last symbol of the PDCCH carrying the triggering DCI and the first symbol of the aperiodic CSI-RS resources in the aperiodic CSI-RS resource set is smaller than a threshold:-If there is no DL signal in the same symbols as the aperiodic CSI-RS-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.~~-Otherwise, the UE shall apply the indicated joint/DL TCI state specific to *coresetPoolIndex* value 0 to the aperiodic CSI-RS resource set. |

**Agreement A**On unified TCI framework extension for S-DCI based MTRP, if the scheduling offset between the last symbol of the PDCCH carrying the triggering DCI and the first symbol of AP CSI-RS resources in an AP CSI-RS resource set for BM/CSI is smaller than a threshold for AP CSI-RS reception:* FFS: If there is any other DL signal in the same symbols as the AP CSI-RS
* If there is no DL signal in the same symbols as the AP CSI-RS:
	+ If the UE is in FR1 or the UE supports the capability of two default beams for S-DCI based MTRP in FR2, the UE shall apply the first or the second indicated joint/DL TCI state to the AP CSI-RS according to the RRC configuration(s) provided to the AP CSI-RS resource or AP CSI-RS resource set
		- Note: If the UE supports the capability of two default beams for S-DCI based MTRP in FR2, UE uses both indicated joint/DL TCI states to buffer the received signal before a threshold.
	+ Otherwise, the UE shall apply the first indicated joint/DL TCI state to the AP CSI-RS.
* FFS: The definition of other DL signals
* Note: Whether to reuse the legacy UE capability (*beamSwitchTiming*/*beamSwitchTiming-r16*) as the threshold for AP CSI-RS reception is discussed in Rel-18 UE feature AI

**Agreement B**On unified TCI framework extension for M-DCI based MTRP, if the scheduling offset between the last symbol of the PDCCH carrying the triggering DCI and the first symbol of AP CSI-RS resources in an AP CSI-RS resource set for BM/CSI is smaller than a threshold for AP CSI-RS reception:* If there is no other DL signal in the same symbols as the AP CSI-RS:
	+ If the UE is in FR1 or the UE supports the capability of default beam per *coresetPoolIndex* for M-DCI based MTRP in FR2:
		- Alt1: The UE shall apply the first or the second indicated joint/DL TCI state to the AP CSI-RS according to the RRC configuration(s) provided to the AP CSI-RS resources or AP CSI-RS resource set
		- Note: If the UE supports the capability of two default beam per *coresetPoolIndex* for M-DCI based MTRP in FR2, UE uses both indicated joint/DL TCI states to buffer the received signal before a threshold.
	+ Otherwise, the UE shall apply the indicated joint/DL TCI state specific to *coresetPoolIndex* value 0 to the AP CSI-RS resource set.
* FFS: If there is any other DL signal in the same symbols as the AP CSI-RS
* FFS: The definition of other DL signals
* Note: Whether to reuse the legacy UE capability (*beamSwitchTiming*/*beamSwitchTiming-r16*) as the threshold for AP CSI-RS reception is discussed in Rel-18 UE feature AI

**Agreement C (RAN1 112)**On unified TCI framework extension for S-DCI based MTRP, a 2-bit [TCI selection field] can be configured by RRC to be present in a DCI format 1\_1/1\_2 that schedules/activates PDSCH reception (including dynamic PDSCH and SPS PDSCH) according to the followings:* If the DCI format 1\_1/1\_2 indicates codepoint "00" for the [TCI selection field], the UE shall apply the first one of two indicated joint/DL TCI states to all PDSCH DMRS port(s) of corresponding PDSCH transmission occasions(s) scheduled/activated by the DCI format 1\_1/1\_2
* If the DCI format 1\_1/1\_2 indicates codepoint "01" for the [TCI selection field], the UE shall apply the second one of two indicated joint/DL TCI states to all PDSCH DMRS port(s) of corresponding PDSCH transmission occasions(s) scheduled/activated by the DCI format 1\_1/1\_2
* If the DCI format 1\_1/1\_2 indicates codepoint "10" for the [TCI selection field], the UE shall apply both indicated joint/DL TCI states to the PDSCH reception scheduled/activated by the DCI format 1\_1/1\_2
* FFS: Whether and how to use the codepoint "11" of the [TCI selection field]

If the UE is in FR1, or the UE supports the capability of two default beams for S-DCI based MTRP in FR2 regardless of threshold, above apply to PDSCH reception(s) scheduled/activated by the DCI format 1\_1/1\_2. * Note: If the UE supports the capability of two default beams for S-DCI based MTRP in FR2, UE uses both indicated joint/DL TCI states to buffer the received signal before a threshold.

If the UE doesn’t support the capability of two default beams for S-DCI based MTRP in FR2, above apply to the scheduled/activated PDSCH reception when the offset between the reception of the scheduling DCI format 1\_1/1\_2 and the scheduled/activated PDSCH reception is equal to or larger than a threshold* FFS: How to apply the indicated joint/DL TCI state(s) to the scheduled/activated PDSCH reception if the offset between the reception of the scheduling DCI format 1\_1/1\_2 and the scheduled/activated PDSCH reception is less than a threshold in FR2

FFS: Detail of the capability of two default beams for S-DCI based MTRP FFS: The threshold value**Comment#4 (Clause 6.1)**Suggest following modification for a better accuracy and alignment with the corresponding Agreements A and B below. Also, in mDCI-based operation, *applyIndicatedTCIState* is not supposed to indicate ‘both’ for Type 1 CG-PUSCH (See Agreement C below). However, the current CR text does not preclude ‘both’ for mDCI-based operation. Suggest he following modification to avoid misunderstanding.

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| When a UE is configured with *dl-OrJointTCI-StateList* and is having two indicated TCI-States or TCI-UL-States, a UE configured with a PUSCH transmission corresponding to a Type 1 configured grant is expected to be configured with the higher layer parameter *applyIndicatedTCIState* indicating the *first*, the *second* or *both* of the indicated TCI states to be applied for the PUSCH transmission. If ‘both’ TCI states are indicated, the UE should apply the first indicated TCI state to the PUSCH transmission occasion(s) or the PUSCH antenna port(s) associated with the first SRS resource set for CB/NCB transmission, and the second indicated TCI state to the PUSCH transmission occasion(s) or the PUSCH antenna port(s) associated with the second SRS resource set for CB/NCB transmission; otherwise the UE should apply either the ‘first’ or ‘second’ indicated TCI state to all PUSCH transmission occasions.- If the UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in different *ControlResourceSets*, the first and the second indicated TCI states correspond to the indicated TCI-States or TCI-UL-States specific to coresetPoolIndex value 0 and value 1, respectively, and  *applyIndicatedTCIState* does not indicate *both* of the indicated TCI states to be applied for the PUSCH transmission. |

**Agreement A(113)**On unified TCI framework extension for S-DCI based MTRP, when two indicated joint/UL TCI states are applied to a PUSCH transmission * For SDM and SFN based PUSCH Tx schemes, the UE shall apply the first indicated joint/UL TCI state to the PUSCH antenna port(s) associated with the first SRS resource set, and the second indicated joint/UL TCI state to the PUSCH antenna port(s) associated with the second SRS resource set, respectively.
* Note: The association between PUSCH antenna port(s) and an SRS resource set is discussed and defined in STxMP AI

**Agreement B (112b)**On unified TCI framework extension for S-DCI based MTRP, an RRC configuration is provided to a Type1 CG configuration to inform that the UE shall apply the first, the second, or both indicated joint/UL TCI states to the corresponding CG-PUSCH transmission* If the first or the second indicated joint/UL TCI state is applied, the UE shall apply the first or the second indicated joint/UL TCI state to all PUSCH antenna port(s) of corresponding PUSCH transmission occasions(s)
* If both indicated joint/UL TCI states are applied:
	+ For TDM based PUSCH Tx scheme, the UE shall apply the first indicated joint/UL TCI state to the PUSCH transmission occasions(s) associated with the first SRS resource set for CB/NCB, and the second indicated joint/UL TCI state to the PUSCH transmission occasions(s) associated with the second SRS resource set for CB/NCB
	+ FFS: SDM and SFN based PUSCH Tx schemes

**Agreement C (112b)**On unified TCI framework extension for M-DCI based MTRP, an RRC configuration is provided to a Type1 CG configuration to inform that the UE shall apply the first or the second indicated joint/UL TCI state to the corresponding CG-PUSCH transmission, where the first and the second indicated joint/DL TCI states correspond to the indicated joint/UL TCI states specific to *coresetPoolIndex* value 0 and value 1, respectively. |  |
| MediaTek | Thanks for your great effort on the draft CR. Please find our comments bellow.**5.1 UE procedure for receiving the physical downlink shared channel****Comment 1:** The UE behavior of following paragraph has been captured in 213 (together with PDCCH reception), thus we suggest to remove it.

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**5.1.5 Antenna ports quasi co-location****Comment 2:** Since there could be two indicated joint/DL TCI states and UL TCI states in unified TCI extension for S-DCI based MTRP, we suggest the following changes:

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| The UE receives an activation command, as described in clause 6.1.3.14 of [10, TS 38.321], 6.1.3.47 of [10, TS 38.321] or 6.1.4.xx of [10, TS 38.321], used to map up to 8 TCI states and/or pairs of TCI states, with one TCI state for DL channels/signals and/or one TCI state for UL channels/signals to the codepoints of the DCI field *'Transmission Configuration Indication'* for one or for a set of CCs/DL BWPs, [and/] or up to 8 pairs of TCI states or sets of TCI states, where each set is comprised of one or two TCI state(s) for DL channels/signals and/or one or two TCI state(s) for UL channels/signals to the codepoints of the DCI field *'Transmission Configuration Indication'* for one or for a set of CCs/DL BWPs, and if applicable, for one or for a set of CCs/UL BWPs. When a set of TCI state IDs are activated for a set of CCs/DL BWPs and if applicable, for a set of CCs/UL BWPs, where the applicable list of CCs is determined by the indicated CC in the activation command, the same set of TCI state IDs are applied for all DL and/or UL BWPs in the indicated CCs. If the activation command maps *TCI-State* and/or *TCI-UL-State* to only one TCI codepoint, the UE shall apply the indicated *TCI-State(s)* and/or *TCI-UL-State(s)* to one or to a set of CCs /DL BWPs, and if applicable, to one or to a set of CCs /UL BWPs once the indicated mapping for the one single TCI codepoint is applied as described in [11, TS 38.133].When the *bwp-id* or *cell* for QCL-TypeA/D source RS in a QCL-Info of the TCI state is not configured, the UE assumes that QCL-TypeA/D source RS is configured in the CC/DL BWP where TCI state applies.When *tci-PresentInDCI* is set as 'enabled' or *tci-PresentDCI-1-2* is configured for the CORESET, a UE configured with *dl-OrJointTCI-StateList* with activated *TCI-State* or *ul-TCI-StateList* with activated *TCI-UL-State* receives DCI format 1\_1/1\_2 providing indicated *TCI-State(s)* and/or *TCI-UL-State(s)* for a CC or all CCs in the same CC list configured by *simultaneousU-TCI-UpdateList1-r17, simultaneousU-TCI-UpdateList2-r17, simultaneousU-TCI-UpdateList3-r17, simultaneousU-TCI-UpdateList4-r17*. The DCI format 1\_1/1\_2 can be with or without, if applicable, DL assignment. If the DCI format 1\_1/1\_2/ is without DL assignment, the UE can assume the following: |

**Comment 4:** Re the presence of DCI field, we think it would be better to capture it in 212 instead of 214 (and it has been captured). Thus, we suggest to remove the following paragraph from session 5.1.5.

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**6.1 UE procedure for transmitting the physical uplink shared channel****Comment 5:** The following agreement is missing in current draft CR.**Agreement (RAN1#112bis)**On unified TCI framework extension for S-DCI based MTRP, the UE shall apply the first indicated joint/UL TCI state to PUSCH transmission(s) scheduled/activated by DCI format 0\_0 (including DG and Type2 CG)**6.1.1.1 Aperiodic CSI Reporting/Aperiodic CSI-RS when the triggering PDCCH and the CSI-RS have the same numerology****Comment 6:** We think spec doesn’t have to capture the “note” clarifying the UE behavior how to buffer OFDM symbols if UE support two default beams. Thus, we suggest to remove the corresponding sentences.

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| When a UE is configured with *dl-OrJointTCI-StateList* and is having two indicated TCI states and if the offset between the last symbol of the PDCCH carrying the triggering DCI and the first symbol of the aperiodic CSI-RS resources in the aperiodic CSI-RS resource set is smaller than a threshold:-If there is no DL signal in the same symbols as the aperiodic CSI-RS-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. -Otherwise, the UE shall apply the first indicated joint/DL TCI state to the aperiodic CSI-RS.When a UE is configured with *dl-OrJointTCI-StateList*, is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in different *ControlResourceSets,* is having two indicated TCI states and if the offset between the last symbol of the PDCCH carrying the triggering DCI and the first symbol of the aperiodic CSI-RS resources in the aperiodic CSI-RS resource set is smaller than a threshold:-If there is no DL signal in the same symbols as the aperiodic CSI-RS-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. -Otherwise, the UE shall apply the indicated joint/DL TCI state specific to *coresetPoolIndex* value 0 to the aperiodic CSI-RS resource set. |

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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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| Huawei, HiSilicon | **Comment#1 (Clause 6.1)**In the following, suggest to change “codepoint” to “field” for a better accuracy

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| 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~~ field ‘SRS Resource Set Indicator’ is not present. |

**Comment#2 (Clause 6.1):**Suggest to add the following few words for the sake of better clarity and alignment with the legacy version. Further, when we write “a<b defines c”, we typically mean that “a defines c” and NOT “b defines c”. So, “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.”, implies that v1 and v2 define the maximum number of layers which is not correct. Therefore, we suggest the following changes. Similar comment regarding the SFN part is also applicable.

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| 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 that corresponds to the SRS resource 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} and that corresponds to the SRS resource, v1 ≤ *maxRankSdm* andv2 ≤ *maxRankSdm* or *maxRankSdmDCI-0-2* and *maxRankSdm* or *maxRankSdmDCI-0-2* is defining the maximum number of layers applied over the first and the second SRS resource sets, separately. |

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| OPPO | Thank you for your great efforts. Please find our comments below:**Comment 1**: Suggest to capture following agreement in section 6.2.3.1:**Agreement**For SDM scheme, maximum of 2 PTRS ports can be configured if UE has reported the capability of supporting full-coherent UL transmission.* + Where there are at most 1 PTRS port per SRS resource set

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| If a UE has reported the capability of supporting full-coherent UL transmission, the UE shall expect the number of UL PT-RS ports to be configured as one if UL-PTRS is configured. If a UE has reported the capability of supporting full-coherent UL transmission and when the higher layer parameter *multipanelScheme* is set to ‘sdmscheme’, the UE shall expect the number of UL PT-RS ports to be configured as one per SRS resource set if UL-PTRS is configured and 2 PTRS ports are configured. |

**Comment 2**: Suggest to capture following agreement in section 6.2.3.1:**Agreement**Support single-DCI based SDM and SFN scheme in CG-PUSCH within one CG configuration* For Type-1 CG-PUSCH, configure two SRI fields and two TPMI fields in CG configuration.
	+ For Type-1 CG-PUSCH single-DCI based SFN, the UE may assume the association between UL PT-RS port(s) and DM-RS port(s) defined by value 0 in Table 7.3.1.1.2-25 or value "00" in Table 7.3.1.1.1.2-26 described in Clause 7.3.1 of [5, TS38.212].
		- Note: it is the same behavior as Type1 CG-PUSCH for sTRP transmission.
	+ For Type-1 CG-PUSCH single-DCI based SDM, the UE may assume the association between UL PT-RS port(s) and DM-RS port(s) defined by value 0 in Table 7.3.1.1.2-25 or value "00" in Table 7.3.1.1.1.2-25a described in Clause 7.3.1 of [5, TS38.212].
* For Type-2 CG-PUSCH, the SRS resource set indicator/SRI fields/TPMI fields in the activation DCI of the SDM/SFN are applied to the activated CG PUSCH.

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| For codebook or non-codebook based UL transmission, 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. For a PUSCH corresponding to a configured grant Type 1 transmission, the UE may assume the association between UL PT-RS port(s) and DM-RS port(s) defined by value 0 in Table 7.3.1.1.2-25 or value "00" in Table 7.3.1.1.1.2-26 described in Clause 7.3.1 of [5, TS38.212]. For a PUSCH corresponding to a configured grant Type 1 transmission and when the higher layer parameter *multipanelScheme* is set to ‘SFNscheme’, the UE may assume the association between UL PT-RS port(s) and DM-RS port(s) defined by value 0 in Table 7.3.1.1.2-25 or value "00" in Table 7.3.1.1.1.2-26 described in Clause 7.3.1 of [5, TS38.212]. For a PUSCH corresponding to a configured grant Type 1 transmission and when the higher layer parameter *multipanelScheme* is set to ‘sdmscheme’, the UE may assume the association between UL PT-RS port(s) and DM-RS port(s) defined by value 0 in Table 7.3.1.1.2-25 or value "00" in Table 7.3.1.1.1.2-25a described in Clause 7.3.1 of [5, TS38.212]. |

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| MediaTek | Thanks for your great effort on the draft CR. Please find our comments bellow.**6.1 UE procedure for transmitting the physical uplink shared channel****Comment 1:** Re the presence of DCI field, we think it would be better to capture it in 212 instead of 214 (and it has been captured). Thus, we suggest to remove the following paragraph from session 6.1.

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**6.1.1.1 Codebook based UL transmission****Comment 2:** Regarding the max number of layers for SFN scheme, we think it not necessary to capture it in 214 since it will be reflected in the value rage of corresponding RRC parameter. Meanwhile, some correction to the typos.

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| 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 *maxRankSfnDCI-0-2* 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. - |

**Comment 3:** There could be two SRS resources indicated for PUSCH transmission occasion for SDM/SFN based STxMP, thus we suggest the following change:

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| The UE shall transmit PUSCH using the same antenna port(s) as the SRS port(s) in the SRS resource(s) indicated by the DCI format 0\_1 or 0\_2 or by *configuredGrantConfig* according to clause 6.1.2.3. |

**6.1.1.2 Non-Codebook based UL transmission****Comment 4:** Same as Comment 2 for the sub-bullet for maximum number of layers. Meanwhile, similar to CB based Tx, we think the maximum value of v can be defined directly based on RRC parameters. Thus, we sugest the following changes:

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| 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 ≤ *maxMIMO-LayersforSfn* or *maxMIMO-LayersforSfnDCI-0-2* - 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 ≤ *maxMIMO-Layers* or *maxMIMO-LayersDCI-0-2*. 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. - |

**6.2.3.1 UE PT-RS transmission procedure when transform precoding is not enabled****Comment 4:** To align with the wording of “actual number of UL PT-RS port(s)” in the first half paragraph.

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| 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 actual 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 actual 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]. |

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| SS2 | We share similar view as QC that the following agreement is NOT capture in the draft CR.

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| **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.
 |

We suggest the following update to better align with the current wording in 38.214.

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| Except for the case when a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet* and the UE is configured with *enableSTx2PofmDCI* and two PUSCHs are associated with different values of *coresetPoolIndex,* ~~A~~ 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].  |

In addition, the following update is suggested for PUSCH with CSI reports.

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| 5.2.5 Priority rules for CSI reportsFor two overlapping PUSCHs, the priority rules in this clause are applied for physical channels with same priority index according to clause 9 in [6, TS 38.213] if a UE is not configured with *enableSTx2PofmDCI*. When a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet* and the UE is configured with *enableSTx2PofmDCI,* the priority rules in this clause are applied for physical channels associated with same value of *coresetPoolIndex* with same priority index according to clause 9 in [6, TS 38.213] |

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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:

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
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| **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.” |  |
| LG | Thanks Mihai for your great effort with drafting TS.Regarding Samsung’s first comment, because configuration of TCI state for a CORESET is an optional, so the original version is correct from our view.Regarding Samsung’s second comment, we prefer the original version from editor, since the condition for PDCCH order is different from legacy behaviour, i.e., PDCCH order is received from additional PCI. So, the original version which also includes QCL assumption for RAR scheduling PDCCH should be crystal clear for describing exact UE behaviour. |  |
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