**3GPP TSG RAN WG1 #118 R1-2407188**

**Maastricht, NL, August 19th – 23rd, 2024**

**Source: Moderator (OPPO)**

**Title: Summary on Rel-18 STxMP**

**Agenda Item: 8.1**

**Document for: Discussion and Decision**

# Introduction

This document summarizes draft CRs on Rel-18 STxMP proposed in company contributions of AI 8.1.

# Draft CRs

## **PUSCH out-of-order in mDCI-based STxMP**

In draft CR R1-2406623 along with discussion paper R1-2406622, Samsung proposed text changes for 38.214 to clarify the UE behaviour of PUSCH out-of-order in mDCI based STxMP PUSCH+PUSCH. The reason for this change is: In TS 38.214-i20, the condition “non-overlapping in time domain” on two PUSCHs scheduling has been deleted, and it is not able to clearly capture UE behaviours without using STx2P related RRC parameter and UE capability for supporting out-of-order operation for STx2P. Specially, the proposed change is:

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| 6.1 UE procedure for transmitting the physical uplink shared channel  < Unchanged parts are omitted >  Except for the case when a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet* for the active BWP of a serving cell and PDCCHs that schedule two non-overlapping in time domain PUSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex* and the UE reports its capability of *outOfOrderOperationUL-r16,* for any two HARQ process IDs in a given scheduled cell, if the UE is scheduled to start a first PUSCH transmission starting in symbol *j* by a PDCCH ending in symbol *i*, the UE is not expected to be scheduled to transmit a PUSCH starting earlier than the end of the first PUSCH by a PDCCH that ends later than symbol *i*.  < Unchanged parts are omitted >  If a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet* for the active BWP of a serving cell and PDCCHs that schedule two non-overlapping in time domain PUSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex* and the UE reports its capability of *outOfOrderOperationUL-r16,* for any two HARQ process IDs in a given scheduled cell, if the UE is not configured with *sTx-2Panel* and is scheduled to start a first PUSCH transmission starting in symbol *j* by a PDCCH associated with a value of *coresetPoolIndex* ending in symbol *i*, the UE can be scheduled to transmit a PUSCH starting earlier than the end of the first PUSCH by a PDCCH associated with a different value of *coresetPoolIndex* that ends later than symbol *i*.  If a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet* for the active BWP of a serving cell and PDCCHs that schedule two PUSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex* and the UE is configured with *sTx-2Panel,* for any two HARQ process IDs in a given scheduled cell, if the UE is scheduled to start a first PUSCH transmission starting in symbol *j* by a PDCCH associated with a value of *coresetPoolIndex* ending in symbol *i*   * if the UE reports its capability of [*outOfOrderOperationUL-r18*],   + the UE can be scheduled to transmit a PUSCH starting earlier than the end of the first PUSCH by a PDCCH associated with a different value of *coresetPoolIndex* that ends later than symbol *i*. * Otherwise,   + the UE is not expected to be scheduled to transmit a PUSCH starting earlier than the end of the first PUSCH by a PDCCH associated with a different value of *coresetPoolIndex* that ends later than symbol *i*. |

**Proposal 1:** Adopt the above text proposal for TS 38.214

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| **Company** | **Comments** |
| Mod | This draft CR was discussed in previous meeting. In last meeting, the views diverged. A couple of companies thought this change is not needed while some companies were ok/supportive of this change.  Please share our views on this TP |
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## **Clarify the precoding behavior of SDM/SFN in 38.211**

ZTE proposed to add a new paragraph to describe the precoding of SDM and SFN scheme in 38.211. The draft CR is in R1-2406040 along with the discussion paper R1-2406039. The proposed change for 38.211 is:

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| 6.3.1.5 Precoding  The block of vectors shall be precoded according to  where , . The set of antenna ports shall be determined according to the procedure in [6, TS 38.214].  - When the higher layer parameter *multipanelSchemeSDM* is configured, and if codepoint "10" of of *SRS Resource Set* *indicator* is indicated, the block of vectors shall be precoded by the precoder indicated by the first TPMI and the block of vectors shall be precoded by the precoder indicated by the second TPMI according to the procedure in [6, TS 38.214];  - When the higher layer parameter *multipanelSchemeSFN* is configured, and if codepoint "10" of of *SRS Resource Set* *indicator* is indicated, the block of vector shall be precoded by the precoder indicated by the first TPMI and the precoder indicated by the second TPMI separately according to the procedure in [6, TS 38.214].  For non-codebook-based transmission, the precoding matrix equals the identity matrix.  For codebook-based transmission, the precoding matrix depends on the number of antenna ports used for the transmission:  - for single-layer transmission on a single antenna port, ;  - for transmissions using 2, or 4 antenna ports, is given by Tables 6.3.1.5-1 to 6.3.1.5-7;  - for transmissions using 8 antenna ports, is given by  where  - the subscripts and denote the row of the respective matrix;  - is given by Table 6.3.1.5-8;  - the intermediate precoding matrix is given by Tables 6.3.1.5-9 to 6.3.1.5-24, 6.3.1.5-29 to 6.3.1.5-36, and 6.3.1.5-39 to 6.3.1.5-47 with representing the all-zero matrix with rows and columns;  - the submatrices are given by Tables 6.3.1.5-25 to 6.3.1.5-28 and 6.3.1.5-37 to 6.3.1.5-38.  The TPMI index used in the tables above is obtained from the DCI scheduling the uplink transmission or the higher layer parameters according to the procedure in [6, TS 38.214].  When the higher-layer parameter *txConfig* is not configured, the precoding matrix .  <------------------------- **Irrelevant parts are omitted** -------------------------> |

**Proposal 2:** Adopt the above text proposal for TS 38.211

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| **Company** | **Comments** |
| Mod | This issue has been discussed in a couple of previous meetings. Per discussion in last meeting, more companies thought this change is not needed/essential.  Please share your views on this TP. |
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## **Maximum number of simultaneous SRS resources across two NCB SRS sets**

ZTE proposed draft CR for 38.214 in R1-2406042 along with the discussion paper R1-2406041 to specify that for the maximum number of SRS resources across two SRS resource sets for NCB of SDM/SFN scheme that can be transmitted simultaneously should be limited by the UE capability:

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| 6.1.1.2 Non-Codebook based UL transmission  For non-codebook based transmission, PUSCH can be scheduled by DCI format 0\_0, DCI format 0\_1, DCI format 0\_2, DCI format 0\_3 or semi-statically configured to operate according to Clause 6.1.2.3. If this PUSCH is scheduled by DCI format 0\_1, DCI format 0\_2, DCI format 0\_3 or semi-statically configured to operate according to Clause 6.1.2.3, the UE can determine its PUSCH precoder(s) and transmission rank based on the SRI(s) when multiple SRS resources are configured, where the SRI(s) is given by one or two SRS resource indicator(s) in DCI according to clause 7.3.1.1.2 and 7.3.1.1.3 of [5, 38.212] for DCI format 0\_1 and DCI format 0\_2, or the SRI is given by one SRS resource indicator in DCI according to clause 7.3.1.1.4 of [5, 38.212] for DCI format 0\_3, or the SRI is given by *srs-ResourceIndicator* according to clause 6.1.2.3, or SRIs given by *srs-ResourceIndicator* and *srs-ResourceIndicator2* according to clause 6.1.2.3.. The *SRS-ResourceSet(s)* applicable for PUSCH scheduled by DCI format 0\_1 and DCI format 0\_2 are defined by the entries of the higher layer parameter *srs-ResourceSetToAddModList* and *srs-ResourceSetToAddModListDCI-0-2* in *SRS-config*, respectively. The UE shall use one or multiple SRS resources for SRS transmission, where, in one or two SRS resource set(s), the maximum number of SRS resources which can be configured to the UE for simultaneous transmission in the same symbol and the maximum number of SRS resources are UE capabilities. The SRS resources transmitted simultaneously occupy the same RBs. For a given CC, multiple SRS resources in a set with usage “nonCodebook” are not expected to be partially overlapped in time. Only one SRS port for each SRS resource is configured. Only one or two SRS resource sets can be configured in *srs-ResourceSetToAddModList* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'nonCodebook', and only one or two SRS resource sets can be configured in *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'nonCodebook'. 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', SRIs are given by the DCI fields of two SRS resource indicators in clauses 7.3.1.1.2 and 7.3.1.1.3 of [5, TS 38.212] for DCI format 0\_1 and 0\_2 and the UE applies the indicated SRI(s) to one or more PUSCH repetitions according to the associated SRS resource set of a PUSCH repetition according to clause 6.1.2.1. A UE does not expect two SRS resource sets are configured in *srs-ResourceSetToAddModList* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'nonCodebook' for a serving cell, when the serving cell is included in *schedulingCellListDCI-0-3-r18* for a set of serving cells provided by *mc-DCI-SetOfCellsToAddModList-r18*. The maximum number of SRS resources per SRS resource set that can be configured for non-codebook based uplink transmission is 1, 2, 4 or 8 depending on UE capability. Each of the indicated SRIs in slot *n* is associated with the most recent transmission of SRS resource(s) of associated SRS resource set identified by the SRI, where the SRS transmission 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.  <------------------------- **Irrelevant parts are omitted** -------------------------> |

**Proposal 3:** Adopt the above text proposal for TS 38.214

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| **Company** | **Comments** |
| Mod | This issue was also discussed a few times in previous meetings and per the inputs of companies in last meeting, most of the companies thought this is not needed.  Please share your views on this TP |
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## **Correction on the condition for mTRP PUSCH TDM repetition**

Ericsson proposed draft CR for 38.214 in R1-2407180 to clarify that the Rel-17 mTRP TDM PUSCH repetition scheme can be used when two SRS resource sets are configured and SDM/SFN scheme is not configured. Their explanation is:

* We have made conclusion in rel-18 that no consensus to support dynamic switch between SDM/SFN and rel-17 mTRP PUSCH TDM scheme.
* But in current rel-18 spec (38.214), the text suggests that when two SRS resource sets of CB/NCB are configured, rel17 mTRP PUSCH TDM scheme is always used even when SDM/SFN is configured.

Therefore, they proposed to add text “When neither *multipanelSchemeSDM* nor *multipanelSchemeSFN* is configured and…” to clarify that only when rel-19 SDM/SFN is not configured, the rel-17 mTRP TDM PUSCH can be used. **For the details of the TP, please see the tdoc R1-2407180**.

**Proposal 4:** Adopt the text proposal for TS 38.214 in R1-2407180

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| **Company** | **Comments** |
| Mod | My understanding is that the proposed changes are needed for clarifying the Rel-18 behavior of mTRP PUSCH TDM scheme vs rel18 SDM/SFN scheme  Please share your views on the TP |
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## **Correction on Simultaneous UL transmission related with HARQ**

Ericsson and Google proposed draft CR R1-2407154 to clarify that overlapping PUSCHs with different HARQ Ids are allowed for mDCI mTRP when STxMP PUSCH+PUSCH is configured. Their reason for change is: with STxMP, the UE may now under some circumstances transmit two PUSCHs at the same time. However, 38.214 still states that the UE never transmits overlapping PUSCH. Thus, the specification is contradictory.

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| 6.1 UE procedure for transmitting the physical uplink shared channel  <Unchanged parts omitted>  When the UE is scheduled with multiple PUSCHs on a serving cell by a DCI, HARQ process ID indicated by this DCI applies to the first PUSCH not overlapping with a DL symbol indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* if provided, or a symbol of an SS/PBCH block with index provided by *ssb-PositionsInBurst*, HARQ process ID is then incremented by 1 for each subsequent PUSCH(s) in the scheduled order, with modulo operation of *nrofHARQ-ProcessesForPUSCH* applied if *nrofHARQ-ProcessesForPUSCH* is provided, or with modulo operation of *nrofHARQ-ProcessesForPUSCH-r17* applied if *nrofHARQ-ProcessesForPUSCH-r17* is provided, or with modulo operation of 16 applied, otherwise. HARQ process ID is not incremented for PUSCH(s) not transmitted if at least one of the symbols indicated by the indexed row of the used resource allocation table in the slot overlaps with a DL symbol indicated by *tdd-UL-DL-ConfigurationCommon* or *tdd-UL-DL-ConfigurationDedicated* if provided, or a symbol of an SS/PBCH block with index provided by *ssb-PositionsInBurst*. Except for the case when the UE is configured with *sTx-*2Panel and the UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet* for the active DL BWP of a serving cell and PDCCHs that schedule two PUSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex,* for any HARQ process ID(s) in a given scheduled cell, the UE is not expected to transmit a PUSCH that overlaps in time with another PUSCH. The UE is not expected to transmit a PUSCH that overlaps in time with another PUSCH for the same HARQ process ID in a serving cell. Except for the case when a UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet* for the active BWP of a serving cell and PDCCHs that schedule two PUSCHs are associated to different *ControlResourceSets* having different values of *coresetPoolIndex,* for any two HARQ process IDs in a given scheduled cell, if the UE is scheduled to start a first PUSCH transmission starting in symbol *j* by a PDCCH ending in symbol *i* on a scheduling cell,, the UE is not expected to be scheduled to transmit a PUSCH starting earlier than the end of the first PUSCH by a PDCCH that ends later than symbol *i* of the scheduling cell. When the PDCCH reception includes two PDCCH candidates from two respective search space sets, as described in clause 10.1 of [6, TS 38.213], for the purpose of determining the PDCCH ending in symbol *i*, the PDCCH candidate that ends later in time is used. The UE is not expected to be scheduled to transmit another PUSCH by a DCI format 0\_0 with CRC scrambled by TC-RNTI, for a given HARQ process with the DCI received before the end of the expected transmission of the last PUSCH for that HARQ process if the latter is scheduled by a DCI format 0\_0 with CRC scrambled by TC-RNTI or by an UL grant in RA Response. The UE is not expected to be scheduled to transmit another PUSCH by DCI format 0\_0, 0\_1, 0\_2 or 0\_3 scrambled by C-RNTI, CS-RNTI or MCS-C-RNTI for a given HARQ process with the DCI received before the end of the expected transmission of the last PUSCH for that HARQ process if the latter is scheduled by a DCI with CRC scrambled by C-RNTI, CS-RNTI or MCS-C-RNTI.  <Unchanged parts omitted> |

**Proposal 5:** Adopt the above text proposal for TS 38.214

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| **Company** | **Comments** |
| Mod | Please share your views on the TP |
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## **Editorial changes: RRC parameter alignment and Typo correction.**

Two TPs proposed editorial changes for TS 38.212:

* R1-2405860 (Huawei/HiSilicon) proposed RRC parameter alignment for TS 38.212: align the RRC parameter names of SDM/SFN scheme to the latest *multipanelSchemeSDM* and *multipanelSchemeSFN* in latest 38.331.
* R1-2406155 (vivo) proposed to correct one typo in 38.212

Two TPs proposed editorial changes for TS 38.213:

* R1-2405861 (Huawei/HiSilicon) proposed RRC parameter alignment for TS 38.213: align the RRC parameter names of SDM/SFN scheme to the latest *multipanelSchemeSDM* and *multipanelSchemeSFN* in latest 38.331.
* R1-2406912 (NTT DOCOMO) also proposed the same RRC parameter alignment.

One TP proposed editorial changes for TS 38.214:

* R1-2405862 (Huawei/HiSilicon) proposed RRC parameter alignment for TS 38.214: align the RRC parameter names of SDM/SFN scheme to the latest *multipanelSchemeSDM* and *multipanelSchemeSFN* in latest 38.331.

**Proposal 6:** Adopt the following TPs for alignment CRs:

* R1-2405860 (for TS 38.212)
* R1-2405861 (for TS 38.213)
* R1-2405862 (for TS 38.214)
* R1-2406155 (for TS 38.212)
* R1-2406912 (for TS 38.213)

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| **Company** | **Comments** |
| Mod | Please check the details in each of those tdocs and let us know if you have concerns on these 5 editorial TPs |
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# Proposals for Online Discussion