**3GPP TSG-RAN WG1 Meeting #118xxxx**

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

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| *CR-Form-v12.2* | | | | | | | | |
| **DRAFT CHANGE REQUEST** | | | | | | | | |
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|  | **4** | **CR** |  | **rev** |  | **Current version:** | **18.3.0** |  |
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| *For* [***HE******LP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

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| ***Title:*** | CR on Multi-TRP PUSCH Repetition | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Moderator (OPPO), Ericsson | | | | | | | | | |
| ***Source to TSG:*** |  | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_MIMO\_evo\_DL\_UL-Core | | | | |  | ***Date:*** | | | 2024-08-19 |
|  |  | | | |  | |  | | |  |
| ***Category:*** |  |  | | | | | ***Release:*** | | | Rel-18 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) … Rel-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | When two SRS resource sets with usage ‘codebook’ are configured, multi-TRP PUSCH TDM is always used, even if STxMP is configured. According to the agreement in RAN1#112, Rel-17 mTRP and Rel-18 STxMP are separate RRC configurations and should not be configured simultaneously:  **Conclusion**  There is no consensus to support dynamic switching between STxMP SDM/SFN scheme and Rel-17 mTRP PUSCH TDM scheme  Multi-TRP PUSCH repetition was introduced in Rel-17 and in our understanding at that time was the only case in 38.214 where two SRS resource sets with usage ‘codebook’ or ‘non-codebook’ were configured, and so “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’” was used throughout 38.214 to identify that M-TRP PUSCH repetition is used. In Rel-18, STxMP also uses two SRS resource sets, and is used when 'multipanelScheme' is configured. This means the configurations overlap, and so Rel-17 PUSCH repetition is supposed to be used simultaneously with STxMP according to how the spec is written currently. However, the two schemes are not to be configured simultaneously as noted above, nor are they compatible, for example on how to interpret the SRS resource set indicator, etc.  We note that RAN2 have updated the RRC parameters for STxMP, and now two parameters are used to configure the SDM and SFN schemes for PUSCH: multipanelSchemeSDM and multipanelSchemeSFN, respectively. We use these updated parameters in this CR. | | | | | | | | |
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| ***Summary of change:*** | | Clarify that when two SRS resource sets are configured and when neither multipanelSchemeSDM nor multipanelSchemeSFN is configured, the Rel-17 Multi-TRP TDM PUSCH scheme is used.  Correct various mis-capitalizations of ‘nonCodebook’ and the misspelling ‘seoncd’. | | | | | | | | |
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| ***Consequences if not approved:*** | | The UE is not able to use STxMP schemes for PUSCH, since it should operate according to both STxMP and Rel-17 M-TRP PUSCH repetition when STxMP is configured, and these modes of operation are incompatible, e.g. with respect to how SRSI is interpreted. | | | | | | | | |
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| ***Clauses affected:*** | | 6.1.1.1, 6.1.1.2, 6.1.2.1, 6.1.2.3, 6.1.7 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **N** | Other core specifications | | | |  | | |
| ***affected:*** | |  | **N** | Test specifications | | | |  | | |
| ***(show related CRs)*** | |  | **N** | O&M Specifications | | | |  | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

6.1.1.1 Codebook based UL transmission

For 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, or semi-statically configured to operate according to Clause 6.1.2.3, the UE determines its PUSCH transmission precoder(s) based on SRI(s), TPMI(s) and the transmission rank, where the SRI(s), TPMI(s) and the transmission rank are given by DCI fields of one or two SRS resource indicators and one or 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 or given by *srs-ResourceIndicator* and *precodingAndNumberOfLayers* according to clause 6.1.2.3 or given by *srs-ResourceIndicator, srs-ResourceIndicator2,* *precodingAndNumberOfLayers, and precodingAndNumberOfLayers2* according to clause 6.1.2.3. If this PUSCH is scheduled by DCI format 0\_3, the UE determines its PUSCH transmission precoder based on SRI, TPMI and the transmission rank, where the SRI, TPMI and the transmission rank are given by DCI fields of one SRS resource indicator and one Precoding information and number of layers in clause 7.3.1.1.4 of [5, TS 38.212] for DCI format 0\_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. Only one or two SRS resource sets can be configured in *srs-ResourceSetToAddModList* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook', 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 'codebook'.

When only one SRS resource set is configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook', SRI and TPMI are given by the DCI fields of one SRS resource indicator and one Precoding information and number of layers in clauses 7.3.1.1.2, 7.3.1.1.3 and 7.3.1.1.4 of [5, TS 38.212] for DCI format 0\_1, 0\_2 and 0\_3 or given by *srs-ResourceIndicator* and *precodingAndNumberOfLayers* according to clause 6.1.2.3. A UE does not expect two SRS resource sets are configured in *srs-ResourceSetToAddModList* with higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook' 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 TPMI is used to indicate the precoder to be applied over the layers {0…*ν*-1} and that corresponds to the SRS resource selected by the SRI when multiple SRS resources are configured, or if a single SRS resource is configured TPMI is used to indicate the precoder to be applied over the layers {0…*ν*-1} and that corresponds to the SRS resource. The transmission precoder is selected from the uplink codebook that has a number of antenna ports equal to higher layer parameter *nrofSRS-Ports* or *nrofSRS-Ports-n8* in *SRS-Config*, as defined in Clause 6.3.1.5 of [4, TS 38.211]. When the UE is configured with the higher layer parameter *txConfig* set to 'codebook', the UE is configured with at least one SRS resource. The indicated SRI in slot *n* is associated with the most recent transmission of SRS resource identified by the SRI, where the SRS resource is prior to the PDCCH carrying the SRI.

When neither *multipanelSchemeSDM* nor *multipanelSchemeSFN* is configured 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', one or two SRI(s), and one or 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. The UE applies the indicated SRI(s) and TPMI(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. Each TPMI, based on indicated codepoint of *SRS Resource Set* *indicator*, is used to indicate the precoder to be applied over the layers {0…*ν*-1} and 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 a single SRS resource is configured for the applicable SRS resource set TPMI is used to indicate the precoder to be applied over the layers {0…*ν*-1} and that corresponds to the SRS resource. 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 two SRIs are indicated, the UE shall expect the *nrofSRS-Ports* for the two indicated SRS resources 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.

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 or given by *srs-ResourceIndicator, srs-ResourceIndicator2,* *precodingAndNumberOfLayers, and precodingAndNumberOfLayers2* in *configuredGrantConfig*:

- When codepoint "10" of *SRS Resource Set* *indicator* is indicated or when *srs-ResourceIndicator2 and* precodingAndNumberOfLayers2 are provided*,* 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, 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, v1 ≤ *maxRankSdm* or *maxRankSdmDCI-0-2* andv2 ≤ *maxRankSdm* or *maxRankSdmDCI-0-2* and *maxRankSdm* or *maxRankSdmDCI-0-2* are 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 two TPMIs are indicated, the UE shall expect that the precoder indicated by the first TPMI and the precoder indicated by the second TPMI are mapped to different PUSCH antenna ports.

- 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.

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 or given by *srs-ResourceIndicator, srs-ResourceIndicator2,* *precodingAndNumberOfLayers, and precodingAndNumberOfLayers2* in *configuredGrantConfig*:

- When codepoint "10" of *SRS Resource Set* *indicator* is indicated or when *srs-ResourceIndicator2 and* precodingAndNumberOfLayers2 are provided*,* 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* and *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 second SRS resource.

- 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 *nrofSRS-Ports* in *SRS-Config* for the indicated SRI(s), as defined in Clause 6.3.1.5 of [4, TS 38.211]. When two TPMIs are indicated, the UE shall expect that the precoder indicated by the first TPMI and the precoder indicated by the second TPMI are mapped to different PUSCH antenna ports.

- 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.

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 most recent transmission of SRS resource identified by the SRI, the PDCCH candidate that starts earlier in time is used.

🡨---------------------------------------------------------Unchanged Text Omitted--------------------------------------------------🡪

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 a SRS resource set, 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 neither *multipanelSchemeSDM* nor *multipanelSchemeSFN* is configured 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 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.

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 or given by *srs-ResourceIndicator, srs-ResourceIndicator2* in *configuredGrantConfig*:

- When codepoint "10" of *SRS Resource Set* *indicator* is indicated*,* or when *srs-ResourceIndicator2* is provided, 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}, where v2 being the number of layers indicated by the second SRI, v1 ≤ *Lmax* andv2 ≤ *Lmax* where *Lmax* is defined inclauses 7.3.1.1.2 and 7.3.1.1.3 of [5, TS 38.212]. The UE shall expect that SRS resource(s) indicated by the first SRI and SRS resource(s) indicated by the second SRI are corresponding to different PUSCH antenna ports.

- 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 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 or given by *srs-ResourceIndicator and srs-ResourceIndicator2* in *configuredGrantConfig*:

- When codepoint "10" of *SRS Resource Set* *indicator* is indicated*,* or when *srs-ResourceIndicator2* is provided, 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]. The UE shall expect that SRS resource(s) indicated by the first SRI and SRS resource(s) indicated by the second SRI are corresponding to different PUSCH antenna ports.

- 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.

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.

🡨---------------------------------------------------------Unchanged Text Omitted--------------------------------------------------🡪

6.1.2.1 Resource allocation in time domain

When the UE is scheduled to transmit a transport block and no CSI report by a DCI or by a RAR UL grant or fallbackRAR UL grant, or the UE is scheduled to transmit a transport block and a CSI report(s) on PUSCH by a DCI, the '*Time domain resource assignment'* field value *m* for the scheduled PUSCH on the serving cell of the DCI or the *PUSCH time resource allocation* field value *m* of the RAR UL grant or of the fallbackRAR UL grant provides a row index *m* + 1to a resource allocation table. The determination of the used resource allocation table is defined in Clause 6.1.2.1.1. The indexed row defines the slot offset *K2*, the start and length indicator *SLIV*, or directly the start symbol *S* and the allocation length *L*, the PUSCH mapping type, the number of slots used for TBS determination (if *numberOfSlotsTBoMS* is present in the resource allocation table), and the number of repetitions (if *numberOfRepetitions* is present in the resource allocation table) to be applied in the PUSCH transmission.

🡨---------------------------------------------------------Unchanged Text Omitted--------------------------------------------------🡪

When neither *multipanelSchemeSDM* nor *multipanelSchemeSFN* is configured 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' or 'nonCodebook', for PUSCH repetition Type A, in case *K>1,* the same symbol allocation is applied across the *K* consecutive slots and the PUSCH is limited to a single transmission layer. The UE shall repeat the TB across the *K* consecutive slots applying the same symbol allocation in each slot, and the association of the first and second SRS resource set in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* toeach slot is determined as follows:

- if a DCI format 0\_3 schedules the PUSCH, the first SRS resource set is associated with all K consecutive slots,

- if a DCI format 0\_1 or DCI format 0\_2 indicates codepoint "00" for the *SRS resource set indicator*, the first SRS resource set is associated with all K consecutive slots,

- if a DCI format 0\_1 or DCI format 0\_2 indicates codepoint "01" for the *SRS resource set indicator*, the second SRS resource set is associated with all K consecutive slots,

- if a DCI format 0\_1 or DCI format 0\_2 indicates codepoint "10" for the *SRS resource set indicator*, the first and second SRS resource set association to K consecutive slots is determined as follows:

- When K = 2, the first and second SRS resource sets are applied to the first and second slot of 2 consecutive slots, respectively.

- When K > 2 and *cyclicMapping* in *PUSCH-Config* is enabled, the first and second SRS resource sets are applied to the first and second slot of K consecutive slots, respectively, and the same SRS resource set mapping pattern continues to the remaining slots of K consecutive slots.

- When K > 2 and *sequentialMapping* in *PUSCH-Config* is enabled, first SRS resource set is applied to the first and second slots of K consecutive slots, and the second SRS resource set is applied to the third and fourth slot of K consecutive slots, and the same SRS resource set mapping pattern continues to the remaining slots of K consecutive slots.

- Otherwise, a DCI format 0\_1 or DCI format 0\_2 indicates codepoint "11" for the *SRS resource set indicator*, and the first and second SRS resource set association to K consecutive slots is determined as follows,

- When K = 2, the second and first SRS resource set are applied to the first and second slot of 2 consecutive slots, respectively.

- When K > 2 and *cyclicMapping* in *PUSCH-Config* is enabled, the second and first SRS resource sets are applied to the first and second slot of K consecutive slots, respectively, and the same SRS resource set mapping pattern continues to the remaining slots of the K consecutive slots.

- When K > 2 and *sequentialMapping* in *PUSCH-Config* is enabled, the second SRS resource set is applied to the first and second slot of K consecutive slots, and the first SRS resource set is applied to the third and fourth slot of K consecutive slots, and the same SRS resource set mapping pattern continues to the remaining slots of the K consecutive slots.

For PUSCH repetition Type B, when neither *multipanelSchemeSDM* nor *multipanelSchemeSFN* is configured 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' or 'nonCodebook', the SRS resource set association to nominal PUSCH repetitions follows the same method as SRS resource set association to slots in PUSCH Type A repetition by considering nominal repetitions instead of slots.

When a UE is configured with *dl-OrJointTCI-StateList* or *TCI-UL-State* and is having two indicated TCI-States or TCI-UL-States, 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' or 'nonCodebook', for PUSCH repetition Type A or Type B as described above, or for PUSCH transmission when the higher layer parameter *multipanelScheme* is set to 'SDMscheme' or 'SFNscheme', the association of the first and second indicated joint/UL TCI states to PUSCH transmission occasions or to corresponding PUSCH antenna ports is determined as follows:

- if a DCI format 0\_1 or DCI format 0\_2 indicates codepoint “00” or “01” for the *SRS resource set indicator*, the first or second indicated joint/UL TCI state is applied to all PUSCH transmission occasions, respectively.

- if a DCI format 0\_1 or DCI format 0\_2 indicates codepoint “10” or “11” for the *SRS resource set indicator*, and the *multipanelScheme* is not configured,

- the first indicated joint/UL TCI state is applied to the PUSCH transmission occasion(s) associated with the first SRS resource set and the second indicated joint/UL TCI state is applied to the PUSCH transmission occasion(s) associated with the second SRS resource set, where the association of PUSCH transmission occasions to SRS resource sets is determined for K = 2 and K > 2, and depending on whether *cyclicMapping* or *sequentialMapping* in *PUSCH-Config* is enabled, based on the above description in this Clause.

- 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.

For both PUSCH repetition Type A and PUSCH repetition Type B, when a DCI format 0\_1 or DCI format 0\_2 indicates codepoint "10" or "11" for the *SRS resource set indicator*, the redundancy version to be applied on the *n*th transmission occasion (for PUSCH repetition Type A) of the TB, where n = 0, 1, … *K*-1, or *n*th actual repetition (for PUSCH repetition Type B, with the counting including the actual repetitions that are omitted) is determined according to Table 6.1.2.1-2 and Table 6.1.2.1-3. For all PUSCH repetitions associated with the SRS resource set of the first transmission occasion or actual repetition, the redundancy version to be applied is derived according to Table 6.1.2.1-2, where n is counted only considering PUSCH transmission occasions or actual repetitions associated with the same SRS resource set as the first transmission occasion or actual repetition. The redundancy version for PUSCH transmission occasions or actual repetitions that are associated with an SRS resource set other than the SRS resource set of the first transmission occasion or actual repetition is derived according to Table 6.1.2.1-3, where additional shifting operation for each redundancy version is configured by higher layer parameter *sequenceOffsetforRV* in *PUSCH-Config* and is counted only considering PUSCH transmission occasions or actual repetitions that are not associated with the SRS resource set of the first transmission occasion or actual repetition.

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#### 6.1.2.3 Resource allocation for uplink transmission with configured grant

When PUSCH resource allocation is semi-statically configured by higher layer parameter *configuredGrantConfig* in *BWP-UplinkDedicated* information element, and the PUSCH transmission corresponding to a configured grant, the following higher layer parameters are applied in the transmission:

- For Type 1 PUSCH transmissions with a configured grant, the following parameters are given in *configuredGrantConfig* unless mentioned otherwise:

- For the determination of the PUSCH repetition type, if the higher layer parameter *pusch-RepTypeIndicator* in *rrc-ConfiguredUplinkGrant* is configured and set to 'pusch-RepTypeB', PUSCH repetition type B is applied; otherwise, PUSCH repetition type A is applied;

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- Number of DM-RS CDM groups, DM-RS ports, SRS resource indication and DM-RS sequence initialization are determined as in Clause 7.3.1.1.2 of [5, TS 38.212], and the antenna port value, the bit value for DM-RS sequence initialization, precoding information and number of layers, SRS resource indicator are provided by *antennaPort, dmrs-SeqInitialization, precodingAndNumberOfLayers*, and *srs-ResourceIndicator* respectively; When two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2,* precoding information and number of layers (applicable when higher layer parameter *usage* in *SRS-ResourceSet* set to 'codebook') associated with the first and second SRS resource set is provided by *precodingAndNumberOfLayers and precodingAndNumberOfLayers2,* respectively, and SRS resource indicators associated with the first and second SRS resource sets are provided by *srs-ResourceIndicator* and *srs-ResourceIndicator2,* respectively. When both *srs-ResourceSetToAddModList* and *srs-ResourceSetToAddModListDCI-0-2* are configured with two SRS resource sets, the two SRS resource sets configured by *srs-ResourceSetToAddModList* is used to determine the SRS resource indications by *srs-ResourceIndicator* and *srs-ResourceIndicator2.*

- If two SRS resource sets with usage set to 'codebook' or 'nonCodebook' are configured in *srs-ResourceSetToAddModList*, the two SRS resource sets are used to determine the SRS resource indications by *srs-ResourceIndicator* and *srs-ResourceIndicator2*.

- otherwise, the two SRS resource sets with usage set to 'codebook' or 'nonCodebook' configured in *srs-ResourceSetToAddModListDCI-0-2* are used to determine the SRS resource indications by *srs-ResourceIndicator* and *srs-ResourceIndicator2*.

- When frequency hopping is enabled, the frequency offset between two frequency hops can be configured by higher layer parameter *frequencyHoppingOffset.*

- For Type 2 PUSCH transmissions with a configured grant: the resource allocation follows the higher layer configuration according to [10, TS 38.321], and UL grant received on the DCI.

- The PUSCH repetition type and the time domain resource allocation table are determined by the PUSCH repetition type and the time domain resource allocation table associated with the UL grant received on the DCI, respectively, as defined in Clause 6.1.2.1. The value of Koffset, if configured, is applied when determining the first transmission opportunity.

For PUSCH transmissions with a Type 1 or Type 2 configured grant, the number of (nominal) repetitions *K* to be applied to the transmitted transport block is provided by the indexed row in the time domain resource allocation table if *numberOfRepetitions* is present in the table; otherwise *K* is provided by the higher layer configured parameters *repK.* For a *configuredGrantConfig*, if a UE is configured with higher layer parameter *nrofSlotsInCG-Period*, the UE does not support repetition nor the TB processing over multiple slots for the *configuredGrantConfig*.

For PUSCH transmissions with a Type 2 configured grant, when neither *multipanelSchemeSDM* nor *multipanelSchemeSFN* is configured and two SRS resource sets are configured in srs-*ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2*, the SRS resource set association to (nominal) repetitions follows *MappingPattern* in *ConfiguredGrantConfig* as defined in Clause 6.1.2.1 for PUSCH scheduled by DCI format 0\_1 and 0\_2. For PUSCH transmissions with a Type 1 configured grant, when neither *multipanelSchemeSDM* nor *multipanelSchemeSFN* is configured and two SRS resource sets with usage set to 'codebook' or 'nonCodebook' are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2*, if *p0-PUSCH-Alpha2* is provided, the SRS resource set association to (nominal) repetitions is determined as follows. When K = 2, the first and second SRS resource sets are applied to the first and second (nominal) repetitions, respectively.

- When K > 2 and *cyclicMapping* in *ConfiguredGrantConfig* is enabled, the first and second SRS resource sets are applied to the first and second (nominal) repetitions, respectively, and the same SRS resource set mapping pattern continues to the remaining (nominal) repetitions.

- When K > 2 and *sequentialMapping* in *ConfiguredGrantConfig* is enabled, first SRS resource set is applied to the first and second (nominal) repetitions, and the second SRS resource set is applied to the third and fourth (nominal) repetitions, and the same SRS resource set mapping pattern continues to the remaining (nominal) repetitions.

For PUSCH transmissions with a Type 1 configured grant, when neither *multipanelSchemeSDM* nor *multipanelSchemeSFN* is configured and two SRS resource sets are configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2*, if configuredGrantConfig contains only one *pathlossReferenceIndex, p0-PUSCH-Alpha, powerControlLoopToUse,* *srs-ResourceIndicator* and *precodingAndNumberOfLayers* (applicable when higher layer parameter usage in *SRS-ResourceSet* set to 'codebook'), PUSCH repetitions are associated only with the first SRS resource set.

If neither *multipanelSchemeSDM* nor *multipanelSchemeSFN* is configured and the UE is provided two SRS resource sets in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with *usage* set to 'codebook' or 'nonCodebook', and the UE is not provided *p0-PUSCH-Alpha2* and *powerControlLoopToUse2*, for a retransmission of a configured grant Type 1 PUSCH, or for activation or retransmission of a configured grant Type 2 PUSCH, scheduled by a DCI format that includes an SRS resource set indicator field, the UE expects the value of the SRS resource set indicator field to be set to '00', and PUSCH repetitions are associated only with the first SRS resource set.

The UE shall not transmit anything on the resources configured by *configuredGrantConfig* if the higher layers did not deliver a transport block to transmit on the resources allocated for uplink transmission without grant.

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### 6.1.7 UE procedure for determining time domain windows for bundling DM-RS

For PUSCH transmissions of PUSCH repetition Type A scheduled by DCI format 0\_1 or 0\_2, PUSCH repetition Type A with a configured grant, PUSCH repetition Type B and TB processing over multiple slots, when *pusch-DMRS-Bundling* is enabled, and for PUCCH transmissions of PUCCH repetition, when *PUCCH-DMRS-Bundling* is enabled, the UE determines one or multiple nominal TDWs, as follows:

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Events which cause power consistency and phase continuity not to be maintained across PUSCH transmissions of PUSCH repetition type A scheduled by DCI format 0\_1, 0\_2 or 0\_3, or PUSCH repetition Type A with a configured grant, or PUSCH repetition type B or TB processing over multiple slots, or PUCCH transmissions of PUCCH repetition, within the nominal TDW, are:

- A downlink slot or downlink reception or downlink monitoring based on *tdd-UL-DL-ConfigurationCommon* and *tdd-UL-DL-ConfigurationDedicated* for unpaired spectrum.

- For the UE indicating the capability *dmrs-BundlingNonBackToBackTX* or *dmrs-BundlingNonBackToBackTX-PerBC* in [13, TS 38.306], the gap between any two consecutive PUSCH transmissions, or the gap between any two consecutive PUCCH transmissions, exceeds 13 symbols for normal cyclic prefix or exceeds 11 symbols for extended cyclic prefix.

- For the UE not indicating either of the capabilities *dmrs-BundlingNonBackToBackTX* or *dmrs-BundlingNonBackToBackTX-PerBC* in [13, TS 38.306], a non-zero symbol gap is scheduled between any two consecutive PUSCH transmissions or between any two consecutive PUCCH transmissions.

- The gap between any two consecutive PUSCH transmissions, or the gap between any two consecutive PUCCH transmissions, does not exceed 13 symbols but other uplink transmissions are scheduled between the two consecutive PUSCH transmissions or the two consecutive PUCCH transmissions.

- For PUSCH transmissions of PUSCH repetition type A, or PUSCH repetition type B or TB processing over multiple slots, a dropping or cancellation of a PUSCH transmission according to clause 9, clause 11.1 and clause 11.2A of [6, TS 38.213] or due to cell DRX operation.

- For PUCCH transmissions of PUCCH repetition, a dropping or cancellation of a PUCCH transmission according to clause 9, clause 9.2.6 and clause 11.1 of [6, TS 38.213] or due to cell DRX operation.

- For any two consecutive PUSCH transmissions of PUSCH repetition type A, or PUSCH repetition type B, and when neither *multipanelSchemeSDM* nor *multipanelSchemeSFN* is configured 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' or 'nonCodebook', a different SRS resource set association is used for the two PUSCH transmissions of PUSCH repetition type A, or PUSCH repetition type B, according to Clause 6.1.2.1.

- For any two consecutive PUCCH transmissions of PUCCH repetition, and when a PUCCH resource used for repetitions of a PUCCH transmission by a UE includes first and second spatial relations or first and second sets of power control parameters, as described in [10, TS 38.321] and in clause 7.2.1 of [6, TS 38.213], different spatial relations or different power control parameters are used for the two PUCCH transmissions of PUCCH repetition, according to Clause 9.2.6 of [6, TS 38.213].

- Uplink timing adjustment in response to a timing advance command according to clause 4.2 of [6, TS 38.213].

- Frequency hopping.

- For reduced capability half-duplex UEs,

- a dropping or cancellation of a PUSCH or PUCCH transmission according to clause 17.2 of [6, TS 38.213] or

- an overlapping of the gap between two consecutive PUSCH or two consecutive PUCCH transmissions and any symbol of downlink reception or downlink monitoring