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

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

**Agenda item:** 9.17

**Source:** Samsung

**Title:** Summary of email discussions [114-R18-38.213-NR\_MIMO\_evo\_DL\_UL]

**Document for:** Discussion and decision

# Introduction

The purpose of this document is to collect inputs/comments on the draft CR for TS 38.213 [draftCR\_38213 MIMO](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_114/Inbox/drafts/9.17%28Other%29/%5B38.213%20draft%20CRs%5D/NR_MIMO_evo_DL_UL/R1-230xxxx%20draftCR_38213%20MIMO.docx) on the introduction of MIMO Evolution for Downlink and Uplink. If a comment on a particular aspect has been made by another company, please do not repeat it until, if needed, after a response.

The first checkpoint is on September 5, UTC 13:00.

# First Round Discussion

Please provide your comments on the draft CR for TS 38.213 [draftCR\_38213 MIMO](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_114/Inbox/drafts/9.17%28Other%29/%5B38.213%20draft%20CRs%5D/NR_MIMO_evo_DL_UL/R1-230xxxx%20draftCR_38213%20MIMO.docx).

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| Company | Comments |
| MediaTek (eUTCI) | Thanks for your great effort on the draft CR. Please find our comments bellow.**10.1 UE procedure for determining physical downlink control channel assignment**Comment: According to RAN1 agreement for M-DCI case, since PUSCH transmission scheduled by PDCCH would follow similar behavior as PDSCH, we think it is better to capture them in the same paragraph. Thus, we suggest the following change:**Agreement (RAN1#111)**On unified TCI framework extension for M-DCI based MTRP, the UE shall apply the indicated joint/UL TCI state specific to a *coresetPoolIndex* value to PUSCH transmission scheduled/activated by PDCCH (including DG-PUSCH and Type2 CG-PUSCH) on a CORESET that is associated with the same *coresetPoolIndex* value.[Aris]: OK (I probably assumed it was to be captured in 38.214 for PUSCH).

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| If the UE is provided *dl-OrJointTCI-StateList* and- is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with a value of 0 for first CORESETs on an active DL BWP of a serving cell,- is provided *coresetPoolIndex* with a value of 1 for second CORESETs on the active DL BWP of the serving cells, and- is provided *followUnifiedTCI-State* for the first and second CORESETs, that do not include a CORESET with index 0 and are associated only with USS sets and/or Type3-PDCCH CSS sets, or with CSS sets other than Type3-PDCCH CSS sets,the UE assumes that DM-RS antenna ports for PDCCH receptions in the first and second CORESETs, and DM-RS antenna ports for PDSCH receptions scheduled by DCI formats provided by PDCCH receptions in the first and second CORESETs, are quasi co-located with the reference signals provided by indicated *TCI-State* specific to the first and second CORESETs, respectively; andthe UE transmits PUSCH scheduled by DCI formats provided by PDCCH receptions in the first and second CORESETs using a spatial domain filter corresponding to *TCI-State* or *TCI-UL-State* specific to the first and second CORESETs, respectively.  |

**9.2.2 PUCCH Formats for UCI transmission**Comment* It is a bit confusing to add “of the PUCCH resource” after “the TCI state” since they are “unified” TCI states provided to all channels/signals instead of dedicated to the PUCCH resource. Thus, we suggest to remove it.

[Aris]: Agree.* Re the new sub-bullet “if *multipanelSfnScheme* is provided for the PUCCH resource”, it is not correct. Even *multipanelSfnScheme* is provided for a PUCCH resource, STxMP is applied only when *apply-IndicatedTCIState* = ‘both’. Thus, we think the new sub-bullet can be removed, the corresponding behavior is already reflected in the sub-bullet when *apply-IndicatedTCIState* = ‘both’.

[Aris]: OK - missed a RAN1#113 agreement for S-DCI and assumed the use of *apply-IndicatedTCIState* was only for M-DCI (and *multipanelSfnScheme* was generic).

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| A spatial setting for a PUCCH transmission by a UE using a PUCCH resource is provided by- an indicated *TCI-State* or *TCI-UL-State*, if provided, as described in [6, TS 38.214];- *PUCCH-SpatialRelationInfo* if the UE is configured with a single value for *pucch-SpatialRelationInfoId*; - as described in [11, TS 38.321], if the UE is provided multiple values for *PUCCH-SpatialRelationInfo*. The UE applies corresponding actions in [11, TS 38.321] and a corresponding setting for a spatial domain filter to transmit PUCCH in the first slot that is after slot where is the slot where the UE would transmit a PUCCH with HARQ-ACK information with ACK value corresponding to a PDSCH reception providing the *PUCCH-SpatialRelationInfo*, each slot consists of symbols as defined in [4, TS 38.211],and is the SCS configuration for the PUCCH- If *PUCCH-SpatialRelationInfo* or the indicated *TCI-UL-State* provides *ssb-Index*, the UE transmits the PUCCH using a same spatial domain filter as for a reception of a SS/PBCH block with index provided by *ssb-Index* for a same serving cell or, if *servingCellId* is provided, for a serving cell indicated by *servingCellId* - else if *PUCCH-SpatialRelationInfo* or the indicated *TCI-UL-State* provides *csi-RS-Index*, or the indicated *TCI-State* provides *csi-rs* configured with *qcl-Type* set to 'typeD', the UE transmits the PUCCH using a same spatial domain filter as for a reception of a CSI-RS with resource index provided by *csi-RS-Index* or csi-rs for a same serving cell or, if *servingCellId* or *cell* is provided, for a serving cell indicated by *servingCellId* or *cell*- else *PUCCH-SpatialRelationInfo* or the indicated *TCI-UL-State* provides *srs*, the UE transmits the PUCCH using a same spatial domain filter as for a transmission of an SRS with resource index provided by *resource* for a same serving cell and/or active UL BWP or, if *servingCellId* and/or *uplinkBWP* are provided, for a serving cell indicated by *servingCellId* and/or for an UL BWP indicated by *uplinkBWP*- an indicated *apply-IndicatedTCIState*, if provided- if *apply-IndicatedTCIState* = ‘first’, the UE transmits a PUCCH using a spatial domain filter corresponding to a first *TCI-State* or *TCI-UL-State* - if *apply-IndicatedTCIState* = ‘second’, the UE transmits a PUCCH using a spatial domain filter corresponding to second *TCI-State* or *TCI-UL-State* - if *apply-IndicatedTCIState* = ‘both’, the UE transmits a PUCCH using respective first and second spatial domain filters corresponding to the first and the second *TCI-State* or *TCI-UL-State* If the UE- is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with a value of 0 for first CORESETs on an active DL BWP of a serving cell, and- is provided *coresetPoolIndex* with a value of 1 for second CORESETs on the active DL BWP of the serving cells,the first and second *TCI-State* or *TCI-UL-State* are specific to the first and second CORESETs, respectively.-  |

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| QC(2TAs, STxMP) | **Comment 1**: Section 8.2: The following conditions of the RAN1 agreement is not captured. That is, this new QCL rule is applicable only if the PDCCH order is transmitted from a TRP associated with additional PCI. In other words, if the PDCCH order is transmitted from the serving PCI (irrespective of whether PRACH is toward serving PCI or additional PCI based on cell indicator field in the PDCCH order), the legacy rule of the PCell (UE may assume that the PDCCH that includes the DCI format 1\_0 and the PDCCH order have same DM-RS antenna port quasi co-location properties) is still applied.**Agreement**For inter-cell multi-DCI based multi-TRP operation with two TAGs configured in Spcell, when the PDCCH order is transmitted from a TRP associated with additionalPCI, PDCCH RAR and PDSCH RAR of a CFRA are both QCLed with the CORESET associated with the Type I CSS set[Aris]: OK. Will revise as follows:“… or if ~~for a cell indicated by a cell indicator field in~~ the PDCCH order is from a cell other than the serving cell, the UE may assume the DM-RS antenna port quasi co-location properties of the CORESET associated with the Type1-PDCCH CSS set for receiving the PDCCH that includes the DCI format 1\_0 and the PDSCH scheduled by the DCI format 1\_0”.**Comment 2**: Section 9.2.2: The following added text seems not accurate since applying both indicated TCI states to a PUCCH resource is not a function of *multipanelSfnScheme*. Instead, it depends on *apply-IndicatedTCIState*. The configuration *multipanelSfnScheme* (per PUCCH-Config) determines “how” to apply both TCI states (if not configured, in TDM manner; if configured, in SFN manner)“- if *multipanelSfnScheme* is provided for the PUCCH resource, the UE transmits a PUCCH using respective first and second spatial domain filters corresponding to first and second *TCI-State* or *TCI-UL-State* of the PUCCH resource”[Aris]: OK, please see response to Mediatek.**Comment 3**: Section 9.2.6: Similarly, the following added text may not be accurate since this would be the case only if *apply-IndicatedTCIState=both* for the PUCCH resource.“- if the UE is provided *multipanelSfnScheme* for the PUCCH resource, a repetition of the PUCCH transmission uses first and second spatial domain filters corresponding to first and second *TCI-State* or *TCI-UL-State* of the PUCCH resource” [Aris]: I think this is a different issue. If the above text is removed, there is nothing in 9.2.6 to capture SFN PUCCH repetitions or to clearly differentiate from TDM. The condition that the UE is also provided *apply-IndicatedTCIState=both* may be added (but is not necessary since it is an understood prerequisite to *multipanelSfnScheme*). |
| ZTE | **Comment#1 (eUTCI)**In RAN1#114, one alignment for default power control for PUCCH and SRS was agreed as follows.

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| ***For the editors***The following text proposal is provided to improve the clarity of the RAN1 specifications. Please include it in the Rel-17 alignment CR (TS38.213).* [R1-2307450](file:///C%3A%5CUsers%5Cyounsun%5CDocuments%5C3GPP%20documents%5CRAN1%20tdocs%5CTSGR1_114%5CDocs%5CR1-2307450.zip) for correction of RRC parameters of p0 for PUCCH/SRS in Rel-17 unified TCI framework
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In short, the UE-specific P0 for PUCCH and SRS (rather than UE-specific P0 + nominal) was provided by *p0AlphaSetforPUCCH/ p0AlphaSetforSRS* associated with the smallest value of *ul-powercontrolId*. Similarly, for Rel-18 BFR extension for eUTCI, the same update is needed. **Proposed change (Section 6 Link recovery procedures)**----------------------------For a serving cell associated with sets and , and with sets and , and having radio link quality worse than Qout,LR, and if a UE is provided *dl-OrJointTCI-StateList* or *TCI-UL-State* and is indicated a first *TCI-State* or *TCI-UL-State* and a second *TCI-State* or *TCI-UL-State*, after 28 symbols from a last symbol of a first PDCCH reception with a DCI format scheduling a PUSCH transmission with a same HARQ process number as for the transmission of the second PUSCH and having a toggled NDI field value, the UE- monitors PDCCH that applies the first *TCI-State* state, and receives PDSCH and aperiodic CSI-RS resource that apply the first *TCI-State*, using same antenna port quasi co-location parameters as the ones associated with a corresponding index from , if any, on the serving cell- monitors PDCCH that applies the second *TCI-State*, and receives PDSCH and aperiodic CSI-RS resource that apply the second *TCI-State*, on the serving cell using same antenna port quasi co-location parameters as the ones associated with a corresponding index from , if any, on the serving cell- transmits PUSCH, PUCCH, and SRS that apply the first *TCI-State* or *TCI-UL-State* using a same spatial domain filter as the one corresponding to from , if any, on the serving cell and using the following parameters for determination of a corresponding power as described in clauses 7.1.1, 7.2.1, and 7.3.1 - the RS index from , if any, for obtaining a corresponding downlink pathloss estimate for the serving cell- the values of , , and the PUSCH power control adjustment state provided by *p0AlphaSetforPUSCH* associated with the smallest value of *ul-powercontrolId* for the serving cell- the value of and the PUCCH power control adjustment state provided by *p0AlphaSetforPUCCH* associated with the smallest value of *ul-powercontrolId* for the serving cell - the values of , , and the SRS power control adjustment state provided by *p0AlphaSetforSRS* associated with the smallest value of *ul-powercontrolId* for the serving cell- transmits PUSCH, PUCCH, and SRS that apply the second *TCI-State* or *TCI-UL-State* using a same spatial domain filter as the one corresponding to from , if any, on the serving cell and using the following parameters for determination of a corresponding power as described in clauses 7.1.1, 7.2.1, and 7.3.1 - the RS index from , if any, for obtaining a corresponding downlink pathloss estimate for the serving cell- the values of , , and the PUSCH power control adjustment state provided by *p0AlphaSetforPUSCH* associated with the smallest value of *ul-powercontrolId* for the serving cell- the value of and the PUCCH power control adjustment state provided by *p0AlphaSetforPUCCH* associated with the smallest value of *ul-powercontrolId* for the serving cell - the values of , , and the SRS power control adjustment state provided by *p0AlphaSetforSRS* associated with the smallest value of *ul-powercontrolId* for the serving cellwhere the SCS configuration for the 28 symbols is the smallest of the SCS configurations of the active DL BWP for the PDCCH reception and of the active DL BWP(s) of the serving cells.For a serving cell associated with sets and , and with sets and , and having radio link quality worse than Qout,LR, and if a UE is provided two coresetPoolIndex values 0 and 1 for the first and second CORESETs, or is not provided coresetPoolIndex value for the first CORESETs and is provided coresetPoolIndex value of 1 for the second CORESETs, respectively, and the UE is provided *dl-OrJointTCI-StateList* or *TCI-UL-State*, after 28 symbols from a last symbol of a first PDCCH reception with a DCI format scheduling a PUSCH transmission with a same HARQ process number as for the transmission of the second PUSCH and having a toggled NDI field value, the UE- monitors PDCCH in the first CORESETs, and receives PDSCH scheduled/activated by PDCCH in the first CORESETs, and aperiodic CSI-RS resource that apply a *TCI-State* specific to the first CORESETs, using same antenna port quasi co-location parameters as the ones associated with a corresponding index from , if any, for the serving cell- monitors PDCCH in the second CORESETs, and receives PDSCH scheduled/activated by PDCCH in the second CORESETs, and aperiodic CSI-RS resource that apply a *TCI-State* specific to the second CORESETs, using the same antenna port quasi co-location parameters as the ones associated with the corresponding index from , if any, for the serving cell- transmits PUSCH, PUCCH, and SRS that apply *TCI-State* or *TCI-UL-State* specific to the first CORESETs using a same spatial domain filter as the one corresponding to from , if any, for the serving cell and using the following parameters for determination of a corresponding power as described in clauses 7.1.1, 7.2.1, and 7.3.1 - the RS index from , if any, for obtaining a corresponding downlink pathloss estimate for the serving cell- the values of , , and the PUSCH power control adjustment state provided by *p0AlphaSetforPUSCH* associated with the smallest value of *ul-powercontrolId* for the serving cell- the value of and the PUCCH power control adjustment state provided by *p0AlphaSetforPUCCH* associated with the smallest value of *ul-powercontrolId* for the serving cell - the values of , , and the SRS power control adjustment state provided by *p0AlphaSetforSRS* associated with the smallest value of *ul-powercontrolId* for the serving cell- transmits PUSCH, PUCCH, and SRS that apply *TCI-State* or *TCI-UL-State* specific to the second CORESETs using a same spatial domain filter as the one corresponding to from , if any, for the serving cell and using the following parameters for determination of a corresponding power as described in clauses 7.1.1, 7.2.1, and 7.3.1 - the RS index from , if any, for obtaining a corresponding downlink pathloss estimate for the serving cell- the values of , , and the PUSCH power control adjustment state provided by *p0AlphaSetforPUSCH* associated with the smallest value of *ul-powercontrolId* for the serving cell- the value of and the PUCCH power control adjustment state provided by *p0AlphaSetforPUCCH* associated with the smallest value of *ul-powercontrolId* for the serving cell - the values of , , and the SRS power control adjustment state provided by *p0AlphaSetforSRS* associated with the smallest value of *ul-powercontrolId* for the serving cellwhere the SCS configuration for the 28 symbols is the smallest of the SCS configurations of the active DL BWP for the PDCCH reception and of the active DL BWP(s) of the serving cells.--------------------------------------[Aris]: This is not applicable for this draft CR. It will be captured in v17.7.0 and will be reflected in v18.0.0. **Comment #2 (2TA)**According to the outcome from RAN1#114 meeting, PRACH triggering towards inactive additional PCI was precluded. Consequently, the new field with 1-bit is enough to indicate that PRACH triggering towards either serving cell or active additional PCI. Therefore, it is somehow arbitrary and also wasted to reuse cell indicator field with 4-bit of L1-mobility. In addition, it is proper to use two separated fields, instead of one shared fields, especially when both L1-mobility and MDCI MTRP are enabled. Notably, there is no any agreement reached so far with respect to reuse cell indicator field of L1-mobility for PRACH triggering indication of MDCI MTRP, it should be a consensus in RAN1 session at first if deemed necessary. Besides, it should be noticed that companies include us also commented to added this 1-bit new field in PDCCH order of DCI format 1\_0 in the running discussion of draft TS 38.212. In light of the above, we have the following suggestion.

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| **Proposed change (Section 8.2):**If the UE attempts to detect the DCI format 1\_0 with CRC scrambled by the corresponding RA-RNTI in response to a PRACH transmission initiated by a PDCCH order that triggers a contention-free random access procedure for the SpCell [11, TS 38.321], the UE may assume that the PDCCH that includes the DCI format 1\_0 and the PDCCH order have same DM-RS antenna port quasi co-location properties. If the UE attempts to detect the DCI format 1\_0 with CRC scrambled by the corresponding RA-RNTI in response to a PRACH transmission initiated by a PDCCH order that triggers a contention-free random access procedure for a secondary cell or for a cell indicated by a [1-bit new field] in the PDCCH order, the UE may assume the DM-RS antenna port quasi co-location properties of the CORESET associated with the Type1-PDCCH CSS set for receiving the PDCCH that includes the DCI format 1\_0 and the PDSCH scheduled by the DCI format 1\_0. |

**Agreement**For inter-cell multi-DCI based Multi-TRP operation with two TA enhancement, support indication of additionalPCI in the PDCCH order* as baseline capability: support PRACH triggering towards servingCell PCI or active additionalPCI.

**Conclusion**For inter-cell multi-DCI based Multi-TRP operation with two TA enhancement, no consensus on introducing the following optional UE capability:optional UE capability: support PRACH triggering towards servingCell PCI, active additionalPCI, or up to 1 inactive additionalPCI[Aris]: That text will be replaced – please see response to Comment 1 from Qualcomm. The indication details (X-bits) are expected to be captured in TS 38.212.**Comment #3(STxUL)**As per the agreement endorsed in RAN1#114 meeting, single DCI based STxMP SFN PUCCH transmission is enabled by *multipanelSfnScheme* provided in *PUCCH-Config* and then the PUCCH resource is applied with two indicated TCI states. Then, when ‘*multipanelSfnScheme*’ is provided, the UE should use the both spatial filters corresponding to first and second TCI states, simultaneously, for a given PUCCH transmission, in order to differentiate that from TDMed PUCCH repetition.Hence, we have the following suggestion.

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| **Proposed change (Section 9.2.2):**A spatial setting for a PUCCH transmission by a UE using a PUCCH resource is provided by- an indicated *TCI-State* or *TCI-UL-State*, if provided, as described in [6, TS 38.214];- *PUCCH-SpatialRelationInfo* if the UE is configured with a single value for *pucch-SpatialRelationInfoId*; - as described in [11, TS 38.321], if the UE is provided multiple values for *PUCCH-SpatialRelationInfo*. The UE applies corresponding actions in [11, TS 38.321] and a corresponding setting for a spatial domain filter to transmit PUCCH in the first slot that is after slot where is the slot where the UE would transmit a PUCCH with HARQ-ACK information with ACK value corresponding to a PDSCH reception providing the *PUCCH-SpatialRelationInfo*, each slot consists of symbols as defined in [4, TS 38.211],and is the SCS configuration for the PUCCH- If *PUCCH-SpatialRelationInfo* or the indicated *TCI-UL-State* provides *ssb-Index*, the UE transmits the PUCCH using a same spatial domain filter as for a reception of a SS/PBCH block with index provided by *ssb-Index* for a same serving cell or, if *servingCellId* is provided, for a serving cell indicated by *servingCellId* - else if *PUCCH-SpatialRelationInfo* or the indicated *TCI-UL-State* provides *csi-RS-Index*, or the indicated *TCI-State* provides *csi-rs* configured with *qcl-Type* set to 'typeD', the UE transmits the PUCCH using a same spatial domain filter as for a reception of a CSI-RS with resource index provided by *csi-RS-Index* or csi-rs for a same serving cell or, if *servingCellId* or *cell* is provided, for a serving cell indicated by *servingCellId* or *cell*- else *PUCCH-SpatialRelationInfo* or the indicated *TCI-UL-State* provides *srs*, the UE transmits the PUCCH using a same spatial domain filter as for a transmission of an SRS with resource index provided by *resource* for a same serving cell and/or active UL BWP or, if *servingCellId* and/or *uplinkBWP* are provided, for a serving cell indicated by *servingCellId* and/or for an UL BWP indicated by *uplinkBWP*- an indicated *apply-IndicatedTCIState*, if provided- if *apply-IndicatedTCIState* = ‘first’, the UE transmits a PUCCH using a spatial domain filter corresponding to a first *TCI-State* or *TCI-UL-State* of the PUCCH resource- if *apply-IndicatedTCIState* = ‘second’, the UE transmits a PUCCH using a spatial domain filter corresponding to second *TCI-State* or *TCI-UL-State* of the PUCCH resource- if *apply-IndicatedTCIState* = ‘both’, the UE transmits a PUCCH using respective first and second spatial domain filters corresponding to the first and the second *TCI-State* or *TCI-UL-State* of the PUCCH resourceIf the UE- is not provided *coresetPoolIndex* or is provided *coresetPoolIndex* with a value of 0 for first CORESETs on an active DL BWP of a serving cell, and- is provided *coresetPoolIndex* with a value of 1 for second CORESETs on the active DL BWP of the serving cells,the first and second *TCI-State* or *TCI-UL-State* are specific to the first and second CORESETs, respectively.- if *multipanelSfnScheme* is provided in *PUCCH-Config* and the first and second *TCI-State* or *TCI-UL-State* are applied to the PUCCH resource, the UE transmits a PUCCH simultaneously using respective first and second spatial domain filters corresponding to first and second *TCI-State* or *TCI-UL-State* of the PUCCH resource |

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| **Proposed change (Section 9.2.6):**For , - the UE repeats the PUCCH transmission with the UCI over slots- if the UE is provided *multipanelSfnScheme* in *PUCCH-Config* and the first and second *TCI-State* or *TCI-UL-State* are applied to the PUCCH resource, a repetition of the PUCCH transmission simultaneously uses first and second spatial domain filters corresponding to first and second *TCI-State* or *TCI-UL-State* of the PUCCH resource  |

[Aris]: No need to add “simultaneously” as this is for a single/same repetition. Will clarify that the PUCCH resource is associated with first and second *TCI-State* or *TCI-UL-State* although that is redundant given *multipanelSfnScheme*. There is also the following note in the spreadsheet for the RRC parameter “TBD in RAN1: Whether the Parent IE is PUCCH-Resource or PUCCH-Config”. For now, using “for the PUCCH resource” is sufficient and does not imply where *multipanelSfnScheme* is provided – that will be visible in 38.331 and may be updated, if needed, in 38.213.**Agreement**Introduce one RRC parameter in PUCCH-config to configure STxMP SFN scheme. When this RRC parameter is configured:* When two indicated TCI states are applied to one PUCCH resource, the STxMP SFN scheme is enabled to this PUCCH resource.
* When one TCI state is applied to one PUCCH resource, the sTRP transmission is enabled to this PUCCH resource.
* It is subject to UE capability to support enabling Rel-18 STxMP SFN scheme and the Rel-17 repetition number parameter *pucch-RepetitionNrofSlots* in a same PUCCH resource at the same time.

When this RRC parameter is not configured:* When two indicated TCI states are applied to one PUCCH resource, the Rel-17 TDM scheme with unified TCI states is enabled to this PUCCH resource.
* When one TCI state is applied to one PUCCH resource, the sTRP transmission is enabled to this PUCCH resource.
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