**3GPP TSG RAN WG1 #110bis-e R1-220XXXX**

**e-Meeting, October 10th – 19th, 2022**

**Agenda item:** 8.1

**Source:** Moderator (ZTE)

**Title:** Moderator Summary #1 for Maintenance on Rel-17 Multi-Beam

**Document for:** Discussion and Decision

## Introduction

The following in Section 2 and Section 3 (as agreed guidance from preparation phase for R17 multi-beam)) is assigned for discussion on maintenance of Rel-17 Multi-Beam, please provide your comments in corresponding sections.

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| [110bis-e-R17-MIMO-04] Email discussion on remaining maintenance issues on multi-beam enhancement by October 17 – Bo (ZTE)  ·         Issues 1-5, 1-6, 1-7, 1-14, 3-3, 3-4  ·         Editorial corrections for alignment CR: 1-2, 1-4, 1-9, 1-10, 1-18, 1-19, |

## Summary of High priority (H) issues

### Issue 1-5 Draft CR on PHR with unified TCI in TS 38.213(R1-2208756)

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| ***Reason for change:*** | In RAN1#109-e, an agreement was made on power control parameters (i.e., PL-RS, P0, alpha, closed loop index) for calculating Type 1 power headroom based on a reference PUSCH. However, the agreement is not reflected in the specification. This CR proposes to cature the agreement in 38.213.   |  | | --- | | **Agreement**  To calculate the Type 1 power headroom based on a reference PUSCH, the UE uses the PUSCH power control parameters (i.e., PL-RS, P0, alpha, closed loop index) associated with the indicated joint/UL-TCI state. | |
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| ***Summary of change:*** | Capture the texts related to the agreement on power control parameters for calculating the Type 1 power headroom based on a reference PUSCH. |
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| ***Consequences if not approved:*** | How to determine the power control parameters for calculating the Type 1 power headroom based on a reference PUSCH is not clear if a UE is provided DLorJoint-TCIState or UL-TCIstate. |

Due to above, the following draft CR is provided in R1-2208756:

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**7.7.1 Type 1 PH report**

<Unchanged parts are omitted>

If the UE determines that a Type 1 power headroom report for an activated serving cell is based on a reference PUSCH transmission then, for PUSCH transmission occasion on active UL BWP of carrier of serving cell , the UE computes the Type 1 power headroom report as

 [dB]

where is computed assuming MPR=0 dB, A-MPR=0 dB, P-MPR=0 dB. TC = 0 dB. MPR, A-MPR, P-MPR and TC are defined in [8-1, TS 38.101-1], [8-2, TS 38.101-2] and [8-3, TS 38.101-3]. The remaining parameters are defined in clause 7.1.1 and, if *ul-powerControl* is not provided, and are obtained using and *p0-PUSCH-AlphaSetId* *=* 0, is obtained using *pusch-PathlossReferenceRS-Id =* 0, and . If *ul-powerControl* is provided, and are obtained by *p0-Alpha-CLID-PUSCH-Set* associated with the indicated *DLorJoint-TCIState* or *UL-TCIstate*, is obtained by PL-RS associated with the indicated *DLorJoint-TCIState* or *UL-TCIstate*.

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FL note: It is to capture the already agreement in RAN1#109, and last meeting the above CR was quite stable.

Please provide company’s view in the table below.

* If not support, please clarify the reason why not to capture above mentioned agreement.

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| --- | --- |
| Company | Comment |
| Google | Support |
| ASUSTeK | Support |
| Ericsson | There is no *DLorJointTCIState* – propose to change to *TCI-State*. Otherwise it’s OK. |
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### Issue 1-6 Draft CR on PL-RS determination for CA case (R1-2208761, R1-2208535)

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| ***Reason for change:*** | 1. Regarding PL-RS in legacy power control scheme, UE determines an RS resource index with a *PUSCH-PathlossReferenceRS-Id* where the RS resource is either on serving cell or, if provided, on a serving cell indicated by a value of *pathlossReferenceLinking.*   Regarding PL-RS for unified TCI state in Rel-17, the parameter *pathlossReferenceLinking* should be reused, otherwise, cross-CC PL-RS configuration can not be supported.   1. Note that in legacy power control scheme, if the parameter *pathlossReferenceLinking* is not provided, the serving cell *c* is assumed for CC ID determination for PL-RS. In Rel-15/16, it is clear that the CC which the PUSCH transmission is carried on (similar to Rel-17 TCI state applied CC) is the same as the CC where the SRI is configured (similar to Rel-17 TCI state configured CC). However, in Rel-17, the TCI state applied CC may be not same as TCI state configured CC. It needs to specify “TCI state applied CC” or “TCI state configured CC” when the parameter *pathlossReferenceLinking* is not provided to address the above ambiguity.  * In our views, “TCI state configured CC” leads to lower burden for UE measuring PL compared with “TCI state applied CC”, and is more aligned with concept of common TCI state pool among multiple CCs. We suggest to adopt “TCI state configured CC”.  1. According to TS 38.331h10, RAN2 has decided that PL-RS is included in the indicated TCI state, instead of being associated with the indicated TCI state.. |
| ***-*** |  |
| ***Summary of change:*** | 1. Clarifying that the CC of PL-RS for an indicated TCI state can be the CC on which the indicated TCI state is configured, or, if provided, on a CC indicated by a value of *pathlossReferenceLinking*. 2. Removing the pending case that PL-RS is associated with the indicated TCI state. |
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| ***Consequences if not approved:*** | 1. PL-RS for an indicated TCI state cannot support cross carrier indication. That means that each CC which has TCI state pool configuration should have individual RS configurations for PL measurement, without flexibility of parameter *pathlossReferenceLinking* for Rel-15/16 which can indicate a PCell or a SCell. 2. There is misalignment between descriptions of TS38.213 and TS38.331, regarding the inclusion of PL-RS in the indicated TCI state. |

Since having two candidate CRs, let’s try to go with R1-2208535 in this round:

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**7 Uplink Power control**

<Unchanged part omitted>

In the remaining of this clause, if a UE is provided *TCIState* in *dl-OrJoint-TCIStateList* or *UL-TCIstate* and for an indicated *TCIState* or *UL-TCIstate* as described in [6, TS 38.214]

- in clauses 7.1.1, 7.2.1, and 7.3.1, the RS index for obtaining the downlink pathloss estimate for PUSCH, PUCCH, and SRS transmission is provided by *pathlossReferenceRS-Id-r17 ~~PL-RS~~* ~~associated with or included~~ in the indicated *TCIState* or *UL-TCIstate* except for SRS transmission that is not provided *followUnifiedTCIstateSRS* on a serving cell on which the indicated TCI state is configured, or, if provided, on a serving cell indicated by a value of *pathlossReferenceLinking*

<Unchanged part omitted>

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FL note: The issue identified in the problem is valid, otherwise cross-CC PL-RS indication may be precluded in unified TCI framework.

Please provide company’s view in the table below.

* If not support above CR, please clarify whether/how cross-CC PL-RS indication is support in unified TCI based on current spec.

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| Company | Comment |
| Google | OK in general, but we think the text “on a serving cell” should be moved after the words “in the indicated *TCIState* or *UL-TCIstate*”. Currently location seems to suggest this “on a serving cell” is for SRS. |
| Spreadtrum | Firstly, to clarify cross-CC PL-RS indication, we support that PL-RS ID is provided by the *TCIState* or *UL-TCIState* from a reference BWP of a reference CC.  Secondly, it needs to be clarified which serving cell the PL-RS is on. The principle for serving cell determination of PL-RS in 38.213 can be reused. If the UE is provided *pathlossReferenceLinking*, the RS resource is on a serving cell indicated by a value of *pathlossReferenceLinking*.  Thus, we support reusing the parameter *pathlossReferenceLinking* to indicate the serving cell for PL-RS configured in joint/UL TCI state for CA case.  Thirdly, however, there is also ambiguity in the draft CR above, i.e. which *pathlossReferenceLinking* is reused, *pathlossReferenceLinking* configured on the reference CC or *pathlossReferenceLinking* configured on the CC applying the indicated TCI state?  We prefer that the parameter *pathlossReferenceLinking* to be determined from the reference CC together with the PL-RS ID.  Fourthly, similar to the rule of CC/BWP determination for QCL-TypeA/D source RS in 38.214 as follows, if the parameter *pathlossReferenceLinking* is not provided in the reference CC, the PL-RS is on serving cell applying the indicated TCI state.   |  | | --- | | 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. |   Based on the above discussion, the following wording from the draft CR (R1-2208535) is recommended.  - in clauses 7.1.1, 7.2.1, and 7.3.1, the RS resource index for obtaining the downlink pathloss estimate for PUSCH, PUCCH, and SRS transmission is provided by *pathlossReferenceRS-Id-r17* associated with or included in the indicated *TCIState* or *UL-TCIstate* except for SRS transmission that is not provided *followUnifiedTCIstateSRS*  - if the *TCIState* or *UL-TCIstate* configurations are absent in a BWP of the CC, the RS resource index is provided by *pathlossReferenceRS-Id-r17* associated with or included in the indicated *TCIState* or *UL-TCIstate* from a reference BWP of a reference CC, where the RS resource is either on serving cell applying the indicated *TCIState* or *UL-TCIstate* or, if provided, on a serving cell indicated by a value of *pathlossReferenceLinking* configured on the reference CC. |
| Ericsson | Don’t support. This is incorrect: on which the indicated TCI state is configured It is on the serving cell where the TCI state is applied. |
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### Issue 1-7 Draft CR on SRS closed loop power control shared with PUSCH in TS 38.213 (R1-2208762)

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| ***Reason for change:*** | If a UE is provided unified TCI State in Rel-17, UL power control parameters are determined based on the indicated TCI state. In current spec, closed loop power control parameter is provided in a same format for PUSCH, PUCCH and SRS, as follows.   |  | | --- | | P0AlphaSet-r17 ::= SEQUENCE {  p0-r17 INTEGER (-16..15) OPTIONAL, -- Need R  alpha-r17 Alpha OPTIONAL, -- Need R  closedLoopIndex-r17 ENUMERATED { i0, i1 }  } |   For PUSCH or PUCCH, i0 and i1 clearly indicate the first and second closed loop power control respectively. However, for SRS, it can support separate SRS closed loop power control or shared closed power control with PUSCH (either one PUSCH closed power control, i0, or i1).  In Rel-17, there are two types of SRS:   * Case-1: SRS following unified TCI. In such case, the SRS tends to share closed loop power control with PUSCH, * Case-2: SRS not following unified TCI. Then, besides for codebook or non codebook transmission, the SRS may be used for beam management which should have separate closed loop power control. Either way, the closed loop power control parameter is individually indicated using Rel-17 TCI state, instead of by legacy Rel-15/16 mechanisms of separate MAC-CE or RRC signaling.   Therefore, closed loop power control parameter associated with TCI state for SRS should support both separate and shared closed loop power control. In order to minimize RRC impact, we suggest the following changes:   1. For both SRS following unified TCI and SRS not following unified TCI, specify that a parameter *closedLoopIndex-r17* indicates a shared closed loop power control for PUSCH with index of 0 or 1 for value of *i0* or *i1*. 2. For both SRS following unified TCI and SRS not following unified TCI, specify that an absence of the parameter *closedLoopIndex-r17* indicates a separate SRS closed loop power control. Note that this may need to change the property of parameter closedLoopIndex-r17 to be “OPTIONAL”. |
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| ***Summary of change:*** | 1. For both SRS following unified TCI and SRS not following unified TCI, specify that a parameter *closedLoopIndex-r17* indicates a shared closed loop power control for PUSCH with index of 0 or 1 for value of i0 or i1. 2. For both SRS following unified TCI and SRS not following unified TCI, specify that an absence of the parameter *closedLoopIndex-r17* indicates a separate SRS closed loop power control. |
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| ***Consequences if not approved:*** | 1. For both SRS following unified TCI and SRS not following unified TCI, separate SRS closed loop power control could not be supported. 2. Whether RRC configured SRS closed power control parameter refers shared closed loop power control or not is not clear. |

Due to above, the following draft CR is provided in R1-2208756:

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**7 Uplink Power control**

<Unchanged part omitted>

In the remaining of this clause, if a UE is provided *TCIState* in *dl-OrJoint-TCIStateList* or *UL-TCIstate* and for an indicated *TCIState* or *UL-TCIstate* as described in [6, TS 38.214]

- in clauses 7.1.1, 7.2.1, and 7.3.1, the RS index for obtaining the downlink pathloss estimate for PUSCH, PUCCH, and SRS transmission is provided by *PL-RS* associated with or included in the indicated *TCIState* or *UL-TCIstate* except for SRS transmission that is not provided *followUnifiedTCIstateSRS*

- in clause 7.1.1, if *p0AlphaSetforPUSCH* is provided, the values of , , and the PUSCH power control adjustment state are provided by *p0AlphaSetforPUSCH* associated with the indicated *TCIState* or *UL-TCIstate*

- in clause 7.2.1, if *p0AlphaSetforPUCCH* is provided, the values of and the PUCCH power control adjustment state are provided by *p0AlphaSetforPUCCH* associated with the indicated *TCIState* or *UL-TCIstate*

- in clause 7.3.1, if *p0AlphaSetforSRS* is provided,

- if *followUnifiedTCIstateSRS* is provided for a SRS resource set, the values of , , and SRS power control adjustment state are provided by *p0AlphaSetforSRS* associated with the indicated *TCIState* or *UL-TCIState.* The SRS power control adjustment state is the PUSCH power control adjustment state if the parameter *closedLoopIndex-r17* is provided; otherwise, if the parameter *closedLoopIndex-r17* is not provided, the SRS power control adjustment state is a separate SRS power control adjustment state.

- else, if *followUnifiedTCIstateSRS* is not provided for a SRS resource set and for a SRS resource from the SRS resource set, the values of , , and SRS power control adjustment state are provided by *p0AlphaSetforSRS* associated with *TCIState* or *UL-TCIState* of an SRS resource with lowest *SRS-ResourceId* in the SRS resource set and a RS index for obtaining a pathloss estimate for the SRS transmission is provided by PL-RS associated with or included in the *TCIState* or *UL-TCIState* of an SRS resource with lowest *SRS-ResourceId* in the SRS resource set. The SRS power control adjustment state is the PUSCH power control adjustment state if the parameter *closedLoopIndex-r17* is provided; otherwise, if the parameter *closedLoopIndex-r17* is not provided, the SRS power control adjustment state is a separate SRS power control adjustment state.

<Unchanged part omitted>

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FL note: Since now, some companies mentioned in the preparation phase summary that they may not be clear for above issue. For sake of presentation, proponent companies’ clarification is copied herein:

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| **Separate CL-PC for SRS transmission has been supported since LTE, NR also reuse such scheme,** for at least the following cases:   * Case1: No PUSCH/PUCCH is configured on a BWP/CC, then no shared CL-PC with PUSCH can be used. See 7.3.1.3.4 in 38.212. * Case 2: SRS resource set with usage of beam-management also needs separate CL-PC.   Section 7.3.1 in 38.213 clearly describes that there are 3 SRS CL-PC modes: separate SRS CL-PC, shared PUSCH CL-PC with closed-loop index 0 or 1. BTW. If we only need shared CL-PC for SRS, DCI format 2\_2 is enough, why do we need DCI format 2\_3?   |  | | --- | | **Section 7.3.1 in TS 38.213**  - For the SRS power control adjustment state for active UL BWP of carrier of serving cell and SRS transmission occasion  - , where is the current PUSCH power control adjustment state as described in clause 7.1.1, if *srs-PowerControlAdjustmentStates* indicates a same power control adjustment state for SRS transmissions and PUSCH transmissions; or  -  if the UE is not configured for PUSCH transmissions on active UL BWP of carrier of serving cell , or if *srs-PowerControlAdjustmentStates* indicates separate power control adjustment states between SRS transmissions and PUSCH transmissions, and if *tpc-Accumulation* is not provided, where |   Regarding NR R17 unified TCI, there are two types of SRS:   * first type SRS which follows unified TCI, * second type SRS which does not follow unified TCI, i.e., legacy SRS.   It was agreed that a legacy TCI state/spatial scheme cannot be configured with R17 unified TCI scheme in a same band. And legacy SRS in a CC with R17 unified TCI framework is thus configured with R17 TCI state, and power control parameter is determined by R17 TCI state (although not unified/indicated TCI state).  Therefore, **separate SRS CL-PC at least for legacy SRS must be supported in NR R17 when unified TCI scheme is enabled**. Otherwise, legacy SRS with separate CL-PC cannot work in R17. |

Please provide company’s view in the table below

* Question: Do you agree above issue/ambiguity for SRS closed loop RRC configuration: a total of 3 closed loop states, but for RRC, there are only two entries.
  + If yes, do you agree with above CR or any other views.
  + If no, how to interpret the two candidate entries in current RRC parameter ‘closedLoopIndex-r17 ENUMERATED { i0, i1 }’ for SRS.

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| Company | Comment |
| Google | There could be potential misunderstanding without the CR. We do not see any issue to endorse the CR. |
| Ericsson | Do not support. There is no ambiguity. |
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### Issue 1-14 Draft Rel-17 CR on default beam with unified TCI for cross-carrier scheduling(R1-2209937)

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| ***Reason for change:*** | As agreed in RAN1 #109e, the default beam follows the lowest CORESET ID in the latest monitored slot if the indicated TCI is associated with non-serving PCI. However, it is possible for a cross-carrier scheduled CC has indicated TCI associated with non-serving PCI and without CORESET. In this case, the default beam is unspecified.  **Agreement**  If scheduling offset < threshold (*timeDurationForQCL*), regardless of configuration of *followUnifiedTCIstate*   1. If the indicated TCI is associated with PCI different from serving cell PCI (i.e. inter-cell),    1. UE should apply Rel.15 default QCL assumption for both non-UE dedicated and UE dedicated PDSCH (i.e. QCL assumption of the lowest CORESET ID in the latest slot)    2. If the QCL-TypeD property for default beams in a slot for CCs in a band are different, the default beam for the CC with lowest ID is prioritized, i.e. the default beam for the CC with lowest ID is applied to all the CCs in a band 2. If the indicated TCI is associated with serving cell PCI (i.e. intra-cell), UE always uses indicated TCI for both UE-dedicated/non-UE-dedicated PDSCH (i.e. no need to consider default QCL)   The same approach as above is applied to default beam for aperiodic CSI-RS.  Note: UE is not expected to receive a non-UE dedicated PDSCH if the source RS of the TCI state of the corresponding PDSCH is not associated with the serving cell PCID. |
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| ***Summary of change:*** | Use the indicated TCI for a cross-carrier scheduled CC as the corresponding default beam, regardless the indicated TCI is associated with non-serving PCI or not |
|  |  |
| ***Consequences if not approved:*** | The corresponding default beam is unspecified if a cross-carrier scheduled CC has indicated TCI associated with non-serving PCI and without CORESET |

Due to above, the following draft CR is provided in R1-2209937:

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**5.1.5 Antenna ports quasi co-location**

< Unchanged parts are omitted >

If the PDCCH carrying the scheduling DCI is received on one component carrier, and a PDSCH scheduled by that DCI is on another component carrier:

- The *timeDurationForQCL* is determined based on the subcarrier spacing of the scheduled PDSCH. If µPDCCH < µPDSCH an additional timing delay is added to the *timeDurationForQCL*, where *d* is defined in 5.2.1.5.1a-1, otherwise *d* is zero;

- When the UE is configured with *enableDefaultBeamForCCS* and is not provided with *dl-OrJoint-TCIStateList-r17*, if the offset between the reception of the DL DCI and the corresponding PDSCH is less than the threshold *timeDurationForQCL,* or if the DL DCI does not have the TCI field present, the UE obtains its QCL assumption for the scheduled PDSCH from the activated TCI state with the lowest ID applicable to PDSCH in the active BWP of the scheduled cell.

- When the UE is configured with *enableDefaultBeamForCCS* and is provided with *dl-OrJoint-TCIStateList-r17*, if the offset between the reception of the DL DCI and the corresponding PDSCH is less than the threshold *timeDurationForQCL*, or if the DL DCI does not have the TCI field present, the UE obtains its QCL assumption for the scheduled PDSCH based on the indicated TCI state for the active BWP of the component carrier with the scheduled PDSCH.

< Unchanged parts are omitted >

**5.2.1.5.1 Aperiodic CSI Reporting/Aperiodic CSI-RS when the triggering PDCCH and the CSI-RS have the same numerology**

< Unchanged parts are omitted >

- If the scheduling offset between the last symbol of the PDCCH carrying the triggering DCI and the first symbol of the aperiodic CSI-RS resources in a *NZP-CSI-RS-ResourceSet* configured without higher layer parameter *trs-Info* is smaller than the UE reported threshold *beamSwitchTiming,* as defined in [13, TS 38.306], when the reported value is one of the values of {14, 28, 48} and *enableBeamSwitchTiming* is not provided, or is smaller than 48 when the UE provides *beamSwitchTiming-r16*, *enableBeamSwitchTiming* is provided and the *NZP-CSI-RS-ResourceSet* is configured with the higher layer parameter *repetition* set to 'off' or configured without the higher layer parameter *repetition,* or is smaller than the UE reported threshold *beamSwitchTiming-r16,* when *enableBeamSwitchTiming* is provided and the *NZP-CSI-RS-ResourceSet* is configured with the higher layer parameter *repetition* set to 'on'.

- If a UE is configured with *enableDefaultTCI-StatePerCoresetPoolIndex* and the UE is configured by higher layer parameter *PDCCH-Config* that contains two different values of *coresetPoolIndex* in *ControlResourceSet*

< Unchanged parts are omitted >

- else if there is any other DL signal with an indicated TCI state in the same symbols as the CSI-RS, the UE applies the QCL assumption of the other DL signal also when receiving the aperiodic CSI-RS. The other DL signal refers to PDSCH scheduled with offset larger than or equal to the threshold *timeDurationForQCL,* as defined in [13, TS 38.306], periodic CSI-RS, semi-persistent CSI-RS, aperiodic CSI-RS in a *NZP-CSI-RS-ResourceSet* scheduled with offset larger than or equal to the UE reported threshold *beamSwitchTiming* when the reported value is one of the values {14,28,48} and when *enableBeamSwitchTiming* is not provided or the *NZP-CSI-RS-ResourceSet* is configured with the higher layer parameter *trs-Info* , aperiodic CSI-RS in a *NZP-CSI-RS-ResourceSet* configuredwith the higher layer parameter *repetition* set to 'off' or configured without the higher layer parameters *repetition* and *trs-Info* scheduled with offset larger than or equal to 48 when the UE provides *beamSwitchTiming-r16* and *enableBeamSwitchTiming* is provided, aperiodic CSI-RS in a *NZP-CSI-RS-ResourceSet* configuredwith the higher layer parameter *repetition* set to 'on' scheduled with offset larger than or equal to the UE reported threshold *beamSwitchTiming-r16* and *enableBeamSwitchTiming* is provided;

- else if the UE is not provided *dl-OrJoint-TCIStateList-r17*, and if at least one CORESET is configured for the BWP in which the aperiodic CSI-RS is received, when receiving the aperiodic CSI-RS, the UE applies the QCL assumption used for the CORESET associated with a monitored search space with the lowest *controlResourceSetId* in the latest slot in which one or more CORESETs within the active BWP of the serving cell are monitored;

- else if the UE is provided *dl-OrJoint-TCIStateList-r17* and if the indicated TCI state is associated with a PCI different from the serving cell, regardless of configuration of *followUnifiedTCIstate*, and if at least one CORESET is configured for the BWP in which the aperiodic CSI-RS is received, when receiving the aperiodic CSI-RS, the UE applies the QCL assumption used for the CORESET associated with a monitored search space with the lowest *controlResourceSetId* in the latest slot in which one or more CORESETs within the active BWP of the serving cell are monitored. In the CA case, if the 'QCL-TypeD' of the aperiodic CSI-RSs from respective CCs in a band are different in a slot, the QCL-TypeD assumption of the CSI-RS in the CC with lowest CC ID in the band is applied to all the aperiodic CSI-RSs in the CCs in the band;

- else if the UE is provided *dl-OrJoint-TCIStateList-r17* and the indicated TCI state is associated with the PCI of the serving cell, regardless of configuration of *followUnifiedTCIstate*, the indicated TCI state is applied to the aperiodic CSI-RS;

- else if the UE is configured with *enableDefaultBeamForCCS* and is not provided with *dl-OrJoint-TCIStateList-r17*, and when receiving the aperiodic CSI-RS, the UE applies the QCL assumption of the lowest-ID activated TCI state applicable to the PDSCH within the active BWP of the cell in which the CSI-RS is to be received.

- else if the UE is configured with *enableDefaultBeamForCCS* and is provided with *dl-OrJoint-TCIStateList-r17*, and when receiving the aperiodic CSI-RS, the UE applies the QCL assumption based on the indicated TCI state for the active BWP of the cell in which the CSI-RS is to be received.

< Unchanged parts are omitted >

**5.2.1.5.1a Aperiodic CSI Reporting/Aperiodic CSI-RS when the triggering PDCCH and the CSI-RS have different numerologies**

When the triggering PDCCH and the triggered aperiodic CSI-RS are of different numerologies, the behavior defined in 5.2.1.5.1 for the case where the numerologies are the same applies with the following exceptions:

Beam switch timing:

< Unchanged parts are omitted >

- if one of the associated trigger states has the higher layer parameter *qcl-Type* set to 'typeD',

- if there is any other DL signal with an indicated TCI state in the same symbols as the CSI-RS, the UE applies the QCL assumption of the other DL signal also when receiving the aperiodic CSI-RS. The other DL signal refers to PDSCH scheduled with offset larger than or equal to the threshold *timeDurationForQCL,* as defined in [13, TS 38.306], periodic CSI-RS, semi-persistent CSI-RS, aperiodic CSI-RS scheduled with offset larger than or equal to *beamSwitchTiming* + *d*  in CSI-RS symbols when the reported value is one of the values {14,28,48} and when *enableBeamSwitchTiming* is not provided or the *NZP-CSI-RS-ResourceSet* is configured with the higher layer parameter *trs-Info*, aperiodic CSI-RS in a *NZP-CSI-RS-ResourceSet* configuredwith the higher layer parameter *repetition* set to 'off' or configured without the higher layer parameters *repetition* and *trs-Info* scheduled with offset larger than or equal to 48+ in CSI-RS symbols when the UE provides *beamSwitchTiming-r16* and *enableBeamSwitchTiming* is provided, aperiodic CSI-RS in a *NZP-CSI-RS-ResourceSet* configuredwith the higher layer parameter *repetition* set to 'on' and scheduled with offset larger than or equal to *beamSwitchTiming-r16* + *d* in CSI-RS symbols when *enableBeamSwitchTiming* is provided;

- else,

- if at least one CORESET is configured for the BWP in which the aperiodic CSI-RS is to be received, when receiving the aperiodic CSI-RS, the UE applies the QCL assumption used for the CORESET associated with a monitored search space with the lowest *controlResourceSetId* in the latest slot in which one or more CORESETs within the active BWP of the serving cell are monitored.

- else if the UE is configured with *enableDefaultBeamForCCS* and is not provided with *dl-OrJoint-TCIStateList-r17*, when receiving the aperiodic CSI-RS, the UE applies the QCL assumption of the lowest-ID activated TCI state applicable to the PDSCH within the active BWP of the cell in which the CSI-RS is to be received.

- else if the UE is configured with *enableDefaultBeamForCCS* and is provided with *dl-OrJoint-TCIStateList-r17*, when receiving the aperiodic CSI-RS, the UE applies the QCL assumption based on the indicated TCI statefor the active BWP of the cell in which the CSI-RS is to be received.

< Unchanged parts are omitted >

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FL note: After reviewing current spec, from the FL perspective, the above issue is valid.

* BTW, ‘dl-OrJoint-TCIStateList-r17’ is incorrect and has been replaced by legacy TCI state. But, in this round, let’s focus on the logic/technical issue of this CR, and once above can be supported in general, I will make the corresponding update accordingly.

Please provide company’s view in the table below

* + If not support, please clarify the UE behavior for cross-carrier scheduling (whether/how in unified TCI framework based on current spec)

|  |  |
| --- | --- |
| Company | Comment |
| Google | It seems the CR is not aligned with the agreements. In the agreement, the default beam is different for inter-cell and intra-cell. In addition, the highlighted text below seems to be unnecessary.  When the UE is configured with *enableDefaultBeamForCCS* and is provided with *dl-OrJoint-TCIStateList-r17*, if the offset between the reception of the DL DCI and the corresponding PDSCH is less than the threshold *timeDurationForQCL*, or if the DL DCI does not have the TCI field present, the UE obtains its QCL assumption for the scheduled PDSCH based on the indicated TCI state for the active BWP of the component carrier with the scheduled PDSCH. |
| Ericsson | Support, with two comments:   * Note that we do not include a suffix -r17 in RRC field names if there is no risk for ambiguity. So please replace *dl-OrJoint-TCIStateList-r17* with *dl-OrJoint-TCIStateList* * Why do we need the statement   if the offset between the reception of the DL DCI and the corresponding PDSCH is less than the threshold *timeDurationForQCL*  doesn’t the UE always apply the indicated TCI in this case? |
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### Issue 3-3 Draft CR 38.214 Rel-17 multi-beam enhancements\_beam switch HARQ (R1-2210057)

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| ***Reason for change:*** | The current specification is not clear on the application time of the beam indication (indicated TCI state). |
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| ***Summary of change:*** | In section 5.1.5 of 38.214 it should be clarified that the UE applies the Indicated TCI state carried in the latest-in-time DCI for which the UE sends HARQ-ACK. |
|  |  |
| ***Consequences if not approved:*** | The specifications would be incomplete regarding the DCI based beam switch when applied under the Rel-17 unified TCI framework. |

Due to above, the following draft CR is provided in R1-2210057:

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**5.1.5 Antenna ports quasi co-location**

< Unchanged parts are omitted >

When the UE would transmit the last symbol of a PUCCH with HARQ-ACK information corresponding to the latest in time DCI carrying the TCI State indication and without DL assignment, or corresponding to the PDSCH scheduling by the DCI carrying the TCI State indication, and if the indicated TCI State is different from the previously indicated one, the indicated *DLorJointTCIState* or *UL-TCIstate* should be applied starting from the first slot that is at least symbols after the last symbol of the PUCCH. The first slot and the symbols are both determined on the carrier with the smallest SCS among the carrier(s) applying the beam indication.

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FL note: Last meeting the above CR was quite stable, and let’s see whether we can approve above CR quickly.

Please provide company’s view in the table below.

* If not support, please clarify the reason why not to capture above.

|  |  |
| --- | --- |
| Company | Comment |
| Google | If we consider the CA operation, UE may receive DCI from multiple CCs. In that case, how to count the “latest in time” for the DCIs received from multiple CCs? |
| Ericsson | Support |
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### Issue 3-4 Clarification on active BWP for beam application time(R1-2208871)

Since the BAT is considered based on all active BWPs from the target CCs for the indicated TCI state, it is possible that the active BWPs for some CCs could be different at different time as shown in Figure 1. The BWP change could be known by the gNB, e.g. based on BWP switching signaling, or unknown by the gNB, e.g. timer UE-autonomous BWP switching.



**Figure 1: Potential issue for BAT determination for active BWP counting**

It is necessary to clarify the active BWP to determine the BAT based on one of the following options:

* Option 1: The active BWP is determined based on the active BWP with the smallest SCS among the active BWP(s) from the applying CCs in the slot with the TCI indication
* Option 2: The active BWP is determined based on the active BWP with the smallest SCS among the active BWP(s) from the applying CCs in the slot with the HARQ-ACK for the TCI indication

FL note: During last meeting online section, above issue was mentioned. Then, the companies are encouraged to provide your view on above two options. After stable, I can provide the corresponding CR if needed.

Please provide company’s view on above two options in the table below.

|  |  |
| --- | --- |
| Company | Comment |
| Google | We are open to either option 1 or 2, as long as there is no ambiguity. |
| ASUSTeK | Slightly prefer option 2, which is closer to applying timing, but would be fine with majority. |
| Ericsson | Either option is OK |
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## Summary of Editorial (E) issues

The related/updated editorial CR(s) are provided in:

[**https://www.3gpp.org/ftp/tsg\_ran/WG1\_RL1/TSGR1\_110b-e/Inbox/drafts/8.1(NR\_feMIMO)/Multi-Beam/Round%201/Editorial%20issues**](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/8.1(NR_feMIMO)/Multi-Beam/Round%201/Editorial%20issues)

Companies are to share their inputs on the editorial CR for the following issues herein.

### Issue 1-2

* Draft CR for TCI state parameter name alignment in TS 38.214 (Combo CR based on R1-2208751, R1-2210081, R1-2210089, R1-2210216)
* Draft CR for TCI state parameter name alignment in TS 38.213 (Combo CR based on R1-2210079, R1-2210088)

Table 1 Companies’ inputs

|  |  |
| --- | --- |
| Company | Comment |
| Mod\_V00 | The updated combo draft CRs are in:  [Issue 1-2, R1-221xxxx draft CR for TCI state parameter name alignment in TS 38.213\_v0.docx](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/8.1(NR_feMIMO)/Multi-Beam/Round%201/Editorial%20issues/Issue%201-2%2C%20R1-221xxxx%20draft%20CR%20for%20TCI%20state%20parameter%20name%20alignment%20in%20TS%2038.213_v0.docx) [Issue 1-2, R1-221xxxx draft CR for TCI state parameter name alignment in TS 38.214\_v0.docx](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/8.1(NR_feMIMO)/Multi-Beam/Round%201/Editorial%20issues/Issue%201-2%2C%20R1-221xxxx%20draft%20CR%20for%20TCI%20state%20parameter%20name%20alignment%20in%20TS%2038.214_v0.docx) |
| ASUSTeK | We found typos in reason for change in cover sheet of 213 combo CR.  It shall be “TS 38.213” rather than “TS 38.214”, and sorry for causing confusion. |
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### Issue 1-4

* Draft CR on reference of MAC CE in TS38.321 for SRS resource on unified TCI framework to TS38.214 (Lenovo)

Table 2 Companies’ inputs

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| --- | --- |
| Company | Comment |
| Mod\_V00 | The draft CR for endorsement is in:  [Issue 1-4, R1-221xxxx Draft CR on reference of MAC CE in TS38.321 for SRS resource on unified TCI framework to TS38.214\_v0.docx](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/8.1(NR_feMIMO)/Multi-Beam/Round%201/Editorial%20issues/Issue%201-4%2C%20R1-221xxxx%20Draft%20CR%20on%20reference%20of%20MAC%20CE%20in%20TS38.321%20for%20SRS%20resource%20on%20unified%20TCI%20framework%20to%20TS38.214_v0.docx) |
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### Issue 1-9

* On joint DLUL TCI state update in unified TCI framework (CATT)

Table 3 Companies’ inputs

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| Company | Comment |
| Mod\_V00 | The draft CR for endorsement is in:  [Issue 1-9, R1-221xxxx On joint DLUL TCI state update in unified TCI framework\_v0.docx](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/8.1(NR_feMIMO)/Multi-Beam/Round%201/Editorial%20issues/Issue%201-9%2C%20R1-221xxxx%20On%20joint%20DLUL%20TCI%20state%20update%20in%20unified%20TCI%20framework_v0.docx) |
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### Issue 1-10

* Correction on beam activation and update for multiple CCs (Google)

Table 4 Companies’ inputs

|  |  |
| --- | --- |
| Company | Comment |
| Mod\_V00 | The draft CR for endorsement is in:  [Issue 1-10, R1-221xxxx Correction on beam activation and update for multiple CCs\_v0.docx](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/8.1(NR_feMIMO)/Multi-Beam/Round%201/Editorial%20issues/Issue%201-10%2C%20R1-221xxxx%20Correction%20on%20beam%20activation%20and%20update%20for%20multiple%20CCs_v0.docx) |
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### Issue 1-18

* Correction on indicated TCI state (ASUSTeK)

Table 5 Companies’ inputs

|  |  |
| --- | --- |
| Company | Comment |
| Mod\_V00 | The draft CR for endorsement is in:  [Issue 1-18, R1-221xxxx Correction on indicated TCI state\_v0.docx](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/8.1(NR_feMIMO)/Multi-Beam/Round%201/Editorial%20issues/Issue%201-18%2C%20R1-221xxxx%20Correction%20on%20indicated%20TCI%20state_v0.docx) |
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### Issue 1-19

* Clarifying ambiguous usage of *TCI-State* (Huawei)

Table 6 Companies’ inputs

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| --- | --- |
| Company | Comment |
| Mod\_V00 | The draft CR for endorsement is in:  [Issue 1-19, R1-221xxxx Clarifying ambiguous usage of TCI-State\_v0.docx](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/8.1(NR_feMIMO)/Multi-Beam/Round%201/Editorial%20issues/Issue%201-19%2C%20R1-221xxxx%20Clarifying%20ambiguous%20usage%20of%20TCI-State_v0.docx) |
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## Conclusion

# References

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| --- | --- | --- | --- |
| 1 | [**R1-2208534**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208534.zip) | Draft CR on PL-RS for unified TCI framework | Spreadtrum Communications |
| 2 | [**R1-2208535**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208535.zip) | Draft CR on PL-RS determination for CA case | Spreadtrum Communications |
| 3 | [**R1-2208588**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208588.zip) | Discussion on the QCL assumption of the PDSCH not following the indicated TCI state | vivo |
| 4 | [**R1-2208589**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208589.zip) | Draft CR on the QCL assumption of the PDSCH not following the indicated TCI state | vivo |
| 5 | [**R1-2208590**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208590.zip) | Draft CR on the rate match mechanism for PDSCH for inter-cell beam measurement | vivo |
| 6 | [**R1-2208591**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208591.zip) | Draft CR on the UE behavior when PDCCH candidate overlaps with SSBs for inter-cell beam measurement in the same Res | vivo |
| 7 | [**R1-2208751**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208751.zip) | Draft CR on beam indication of SRS resource on unified TCI framework to TS38.214 | Lenovo |
| 8 | [**R1-2208753**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208753.zip) | Draft CR on noncodebook SRS resource on unified TCI framework to TS38.214 | Lenovo |
| 9 | [**R1-2208754**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208754.zip) | Draft CR on reference of MAC CE in TS38.321 for SRS resource on unified TCI framework to TS38.214 | Lenovo |
| 10 | [**R1-2208756**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208756.zip) | Draft CR on PHR with unified TCI in TS 38.213 | Lenovo |
| 11 | [**R1-2208761**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208761.zip) | Draft CR on cross CC power control for unified TCI in TS 38.213 | ZTE |
| 12 | [**R1-2208762**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208762.zip) | Draft CR on SRS closed loop power control shared with PUSCH in TS 38.213 | ZTE |
| 13 | [**R1-2208789**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208789.zip) | Corrections on TCI indication of CORESET not following unified TCI state | OPPO |
| 14 | [**R1-2208790**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208790.zip) | Corrections on activated TCI state in Unified TCI framework | OPPO |
| 15 | [**R1-2208791**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208791.zip) | Corrections on TCI indication of SRS in Unified TCI framework | OPPO |
| 16 | [**R1-2208871**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208871.zip) | Clarification on active BWP for beam application time | Google |
| 17 | [**R1-2208889**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208889.zip) | Draft CR on UL PC with common TCI state pool for CA | LG Electronics |
| 18 | [**R1-2208918**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2208918.zip) | On joint DL/UL TCI state update in unified TCI framework | CATT |
| 19 | [**R1-2209228**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209228.zip) | Draft CR on QCL source for CSI-RS | NEC |
| 20 | [**R1-2209539**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209539.zip) | Correction on beam activation and update for multiple CCs | Google |
| 21 | [**R1-2209559**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209559.zip) | Maintenance on Further enhancements on MIMO for NR | Apple |
| 22 | [**R1-2209824**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209824.zip) | Correction on conflict resolution for PUSCH TCI-state | Huawei, HiSilicon |
| 23 | [**R1-2209825**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209825.zip) | Correction on default power control parameters | Huawei, HiSilicon |
| 24 | [**R1-2209937**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209937.zip) | Draft CR on default beam with unified TCI for cross-carrier scheduling | Qualcomm Incorporated |
| 25 | [**R1-2209938**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209938.zip) | Draft CR on SRS power control parameters with unified TCI | Qualcomm Incorporated |
| 26 | [**R1-2209939**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2209939.zip) | Draft CR on reset accumulation of TPC adjustment state for unified TCI | Qualcomm Incorporated |
| 27 | [**R1-2210056**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2210056.zip) | Draft CR 38.213 Rel-17 CORESET Configured with CSS and Follow Unified TCI State | Nokia, Nokia Shanghai Bell |
| 28 | [**R1-2210057**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2210057.zip) | Draft CR 38.214 Rel-17 multi-beam enhancements\_beam switch HARQ | Nokia, Nokia Shanghai Bell |
| 29 | [**R1-2210058**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2210058.zip) | Draft CR 38.214 Rel-17 multi-beam enhancements\_CG PUSCH type 1 | Nokia, Nokia Shanghai Bell |
| 30 | [**R1-2210079**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2210079.zip) | Draft CR for TCI state parameter name alignment in TS 38.213 | ASUSTeK |
| 31 | [**R1-2210081**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2210081.zip) | Draft CR for TCI state parameter name alignment in TS 38.214 | ASUSTeK |
| 32 | [**R1-2210083**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2210083.zip) | Correction on indicated TCI state | ASUSTeK |
| 33 | [**R1-2210088**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2210088.zip) | Draft CR to 38.213 on UL TCI state parameter naming | Ericsson |
| 34 | [**R1-2210089**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2210089.zip) | Draft CR to 38.214 on UL TCI state parameter naming | Ericsson |
| 35 | [**R1-2210090**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2210090.zip) | Draft CR to 38.213 on unified TCI for PDSCH | Ericsson |
| 36 | [**R1-2210202**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2210202.zip) | Correction on DCI based TCI indication for cross carrier scheduling | Huawei, HiSilicon |
| 37 | [**R1-2210215**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2210215.zip) | Clarifying the ambiguous usage of TCI-State | Huawei, HiSilicon |
| 38 | [**R1-2210216**](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_110b-e/Docs/R1-2210216.zip) | UL TCI state parameter name alignment | Huawei, HiSilicon |
|  |  |  |  |