3GPP TSG-RAN WG2 Meeting #119bis electronic R2-220xxx

Online, October, 2022

Agenda Item: 6.17.2

Source: Ericsson

**Title: [AT119bis-e][018][feMIMO] RRC related Corrections (Ericsson)**

Document for: Discussion, Decision

# Introduction

[R2-2210785](file:///C:\Users\mtk65284\Documents\3GPP\tsg_ran\WG2_RL2\TSGR2_119bis-e\Docs\R2-2210785.zip) [Pre119bis-e][002] Summary RRC MIMO Rel-17 Ericsson

DISCUSSION

- Ericsson think P2 P3 need review / to be scrutinized, to keep them correct.

P2

- ZTE think that just modifying the restriction is not good. OPPO think this has been discussed several times, think explicit indication is a clear way.

- Chair wonder if it is better to add new field and point out that clarity is better than overambitious overhead optimization. HW are ok with new field if BW compatible.

P3

- Huawei think what is proposed is not sufficient, PUSCH power control contains fields that are not supposed to be used, and there are need M fields, these need to be handled somehow, overall reusing this may be complex. Ericsson think that it is proposed to only use the fields that are applicable. Huawei think we should consider a separate new field, which may be simpler in the end. Vivo CATT, Nokia, SS support separate field.

- OPPO has concerns on backwards compatibility. Chair assumes that we introduce all new things in Backwards compatible ways on ASN.1 level. OPPO think adding a new field is NBC on functional level. Chair point out that functional backwards compatibility is only interesting for functionality that works in the first place, in this case it seems that it doesn’t.

P4

- HW think indeed ZTE has found a problem. Xiaomi agrees there is an issue. To which TCI state is the reference? Think we may need to ask R1. ZTE agrees and think indeed there is an issue. Think Option 1 is a safe way (with need for LS). OPPO wonder if there is a problem for UL. ZTE think this is optjon 2.

P6

- HW think we can leave this to R1. No need to reply. Nokia agrees and think R1 are discussing this, can see reply from R1 during the weekend.

* P1: the proposal is agreed
* For P3, we assume to add separate fields
* Include tdoc of P4 in the discussion (P4 not agreed)
* P6: We wait for R1 to reply (CB next week).

Chair: continue offline.

* [AT119bis-e][018][feMIMO] RRC related Corrections (Ericsson)

Scope: Based on R2-2210785, referenced tdocs, online agreements and online comments, progress unclear points to determine agreeable parts. Capture agreeable parts in a CR

Intended outcome: Report, In-principle-Agreed CR

Deadline: Schedule 1 (possibility for CB W2 if needed)

# Contact Information

Respondents to the email discussion are kindly asked to fill in the following table.

|  |  |  |
| --- | --- | --- |
| Company | Name | Email Address |
| Ericsson | Helka-Liina Määttänen | Helka-liina.maattanen@ericsson.com |
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# How to correctly capture “no impact to RRM with inter-cell mTRP”

R2-2210077 Corrections for Release-17 feMIMO Ericsson

Current field description of *additionalPCI-ToAddModListList* states:

List of information for the additional SSB with different PCI than the serving cell PCI. The additional SSBs with different PCIs are not used for measurement event evaluation.

RAN2 agreement is: “RAN2 confirms that there is no impact to RRM with inter-cell mTRP.”

Issue with current text “*The additional SSBs with different PCIs are not used for measurement event evaluation.”* is that it may be interpreted that those PCIs, if same as neighbor cell PCIs, should not be measured as neighbor cells. This would be a impact to RRM and hence to aligned with the agreement.

The sentence should be revised to: “*The additional SSBs with different PCIs shall not impact serving cell quality derivation.”*

The change is as follows:

***additionalPCI-ToAddModListList.***

List of information for the additional SSB with different PCI than the serving cell PCI. The additional SSBs with different PCIs shall not impact serving cell quality derivation. ~~are not used for measurement event evaluation.~~

The above field description is agreed, however, the wording can be improved.

* P1: the proposal is agreed

**Question 1.** **Do you agree with the above wording or have another suggestion?**

|  |  |  |
| --- | --- | --- |
| Company | Yes/no | Comment or suggestion |
| Intel | Yes |  |
| Xiaomi | Yes |  |
| ZTE | Yes with intention,See comments | Just for clairification, if we remove the whole sentence ‘the additional SSBs with different PCI…’ Does it mean the additionalPCI-ToAddModList would impact on the RRM measurement? If the answer is no, maybe we can just remove the whole sentence directly. |
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# Configuring unified TCI state for srs

R2-2210124 Discussion on configurations for Rel-17 unified TCI CATT:

*In RAN1#106e [1], it was agreed that the AP CSI-RS can share the same indicated Rel-17 TCI state as indicated for PDSCH/PDCCH reception.*

|  |
| --- |
| ***Agreement***  *On Rel.17 unified TCI framework, the following DL RSs can* *share the same indicated Rel-17 TCI state as UE-dedicated reception on PDSCH and for UE-dedicated reception on all or subset of CORESETs in a CC*   * *Aperiodic CSI-RS resources for CSI*   + *FFS: Discuss if further restriction or further case is necessary* * *Aperiodic CSI-RS resources for BM*    + *FFS: Discuss if further restriction or further case is necessary* * *FFS: Other CSI-RS time-domain behaviors and/or restriction(s)* |

*As for how to capture this agreement, RAN2 finally agreed whether UE should follow R17 indicated unified TCI state depends on the absence of the field qcl-info, i.e., when the field qcl-info within the resourcesForChannel which is included within the CSI-AperiodicTriggerStateList is absent, it implies that UE shall use QCL information indicated in the “indicated” DL only/Joint TCI state.*

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| --- |
| ***qcl-info, qcl-info2***  *List of references to TCI-States for providing the QCL source and QCL type for each NZP-CSI-RS-Resource listed in nzp-CSI-RS-Resources of the NZP-CSI-RS-ResourceSet indicated by resourceSet within nzp-CSI-RS. Each TCI-StateId refers to the TCI-State which has this value for tci-StateId and is defined in tci-StatesToAddModList in the PDSCH-Config included in the BWP-Downlink corresponding to the serving cell and to the DL BWP to which the resourcesForChannelMeasurement (in the CSI-ReportConfig indicated by reportConfigId above) belong to. First entry in qcl-info corresponds to first entry in nzp-CSI-RS-Resources of that NZP-CSI-RS-ResourceSet, second entry in qcl-info corresponds to second entry in nzp-CSI-RS-Resources, and so on (see TS 38.214 [19], clause 5.2.1.5.1). When this field is absent for aperiodic CSI RS, the UE shall use QCL information included in the "indicated" DL only/Joint TCI state as specified in TS 38.214* |

*According to the presence condition of the field “qcl-info”, when the associated resource type of NZP-CSI-RS is aperiodic, the field “qcl-info” is mandatory present. Since the field is always present for AP CSI-RS, the condition “When this field is absent for aperiodic CSI RS, the UE shall use QCL information included in the "indicated" DL only/Joint TCI state as specified in TS 38.214” will never be fulfilled. This is conflicted with the original intention of RAN2, and the above RAN1 agreements cannot be supported, i.e., AP CSI-RS can share the same indicated Rel-17 TCI state as UE-dedicated reception on PDSCH and for UE-dedicated PUCCH.*

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| --- | --- |
| *Conditional Presence* | *Explanation* |
| *Aperiodic* | *The field is mandatory present if the NZP-CSI-RS-Resources in the associated resourceSet have the resourceType aperiodic. The field is absent otherwise.* |
| *CSI-IM-ForInterference* | *This field is mandatory present if the CSI-ReportConfig identified by reportConfigId is configured with csi-IM-ResourcesForInterference; otherwise it is absent.* |
| *NZP-CSI-RS-ForInterference* | *This field is mandatory present if the CSI-ReportConfig identified by reportConfigId is configured with nzp-CSI-RS-ResourcesForInterference; otherwise it is absent.* |
| *NoUnifiedTCI* | *This field is absent, Need R, if unifiedTCI-StateType is configured for the serving cell in which the CSI-AperiodicTriggerStateList is included. It is optionally present, Need R, otherwise.* |

***Observation 1: Since the “qcl-info” is mandatory present for******aperiodic type, the RAN1 agreement that AP CSI-RS can share the same indicated Rel-17 TCI state as UE-dedicated reception on PDSCH and for UE-dedicated PUCCH is not properly supported with the current spec.***

Indeed, this condition Aperiodic **has been modified in the end of RAN2#118 as shown below** in CR R2-220681 based on discussions in at meeting offline R2-2206592:

|  |  |
| --- | --- |
| Conditional Presence | Explanation |
| *Aperiodic* | The field is mandatory present if the *NZP-CSI-RS-Resources* in the associated *resourceSet* have the resourceType aperiodic. The field is absent otherwise. |

In feMIMO online there was no agreement related to this issue, however, adding the explicit parameter was supported in the comments.

P2

- ZTE think that just modifying the restriction is not good. OPPO think this has been discussed several times, think explicit indication is a clear way.

- Chair wonder if it is better to add new field and point out that clarity is better than overambitious overhead optimization. HW are ok with new field if BW compatible.

Hence, this document is to collect views on which option is preferred:

**Option 1: remove the restriction that “*When this field is absent for aperiodic CSI RS, the UE shall use QCL information included in the "indicated" DL only/Joint TCI state as specified in TS 38.214*” from the field description of the field “qcl-info”, then introduce a new field to indicate that UE should to follow the indicated Rel-17 TCI state as UE-dedicated reception of PDCCH/PDSCH, and specified that when UE receives the new field, UE should ignore the field “qcl-type”.**

**------------------------------start TP Option 1------------------------------------------------------**

#### – *CSI-AperiodicTriggerStateList*

The *CSI-AperiodicTriggerStateList* IE is used to configure the UE with a list of aperiodic trigger states. Each codepoint of the DCI field "CSI request" is associated with one trigger state (see TS 38.321 [3], clause 6.1.3.13). Upon reception of the value associated with a trigger state, the UE will perform measurement of CSI-RS, CSI-IM and/or SSB (reference signals) and aperiodic reporting on L1 according to all entries in the *associatedReportConfigInfoList* for that trigger state.

***CSI-AperiodicTriggerStateList* information element**

-- ASN1START

-- TAG-CSI-APERIODICTRIGGERSTATELIST-START

CSI-AperiodicTriggerStateList ::= SEQUENCE (SIZE (1..maxNrOfCSI-AperiodicTriggers)) OF CSI-AperiodicTriggerState

CSI-AperiodicTriggerState ::= SEQUENCE {

associatedReportConfigInfoList SEQUENCE (SIZE(1..maxNrofReportConfigPerAperiodicTrigger)) OF CSI-AssociatedReportConfigInfo,

...,

[[

ap-CSI-MultiplexingMode-r17 ENUMERATED {enabled} OPTIONAL, -- Need R

followUnifiedTCIState ENUMERATED {enabled} OPTIONAL -- Need R

]]

}

CSI-AssociatedReportConfigInfo ::= SEQUENCE {

reportConfigId CSI-ReportConfigId,

resourcesForChannel CHOICE {

nzp-CSI-RS SEQUENCE {

resourceSet INTEGER (1..maxNrofNZP-CSI-RS-ResourceSetsPerConfig),

qcl-info SEQUENCE (SIZE(1..maxNrofAP-CSI-RS-ResourcesPerSet)) OF TCI-StateId

OPTIONAL -- Cond Aperiodic

},

csi-SSB-ResourceSet INTEGER (1..maxNrofCSI-SSB-ResourceSetsPerConfig)

},

csi-IM-ResourcesForInterference INTEGER(1..maxNrofCSI-IM-ResourceSetsPerConfig) OPTIONAL, -- Cond CSI-IM-ForInterference

nzp-CSI-RS-ResourcesForInterference INTEGER (1..maxNrofNZP-CSI-RS-ResourceSetsPerConfig) OPTIONAL, -- Cond NZP-CSI-RS-ForInterference

...,

[[

resourcesForChannel2-r17 CHOICE {

nzp-CSI-RS2-r17 SEQUENCE {

resourceSet2-r17 INTEGER (1..maxNrofNZP-CSI-RS-ResourceSetsPerConfig),

qcl-info2-r17 SEQUENCE (SIZE(1..maxNrofAP-CSI-RS-ResourcesPerSet)) OF TCI-StateId

OPTIONAL -- Cond Aperiodic

},

csi-SSB-ResourceSet2-r17 INTEGER (1..maxNrofCSI-SSB-ResourceSetsPerConfigExt)

} OPTIONAL, -- Cond NoUnifiedTCI

csi-SSB-ResourceSetExt INTEGER (1..maxNrofCSI-SSB-ResourceSetsPerConfigExt) OPTIONAL -- Need R

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}

-- TAG-CSI-APERIODICTRIGGERSTATELIST-STOP

-- ASN1STOP

|  |
| --- |
| ***CSI-AssociatedReportConfigInfo* field descriptions** |
| ***ap-CSI-MultiplexingMode***  Indicates if the behavior of transmitting aperiodic CSI on the first PUSCH repetitions corresponding to two SRS resource sets configured in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with usage '*codebook*' or '*noncodebook*' is enabled or not. |
| ***csi-IM-ResourcesForInterference***  *CSI-IM-ResourceSet* for interference measurement. Entry number in csi-IM-ResourceSetList in the CSI-ResourceConfig indicated by *csi-IM-ResourcesForInterference* in the *CSI-ReportConfig* indicated by *reportConfigId* above (value 1 corresponds to the first entry, value 2 to the second entry, and so on). The indicated *CSI-IM-ResourceSet* should have exactly the same number of resources like the *NZP-CSI-RS-ResourceSet* indicated in *resourceSet* within *nzp-CSI-RS*. |
| ***csi-SSB-ResourceSet,*** ***csi-SSB-ResourceSet2***  CSI-SSB-ResourceSet for channel measurements. Entry number in *csi-SSB-ResourceSetList* in the *CSI-ResourceConfig* indicated by *resourcesForChannelMeasurement* in the *CSI-ReportConfig* indicated by *reportConfigId* above (value 1 corresponds to the first entry, value 2 to the second entry, and so on). |
| ***followUnifiedTCIstate***  When set to enabled, for *CSI-AperiodicTriggerState*, the UE applies the "indicated" DL only TCI or joint TCI as specified in TS 38.214 [19], clause 5.1.5. |
| ***nzp-CSI-RS-ResourcesForInterference***  *NZP-CSI-RS-ResourceSet* for interference measurement. Entry number in *nzp-CSI-RS-ResourceSetList* in the *CSI-ResourceConfig* indicated by *nzp-CSI-RS-ResourcesForInterference* in the *CSI-ReportConfig* indicated by *reportConfigId* above (value 1 corresponds to the first entry, value 2 to the second entry, and so on). |
| ***qcl-info, qcl-info2***  List of references to TCI-States for providing the QCL source and QCL type for each *NZP-CSI-RS-Resource* listed in *nzp-CSI-RS-Resources* of the *NZP-CSI-RS-ResourceSet* indicated by *resourceSet* within *nzp-CSI-RS*. Each *TCI-StateId* refers to the *TCI-State* which has this value for *tci-StateId* and is defined in *tci-StatesToAddModList* in the *PDSCH-Config* included in the *BWP-Downlink* corresponding to the serving cell and to the DL BWP to which the *resourcesForChannelMeasuremen*t (in the *CSI-ReportConfig* indicated by *reportConfigId* above) belong to. First entry in *qcl-info* corresponds to first entry in *nzp-CSI-RS-Resources* of that *NZP-CSI-RS-ResourceSet*, second entry in *qcl-info* corresponds to second entry in *nzp-CSI-RS-Resources*, and so on (see TS 38.214 [19], clause 5.2.1.5.1). When this field is absent for aperiodic CSI RS, the UE shall use QCL information included in the "indicated" DL only/Joint TCI state as specified in TS 38.214 |
| ***reportConfigId***  The *reportConfigId* of one of the *CSI-ReportConfigToAddMod* configured in *CSI-MeasConfig* |
| ***resourcesForChannel2***  Configures reference signals for channel measurement corresponding to the second resource set for L1-RSRP measurement as configured in IE *CSI-ResourceConfig* when *nrofReportedGroups-r17* is configured in IE *CSI-ReportConfig*. If this is present, network configures csi-SSB-ResourceSetExt instead of csi-SSB-ResourceSet and the UE ignores csi-SSB-ResourceSet in resourcesForChannel, and the *resourcesForChannel* configures the reference signals for channel measurement corresponding to the first resource set for L1-RSRP measurement (see TS 38.214 [19], clause 5.2.1.4). |
| ***resourceSet***  *NZP-CSI-RS-ResourceSet* for channel measurements. Entry number in *nzp-CSI-RS-ResourceSetList* in the *CSI-ResourceConfig* indicated by *resourcesForChannelMeasurement* in the *CSI-ReportConfig* indicated by r*eportConfigId* above (value 1 corresponds to the first entry, value 2 to the second entry, and so on). |

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| **Conditional Presence** | **Explanation** |
| *Aperiodic* | The field is mandatory present if the *NZP-CSI-RS-Resources* in the associated *resourceSet* have the resourceType aperiodic. The field is absent otherwise. |
| *CSI-IM-ForInterference* | This field is mandatory present if the *CSI-ReportConfig* identified by *reportConfigId* is configured with *csi-IM-ResourcesForInterference*; otherwise it is absent. |
| *NZP-CSI-RS-ForInterference* | This field is mandatory present if the *CSI-ReportConfig* identified by *reportConfigId* is configured with *nzp-CSI-RS-ResourcesForInterference*; otherwise it is absent. |
| *NoUnifiedTCI* | This field is absent, Need R, if *unifiedTCI-StateType* is configured for the serving cell in which the *CSI-AperiodicTriggerStateList* is included. It is optionally present, Need R, otherwise. |

**------------------------------end TP Option 1------------------------------------------------------**

**Option 2: change the present condition of the field “qcl-info”, i.e., when configures unified TCI-state and the CSI-RS is AP CSI-RS, the field “qcl-info” can be optional present. This options adds back what was removed in RAN2#118(May)**

**------------------------------start TP Option 2------------------------------------------------------**

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| **Conditional Presence** | **Explanation** |
| *Aperiodic* | The field is mandatory present if the *NZP-CSI-RS-Resources* in the associated *resourceSet* have the resourceType aperiodic and *unifiedTCI-StateType* is not configured for the serving cell. The field is optional present, Need R, if the *NZP-CSI-RS-Resources* in the associated *resourceSet* have the resourceType aperiodic and *unifiedTCI-StateType* is configured for the serving cell. The field is absent otherwise. |
| *CSI-IM-ForInterference* | This field is mandatory present if the *CSI-ReportConfig* identified by *reportConfigId* is configured with *csi-IM-ResourcesForInterference*; otherwise it is absent. |
| *NZP-CSI-RS-ForInterference* | This field is mandatory present if the *CSI-ReportConfig* identified by *reportConfigId* is configured with *nzp-CSI-RS-ResourcesForInterference*; otherwise it is absent. |
| *NoUnifiedTCI* | This field is absent, Need R, if *unifiedTCI-StateType* is configured for the serving cell in which the *CSI-AperiodicTriggerStateList* is included. It is optionally present, Need R, otherwise. |

**------------------------------end TP Option 2------------------------------------------------------**

**Q2: Please give your view which option is preferred?**

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| Company | Option 1 or Option 2 | comment |
| Intel | Option 1 with comment | We prefer to go with explicit signaling as these features are complicated. Previously, the reason why the “optionality” related sentence was removed is because resourcesForChannel2 (for mTRP CSI enhancements) cannot be configured with unified TCI (for BM).  If we go with Option 1, should we also describe such that qcl-info under resourcesForChannel should be ignored? qcl-info under resourcesForChannel is mandatory field and hence, it can not be omitted. |
| Xiaomi | Option 1 | We prefer the explicit signaling. |
| ZTE | Option 1 | Agree with intel, the qcl-info shall be ignored which can be added in the field description. |
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# Pathloss RS configuration

The second issue provided in R2-2210124 is related to pathloss reference RS configuration:

*In R17 unified TCI framework, the pathloss reference signals used for power control is per UL/Joint TCI state configured by referring to a PUSCH Pathloss Reference. The following is the configuration of UL TCI state, as extracted from TS38.331 [2].*

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| --- |
| ***TCI-UL-State information element***  *-- ASN1START*  *-- TAG-TCI-UL-STATE-START*  *TCI-UL-State-r17 ::= SEQUENCE {*  *tci-UL-State-Id-r17 TCI-UL-State-Id-r17,*  *servingCellId-r17 ServCellIndex OPTIONAL, -- Need R*  *bwp-Id-r17 BWP-Id OPTIONAL, -- Cond CSI-RSorSRS-Indicated*  *referenceSignal-r17 CHOICE {*  *ssb-Index-r17 SSB-Index,*  *csi-RS-Index-r17 NZP-CSI-RS-ResourceId,*  *srs-r17 SRS-ResourceId*  *},*  *additionalPCI-r17 AdditionalPCIIndex-r17 OPTIONAL, -- Need R*  *ul-powerControl-r17 Uplink-powerControlId-r17 OPTIONAL, -- Need R*  *pathlossReferenceRS-Id-r17 PUSCH-PathlossReferenceRS-Id-r17 OPTIONAL, -- Need R*  *...*    *}*  *-- TAG-TCI-UL-STATE-STOP*  *-- ASN1STOP* |

*According to the TS38.331 [2], the configuration of the PUSCH pathloss reference signal associated with PUSCH-PathlossReferenceRS-Id-r17 is configured within the IE PUSCH-PowerControl only. However, it is observed that the field PUSCH-PowerControl shall not be configured if unified TCI is configured. That means, the indicated pathlossReferenceRS-Id-r17 within the UL/Joint TCI state is not available, i.e., it is confusing for UE what is the pathlossReferenceRS-Id-r17 and which pathloss reference should be used.*

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| ***pusch-PowerControl***  *Configures power control parameters PUSCH transmission. This field is not configured if unifiedTCI-StateType is configured for the serving cell.* |

***Observation 2: The indicated pathloss reference signal within the current UL/Joint TCI state is unavailable.***

Related agreement is:

P3

- Huawei think what is proposed is not sufficient, PUSCH power control contains fields that are not supposed to be used, and there are need M fields, these need to be handled somehow, overall reusing this may be complex. Ericsson think that it is proposed to only use the fields that are applicable. Huawei think we should consider a separate new field, which may be simpler in the end. Vivo CATT, Nokia, SS support separate field.

- OPPO has concerns on backwards compatibility. Chair assumes that we introduce all new things in Backwards compatible ways on ASN.1 level. OPPO think adding a new field is NBC on functional level. Chair point out that functional backwards compatibility is only interesting for functionality that works in the first place, in this case it seems that it doesn’t.

* For P3, we assume to add separate fields

However, it would be good to once more confirm the addition of separate fields by comparing the two options:

**Option 1: Modify the field description of pusch-PowerControl in IE PUSCH-Config**

**------------------------------start TP Option 1------------------------------------------------------**

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| ***PUSCH-Config* field descriptions** |
| ***pusch-PowerControl***  Configures power control parameters PUSCH transmission. This field configures only parameters pathlossReferenceRSToAddModList, pathlossReferenceRSToReleaseList, or pathlossReferenceRSToAddModListExt-v1710 if *unifiedTCI-StateType* is configured for the serving cell. |

**------------------------------end TP Option 1------------------------------------------------------**

**Option 2: Introduce separate IE within the BWP-UplinkDedicated, which is used to configure the configuration of path loss reference RS and delete Rel-17 extensions of pathlossreferenceRS from IE PUSCH-powerControl. See TP for Option 2 in appendix.**

**Q4: Please indicate your preference on Option 1 and Option 2**

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| --- | --- | --- |
| Company | Option 1 or Option 2 | comment |
| Intel | Option 2 | We prefer option 2 because with option1, we still need to describe the mapping between PUSCH-PathlossReferenceRS-Id and PUSCH-PathlossReferenceRS-Id-r17 because those are configured independently. Actually, we need to have both pathlossReferenceRSToAddModList and pathlossReferenceRSToAddModListSizeExt-v1610 to have the same size as PUSCH-PathlossReferenceRS-Id-r17. |
| Xiaomi | Option 2 | We share the same view with Intel. |
| ZTE | Option 2 | Similar view with intel |
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# BWP and cell ID in unified TCI state for SRS

R2-2210655 CR on 38.331 for unified TCI state in SRS-Config ZTE Corporation, Sanechips

In SRS-config, srs is configured with TCI states:

srs-TCIState-r17 CHOICE {

srs-UL-TCIState-r17 TCI-UL-State-Id-r17,

srs-DLorJoint-TCIState-r17 TCI-StateId

} OPTIONAL -- Need R

]]

In R2-2210655, it is suggested to either add BWP and serving cell ID to the above structure or add the following text to the field description:

**Discussion on this item was as follows:**

P4

- HW think indeed ZTE has found a problem. Xiaomi agrees there is an issue. To which TCI state is the reference? Think we may need to ask R1. ZTE agrees and think indeed there is an issue. Think Option 1 is a safe way (with need for LS). OPPO wonder if there is a problem for UL. ZTE think this is optjon 2.

* Include tdoc of P4 in the discussion (P4 not agreed)

Hence RAN2 needs to discuss how to resolve the issue for UL and DL. There was also comment that the BWP/serving cell association needs to be asked from RAN1.

**Option 1: Specify a field description association srs-TCIState similar to suggested by ZTE**

**------------------------------start TP Option 1------------------------------------------------------**

***srs-TCIState***

Configuration of either a UL TCI state or a joint TCI state for the SRS resource. This field is absent when the SRS resource is in a *SRS-ResourceSet* configured with *followUnifiedTCIstateSRS-r17* or when the field *unifiedTCI-StateType* is not configured to the serving cell which the SRS resource is located in.if thehe TCI-UL-State-Id is present here, it shall be associated with the serving cell and uplink bwp where the SRS-Config is configured, if the TCI-State is present here, it shall be associated with the serving cell where the SRS-Config is configured and the current active DL BWP in this serving cell.

**------------------------------endTP Option 1------------------------------------------------------**

**Option 2: Add BWP and serving cell Ids in the configuration of srs-TCIState**

**Option 3: Ask RAN1 before proceeding with option1 or Option 2.**

**Q6:Please give your view which Option is suggested?**

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| --- | --- | --- |
| Company | Option 1, 2 or 3 | comment |
| Intel | Option 1 or option 3 | We are also ok to ask RAN1 although option 1 seems to be working. |
| Xiaomi | Option 2 or Option 3 | We think that Option 1 has some problem, as “ the current active DL BWP in this serving cell” will change dynamically, and the UL BWP and the DL BWP can be activated/deactivated independently. The RRC configuration is rather static. It will be difficult to provide the RRC configuration before the dynamic change of the DL BWP. On the other hand, “ associated with the serving cell and uplink bwp where the SRS-Config is configured” is also too restrictive, considering that Rel-17 feMIMO already allows the tci-State provided by other reference cell.  We are also open to ask RAN1 for more information |
| ZTE | Option 2 | Although both options can work, we slightly prefer option 2 which is a safer way than option 1(e.g. Option 1 has some logics which may cause potential issues). In addition, the AP/SP SRS TCI State Indication MAC CE have a flexible function to make each TCI state can be from any BWP/Serving cell for one sepcific SRS resources which has been confirmed by RAN1 (e.g. in the LS [R2-2206438](file:///C:\Users\mtk65284\Documents\3GPP\tsg_ran\WG2_RL2\TSGR2_118-e\Docs\R2-2206438.zip)), we think we can have a same logic with the periodic SRS for RRC configured TCI state.  Regarding whether need RAN1 to confirm our understanding, we are okay if most companies think it should be. |
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# Codebookmode for codebookConfig

R2-2210725 FeMIMO RRC corrections Huawei, HiSilicon

CodebookConfig ::= SEQUENCE {

codebookType CHOICE {

type1 SEQUENCE {

subType CHOICE {

typeI-SinglePanel SEQUENCE {

nrOfAntennaPorts CHOICE {

two SEQUENCE {

twoTX-CodebookSubsetRestriction BIT STRING (SIZE (6))

},

moreThanTwo SEQUENCE {

n1-n2 CHOICE {

two-one-TypeI-SinglePanel-Restriction BIT STRING (SIZE (8)),

two-two-TypeI-SinglePanel-Restriction BIT STRING (SIZE (64)),

four-one-TypeI-SinglePanel-Restriction BIT STRING (SIZE (16)),

three-two-TypeI-SinglePanel-Restriction BIT STRING (SIZE (96)),

six-one-TypeI-SinglePanel-Restriction BIT STRING (SIZE (24)),

four-two-TypeI-SinglePanel-Restriction BIT STRING (SIZE (128)),

eight-one-TypeI-SinglePanel-Restriction BIT STRING (SIZE (32)),

four-three-TypeI-SinglePanel-Restriction BIT STRING (SIZE (192)),

six-two-TypeI-SinglePanel-Restriction BIT STRING (SIZE (192)),

twelve-one-TypeI-SinglePanel-Restriction BIT STRING (SIZE (48)),

four-four-TypeI-SinglePanel-Restriction BIT STRING (SIZE (256)),

eight-two-TypeI-SinglePanel-Restriction BIT STRING (SIZE (256)),

sixteen-one-TypeI-SinglePanel-Restriction BIT STRING (SIZE (64))

},

typeI-SinglePanel-codebookSubsetRestriction-i2 BIT STRING (SIZE (16)) OPTIONAL -- Need R

}

},

typeI-SinglePanel-ri-Restriction BIT STRING (SIZE (8))

},

typeI-MultiPanel SEQUENCE {

ng-n1-n2 CHOICE {

two-two-one-TypeI-MultiPanel-Restriction BIT STRING (SIZE (8)),

two-four-one-TypeI-MultiPanel-Restriction BIT STRING (SIZE (16)),

four-two-one-TypeI-MultiPanel-Restriction BIT STRING (SIZE (8)),

two-two-two-TypeI-MultiPanel-Restriction BIT STRING (SIZE (64)),

two-eight-one-TypeI-MultiPanel-Restriction BIT STRING (SIZE (32)),

four-four-one-TypeI-MultiPanel-Restriction BIT STRING (SIZE (16)),

two-four-two-TypeI-MultiPanel-Restriction BIT STRING (SIZE (128)),

four-two-two-TypeI-MultiPanel-Restriction BIT STRING (SIZE (64))

},

ri-Restriction BIT STRING (SIZE (4))

}

},

codebookMode INTEGER (1..2)

},

type2 SEQUENCE {

subType CHOICE {

typeII SEQUENCE {

n1-n2-codebookSubsetRestriction CHOICE {

two-one BIT STRING (SIZE (16)),

two-two BIT STRING (SIZE (43)),

four-one BIT STRING (SIZE (32)),

three-two BIT STRING (SIZE (59)),

six-one BIT STRING (SIZE (48)),

four-two BIT STRING (SIZE (75)),

eight-one BIT STRING (SIZE (64)),

four-three BIT STRING (SIZE (107)),

six-two BIT STRING (SIZE (107)),

twelve-one BIT STRING (SIZE (96)),

four-four BIT STRING (SIZE (139)),

eight-two BIT STRING (SIZE (139)),

sixteen-one BIT STRING (SIZE (128))

},

typeII-RI-Restriction BIT STRING (SIZE (2))

},

typeII-PortSelection SEQUENCE {

portSelectionSamplingSize ENUMERATED {n1, n2, n3, n4} OPTIONAL, -- Need R

typeII-PortSelectionRI-Restriction BIT STRING (SIZE (2))

}

},

phaseAlphabetSize ENUMERATED {n4, n8},

subbandAmplitude BOOLEAN,

numberOfBeams ENUMERATED {two, three, four}

}

}

}

CodebookConfig-r16 ::= SEQUENCE {

codebookType CHOICE {

type2 SEQUENCE {

subType CHOICE {

typeII-r16 SEQUENCE {

n1-n2-codebookSubsetRestriction-r16 CHOICE {

two-one BIT STRING (SIZE (16)),

two-two BIT STRING (SIZE (43)),

four-one BIT STRING (SIZE (32)),

three-two BIT STRING (SIZE (59)),

six-one BIT STRING (SIZE (48)),

four-two BIT STRING (SIZE (75)),

eight-one BIT STRING (SIZE (64)),

four-three BIT STRING (SIZE (107)),

six-two BIT STRING (SIZE (107)),

twelve-one BIT STRING (SIZE (96)),

four-four BIT STRING (SIZE (139)),

eight-two BIT STRING (SIZE (139)),

sixteen-one BIT STRING (SIZE (128))

},

typeII-RI-Restriction-r16 BIT STRING (SIZE(4))

},

typeII-PortSelection-r16 SEQUENCE {

portSelectionSamplingSize-r16 ENUMERATED {n1, n2, n3, n4},

typeII-PortSelectionRI-Restriction-r16 BIT STRING (SIZE (4))

}

},

numberOfPMI-SubbandsPerCQI-Subband-r16 INTEGER (1..2),

paramCombination-r16 INTEGER (1..8)

}

}

}

CodebookConfig-r17 ::= SEQUENCE {

codebookType CHOICE {

type1 SEQUENCE {

typeI-SinglePanel-Group1-r17 SEQUENCE {

nrOfAntennaPorts CHOICE {

two SEQUENCE {

twoTX-CodebookSubsetRestriction1-r17 BIT STRING (SIZE (6))

},

moreThanTwo SEQUENCE {

n1-n2 CHOICE {

two-one-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (8)),

two-two-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (64)),

four-one-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (16)),

three-two-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (96)),

six-one-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (24)),

four-two-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (128)),

eight-one-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (32)),

four-three-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (192)),

six-two-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (192)),

twelve-one-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (48)),

four-four-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (256)),

eight-two-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (256)),

sixteen-one-TypeI-SinglePanel-Restriction1-r17 BIT STRING (SIZE (64))

}

}

}

} OPTIONAL, -- Need R

typeI-SinglePanel-Group2-r17 SEQUENCE {

nrOfAntennaPorts CHOICE {

two SEQUENCE {

twoTX-CodebookSubsetRestriction2-r17 BIT STRING (SIZE (6))

},

moreThanTwo SEQUENCE {

n1-n2 CHOICE {

two-one-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (8)),

two-two-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (64)),

four-one-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (16)),

three-two-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (96)),

six-one-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (24)),

four-two-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (128)),

eight-one-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (32)),

four-three-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (192)),

six-two-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (192)),

twelve-one-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (48)),

four-four-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (256)),

eight-two-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (256)),

sixteen-one-TypeI-SinglePanel-Restriction2-r17 BIT STRING (SIZE (64))

}

}

}

} OPTIONAL, -- Need R

typeI-SinglePanel-ri-RestrictionSTRP-r17 BIT STRING (SIZE (8)) OPTIONAL, -- Need R

typeI-SinglePanel-ri-RestrictionSDM-r17 BIT STRING (SIZE (4)) OPTIONAL -- Need R

},

type2 SEQUENCE {

typeII-PortSelection-r17 SEQUENCE {

paramCombination-r17 INTEGER (1..8),

valueOfN-r17 ENUMERATED {n2, n4} OPTIONAL, -- Need R

numberOfPMI-SubbandsPerCQI-Subband-r17 INTEGER(1..2) OPTIONAL, -- Need R

typeII-PortSelectionRI-Restriction-r17 BIT STRING (SIZE (4))

}

}

}

}

CodebookConfig-v1730 ::= SEQUENCE {

codebookMode-v1730 INTEGER (1..2) OPTIONAL -- Need R

}

***codebookConfig***

Codebook configuration for Type-1 or Type-2 including codebook subset restriction. Network can only configure one of *codebookConfig*, *codebookConfig-r16* or *codebookConfig-r17* to a UE. The network does not configure *codebookConfig-v1730* if *codebookConfig-r17* is not configured.

In R2-2210725, it is pointed out that CodebookConfig-r17 is potentially missing a parameter on codebook mode which is there in the Release 15 version of the CodebookConfig. The related input from RAN1 is:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Two CBSRs can be configured per CodebookConfig, whereas one CBSR is applied to one CMR group in a CMR resource set respectively. | Up to RAN2 |  | Per DL BWP, per CSI-ReportConfig | UE-specific |  | For a CSI report associated with a Multi-TRP/panel NCJT measurement hypothesis configured by single CSI reporting setting: • Two CBSRs can be configured per CodebookConfig, whereas one CBSR is applied to one CMR group in a CMR resource set respectively, i.e. per TRP. |

Per RAN1’s request, RAN2 introduces *CodebookConfig-r17*, in which *typeI-SinglePanel-Group1-r17* and *typeI-*

From LS in R1-2205168:

***Issue 3: CSI-mTRP***

*RAN2 introduced 2 types of RI restrictions and two codebook subset restrictions (CBSR) per CodebookConfig. However, it is not clear how those features are enabled: Currently, same as in previous releases, RAN2 signalling assumes both RI restrictions and CBSR are configured simultaneously, but RAN2 would like to verify this is the correct assumption for the signallling.*

***Question 4:*** *Which of the following assumptions are correct?*

* *If two RI restrictions are configured, two CBSRs are configured and if two CBSRs are configured two CBSRs are configured (i.e. when two are configured for either RI restriction or CBSR, two are also configured for the other).*
* *UE can be configured with either RI restriction for sTRP or RI restriction for NCJT, but not both at the same time.*
* *If two CBSRs are configured, two CMR groups are configured and if two CMR groups are configured, two CBSRs are configured (i.e. when two are configured for either CBSR or CMR groups, two are also configured for the other and there cannot be configuration of e.g. one CBSR but two CMR groups)*

***Answer 4****:*

* *Regarding Assumption 1, RI restriction and CBSR are two independent features*
  + *RAN1 may provide further details later, if needed*
* *Assumption 2 is incorrect.* 
  + *UE is configured with one RI restriction for NCJT if csi-ReportMode-r17 is set to ‘Mode1’ and numberOfSingleTRP-CSI-Mode1-r17 is set to ‘n0’, otherwise UE is configured with two RI restrictions for sTRP and NCJT respectively.*
* *Assumption 3 is correct*

The in LS in R2-2204120:

***2. Follow up answer to a remaining question in R2-2202002***

*RAN1 made the following additional agreement related to Question 3.1 in R2-2202002:*

***Question 3.1:****Which CBSRs are intended to be used and whether there are specific restrictions to be applied for the RRC configuration? Also whether is it introduced for both typeI-SinglePanel1 and typeI-SinglePanel2 and also for both 2Tx and more than 2Tx?*

***Answer 3.1:****RAN1 agreed that ‘typeI-SinglePanel’ codebook is supported for mTRP CSI; hence, there is no further restriction that needs to be introduced.  The mth (m=1,2) CBSR is to be used when computing the PMI corresponding to the NZP CSI-RS resource for channel measurement from the mth Resource group.  The two CBSRs can be introduced for both 2Tx and more than 2Tx.*

* *Note that the CBSR parameter typeI-SinglePanel-codebookSubsetRestriction-i2, configured for semi-open loop, is neither supported nor needed for mTRP CSI*
* *Note that the value of N1 and N2 (and hence the number of ports) is the same for the two CBSR.*
* *Note that the parameters typeI-SinglePanel1 and typeI-SinglePanel2 is not fully clear to RAN1*
* *Regarding the two RI restriction parameters, note that RI restriction parameter of a bitmap of size 4 corresponding to rank combinations {1+1, 1+2, 2+1, 2+2} is needed for mTRP CSI hypotheses (corresponding to any CMR pair) in addition to the existing “typeI-SinglePanel-ri-Restriction” for single-TRP CSI hypotheses (corresponding to any individual CMR).*

While the above RAN1 input does not instruct on the need on codebookmode, there is capability from where this could be deduced:

According to the UE capability IE, there is a field called codebookModeNCJT-r17, which indicates whether the UE supports both mode1 and mode2, or only supports mode1. By this capability, the network should configure either mode 1 or mode 2 to the UE. Now this codebook mode field is missing in *CodebookConfig-r17*.

mTRP-CSI-EnhancementPerBand-r17 SEQUENCE {

maxNumNZP-CSI-RS-r17 INTEGER (2..8),

cSI-Report-mode-r17 ENUMERATED {mode1, mode2, both},

supportedComboAcrossCCs-r17 SEQUENCE (SIZE (1..16)) OF CSI-MultiTRP-SupportedCombinations-r17,

codebookModeNCJT-r17 ENUMERATED{mode1,mode1And2}

} OPTIONAL,

RAN2 should discuss whether it is ok to deduce based on the exiting capability that this parameter codebookmode is indeed missing or if RAN2 should send LS to Ran1 to confirm.

**Option 1: Add parameter codebookmode in cobebookConfig-r17**

**Option 2: Send LS to RAN1 asking if codebookmode is needed for cobebookConfig-r17**

**Q7: Please give your view whether you support Option 1 or Option 2?**

|  |  |  |
| --- | --- | --- |
| Company | Option 1 or option 2 | comment |
| Intel | Option 1 or 2 | Since this meeting is bis meeting, it would be also ok to send an quick LS although we think option 1 is also ok. |
| Xiaomi | Option 1 or 2 |  |
| ZTE | Either one is acceptable. |  |
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# Conclusion

TBA

# Appendix

– *BWP-UplinkDedicated*

The IE *BWP-UplinkDedicated* is used to configure the dedicated (UE specific) parameters of an uplink BWP.

***BWP-UplinkDedicated* information element**

-- ASN1START

-- TAG-BWP-UPLINKDEDICATED-START

BWP-UplinkDedicated ::= SEQUENCE {

pucch-Config SetupRelease { PUCCH-Config } OPTIONAL, -- Need M

pusch-Config SetupRelease { PUSCH-Config } OPTIONAL, -- Need M

configuredGrantConfig SetupRelease { ConfiguredGrantConfig } OPTIONAL, -- Need M

srs-Config SetupRelease { SRS-Config } OPTIONAL, -- Need M

beamFailureRecoveryConfig SetupRelease { BeamFailureRecoveryConfig } OPTIONAL, -- Cond SpCellOnly

...,

[[

sl-PUCCH-Config-r16 SetupRelease { PUCCH-Config } OPTIONAL, -- Need M

cp-ExtensionC2-r16 INTEGER (1..28) OPTIONAL, -- Need R

cp-ExtensionC3-r16 INTEGER (1..28) OPTIONAL, -- Need R

useInterlacePUCCH-PUSCH-r16 ENUMERATED {enabled} OPTIONAL, -- Need R

pucch-ConfigurationList-r16 SetupRelease { PUCCH-ConfigurationList-r16 } OPTIONAL, -- Need M

lbt-FailureRecoveryConfig-r16 SetupRelease { LBT-FailureRecoveryConfig-r16 } OPTIONAL, -- Need M

configuredGrantConfigToAddModList-r16 ConfiguredGrantConfigToAddModList-r16 OPTIONAL, -- Need N

configuredGrantConfigToReleaseList-r16 ConfiguredGrantConfigToReleaseList-r16 OPTIONAL, -- Need N

configuredGrantConfigType2DeactivationStateList-r16 ConfiguredGrantConfigType2DeactivationStateList-r16 OPTIONAL -- Need R

]],

[[

ul-TCI-StateList-r17 CHOICE {

explicitlist SEQUENCE {

ul-TCI-ToAddModList-r17 SEQUENCE (SIZE (1..maxUL-TCI-r17)) OF TCI-UL-State-r17 OPTIONAL, -- Need N

ul-TCI-ToReleaseList-r17 SEQUENCE (SIZE (1..maxUL-TCI-r17)) OF TCI-UL-State-Id-r17 OPTIONAL -- Need N

},

unifiedTCI-StateRef-r17 ServingCellAndBWP-Id-r17

} OPTIONAL, -- Need R

ul-powerControl-r17 Uplink-powerControlId-r17 OPTIONAL, -- Cond NoTCI-PC

pucch-ConfigurationListMulticast1-r17 SetupRelease { PUCCH-ConfigurationList-r16 } OPTIONAL, -- Need M

pucch-ConfigurationListMulticast2-r17 SetupRelease { PUCCH-ConfigurationList-r16 } OPTIONAL -- Need M

]],

[[

pucch-ConfigMulticast1-r17 SetupRelease { PUCCH-Config } OPTIONAL, -- Need M

pucch-ConfigMulticast2-r17 SetupRelease { PUCCH-Config } OPTIONAL -- Need M

]],

[[

pathlossForUnifiedTCI-r17 SetUpRelease{ PathlossForUnifiedTCI-r17 } OPTIONAL -- Cond UnifiedTCI

]]

}

– *BWP-UplinkDedicated*

The IE *BWP-UplinkDedicated* is used to configure the dedicated (UE specific) parameters of an uplink BWP.

***BWP-UplinkDedicated* information element**

|  |
| --- |
| ***BWP-UplinkDedicated* field descriptions** |
| ***beamFailureRecoveryConfig***  Configuration of beam failure recovery. If *supplementaryUplink* is present, the field is present only in one of the uplink carriers, either UL or SUL. |
| ***configuredGrantConfig***  A *Configured-Grant* of *type1* or *type2*. It may be configured for UL or SUL but in case of *type1* not for both at a time. Except for reconfiguration with sync, the NW does not reconfigure *configuredGrantConfig* when there is an active configured uplink grant Type 2 (see TS 38.321 [3]). However, the NW may release the *configuredGrantConfig* at any time. Network can only configure configured grant in one BWP using either this field or *configuredGrantConfigToAddModList.* |
| ***configuredGrantConfigToAddModList***  Indicates a list of one or more configured grant configurations to be added or modified for one BWP. Except for reconfiguration with sync, the NW does not reconfigure a Type 2 configured grant configuration when it is active (see TS 38.321 [3]). The network configures multiple CG configurations for one BWP with either all configurations or no configuration configured with *cg-RetransmissionTimer-r16*. |
| ***configuredGrantConfigToReleaseList***  Indicates a list of one or more UL Configured Grant configurations to be released. The NW may release a configured grant configuration at any time. |
| ***configuredGrantConfigType2DeactivationStateList***  Indicates a list of the deactivation states in which each state can be mapped to a single or multiple Configured Grant type 2 configurations to be deactivated when the corresponding deactivation DCI is received, see clause 7.3.1 in TS 38.212 [17] and clause 10.2 in TS 38.213 [13]. |
| ***cp-ExtensionC2, cp-ExtensionC3***  Configures the cyclic prefix (CP) extension (see TS 38.211 [16], clause 5.3.1). For 15 kHz SCS, {1..28} are valid for both *cp-ExtensionC2* and *cp-ExtensionC3*. For 30 kHz SCS, {1..28} are valid for *cp-ExtensionC2* and {2..28} are valid for *cp-ExtensionC3.* For 60 kHz SCS, {2..28} are valid for *cp-ExtensionC2* and {3..28} are valid for *cp-ExtensionC3*. |
| ***lbt-FailureRecoveryConfig***  Configures parameters used for detection of consistent uplink LBT failures for operationwith shared spectrum channel access, as specified in TS 38.321 [3]. |
| ***pathlossForUnifiedTCI***  A set of Reference Signals (e.g. a CSI-RS config or a SS block) to be used for path loss estimation. |
| ***pucch-Config***  PUCCH configuration for one BWP of the normal UL or SUL of a serving cell. If the UE is configured with SUL, the network configures PUCCH only on the BWPs of one of the uplinks (normal UL or SUL). The network configures *PUCCH-Config* at least on non-initial BWP(s) for SpCell and PUCCH SCell. If supported by the UE, the network may configure at most one additional SCell of a cell group with *PUCCH-Config* (i.e. PUCCH SCell). If PUCCH cell switching is supported by the UE, the network may configure two TDD serving cells with *PUCCH-Config* within each PUCCH group. For supporting PUCCH cell switching in the PUCCH group with the SpCell, the TDD SpCell and one TDD SCell shall have *PUCCH-Config* on their normal UL. For supporting PUCCH cell switching in the PUCCH group with only SCells, two TDD SCells shall have *PUCCH-Config* on their normal UL.  In (NG)EN-DC and NE-DC, the NW configures at most one serving cell per frequency range with PUCCH. In (NG)EN-DC and NE-DC, if two PUCCH groups are configured, the serving cells of the NR PUCCH group in FR2 use the same numerology. For NR-DC, the maximum number of PUCCH groups in each cell group is one, and only the same numerology is supported for the cell group with carriers only in FR2.  The NW may configure PUCCH for a BWP when setting up the BWP. The network may also add/remove the *pucch-Config* in an *RRCReconfiguration* with *reconfigurationWithSync* (for SpCell or PUCCH SCell) or with SCell release and add (for PUCCH SCell) to move the PUCCH between the UL and SUL carrier of one serving cell. In other cases, only modifications of a previously configured *pucch-Config* are allowed.  If one (S)UL BWP of a serving cell is configured with PUCCH, all other (S)UL BWPs must be configured with PUCCH, too. |
| ***pucch-ConfigurationList***  PUCCH configurations for two simultaneously constructed HARQ-ACK codebooks (see TS 38.213 [13], clause 9.1). Different PUCCH Resource IDs are configured in different *PUCCH-Config* within the *pucch-ConfigurationList* if configured. |
| ***pucch-ConfigurationListMulticast1***  PUCCH configurations for two simultaneously constructed HARQ-ACK codebooks for MBS multicast (see TS 38.213, clause 9). |
| ***pucch-ConfigurationListMulticast2***  PUCCH configurations for two simultaneously constructed NACK-only feedback for MBS multicast (see TS 38.213, clause 9). |
| ***pusch-Config***  PUSCH configuration for one BWP of the normal UL or SUL of a serving cell. If the UE is configured with SUL and if it has a *PUSCH-Config* for both UL and SUL, an UL/SUL indicator field in DCI indicates which of the two to use. See TS 38.212 [17], clause 7.3.1. |
| ***pucch-ConfigMulticast1***  PUCCH configuration for the HARQ-ACK codebook for MBS multicast when multicast feedback is not configured with a priority value (see TS 38.213 [13], clause 9). If the field is not configured, *pucch-Config* applies. |
| ***pucch-ConfigMulticast2***  PUCCH configuration for the NACK-only feedback for MBS multicast when multicast feedback is not configured with a priority value (see TS 38.213 [13], clause 9). If the field is not configured, *pucch-Config* applies. |
| ***sl-PUCCH-Config***  Indicates the UE specific PUCCH configurations used for the HARQ-ACK feedback reporting for NR sidelink communication. |
| ***srs-Config***  Uplink sounding reference signal configuration. |
| ***ul-powerControl***  Configures power control parameters for PUCCH, PUSCH and SRS when UE is configured with *unifiedTCI-StateType* for this serving cell. |
| ***ul-TCI-StateList***  Indicates the applicable UL TCI states for PUCCH, PUSCH and SRS. |
| ***ul-TCI-ToAddModList***  Indicates a list of UL TCI states. |
| ***unifiedTCI-StateRef***  Provides the serving cell and UL BWP where UL TCI states applicable to this UL BWP are defined. |
| ***useInterlacePUCCH-PUSCH***  If the field is present, the UE uses uplink frequency domain resource allocation Type 2 for PUSCH (see TS 38.213 [13], clause 8.3 and TS 38.214 [19], clause 6.1.2.2) and uses interlaced PUCCH Format 0, 1, 2, and 3 for PUCCH (see TS 38.213 [13], clause 9.2.1). |

|  |  |
| --- | --- |
| **Conditional Presence** | **Explanation** |
| *NoTCI-PC* | The field is optionally present, Need R, if *unifiedTCI-StateType* is configured for this serving cell and *ul-powerControl* is not configured for any UL TCI state or joint TCI state of this serving cell. Otherwise it is absent, Need R |
| *SpCellOnly* | The field is optionally present, Need M, in the *BWP-UplinkDedicated* of an SpCell. It is absent otherwise. |
| *UnifiedTCI* | This field is optional present, need M, if *unifiedTCI-StateType* is configured for the serving cell. It is absent otherwise. |

NOTE 1: In case of *RRCReconfiguration* with *reconfigurationWithSync*, the UE performs a MAC reset, which involves releasing the PUCCH-CSI/SRS/SR configuration in accordance with clause 5.3.12 and TS 38.321 [3], clauses 5.12 and 5.2. Hence, for these parts of the dedicated radio resource configuration, delta signalling is not supported in the message when *reconfigurationWithSync* is included.

#### – *PathlossReferenceRS*

The IE *PathlossReferenceRS* is used to configure a set of Reference Signals (e.g. a CSI-RS config or a SS block) to be used for path loss estimation.

***PathlossReferenceRS* information element**

-- ASN1START

-- TAG-PATHLOSSREFERENCERS-START

PathlossReferenceRS-r17 ::= SEQUENCE {

pathlossReferenceRS-Id-r17 PUSCH-PathlossReferenceRS-Id-r17,

referenceSignal-r17 CHOICE {

ssb-Index-r17 SSB-Index,

csi-RS-Index-r17 NZP-CSI-RS-ResourceId

},

additionalPCI-r17 AdditionalPCIIndex-r17 OPTIONAL -- Need R

}

-- TAG-PATHLOSSREFERENCERS-STOP

-- ASN1STOP

#### – *PUSCH-PowerControl*

The IE *PUSCH-PowerControl* is used to configure UE specific power control parameter for PUSCH.

*PUSCH-PowerControl* information element

-- ASN1START

-- TAG-PUSCH-POWERCONTROL-START

PUSCH-PowerControl ::= SEQUENCE {

tpc-Accumulation ENUMERATED { disabled } OPTIONAL, -- Need S

msg3-Alpha Alpha OPTIONAL, -- Need S

p0-NominalWithoutGrant INTEGER (-202..24) OPTIONAL, -- Need M

p0-AlphaSets SEQUENCE (SIZE (1..maxNrofP0-PUSCH-AlphaSets)) OF P0-PUSCH-AlphaSet OPTIONAL, -- Need M

pathlossReferenceRSToAddModList SEQUENCE (SIZE (1..maxNrofPUSCH-PathlossReferenceRSs)) OF PUSCH-PathlossReferenceRS

OPTIONAL, -- Need N

pathlossReferenceRSToReleaseList SEQUENCE (SIZE (1..maxNrofPUSCH-PathlossReferenceRSs)) OF PUSCH-PathlossReferenceRS-Id

OPTIONAL, -- Need N

twoPUSCH-PC-AdjustmentStates ENUMERATED {twoStates} OPTIONAL, -- Need S

deltaMCS ENUMERATED {enabled} OPTIONAL, -- Need S

sri-PUSCH-MappingToAddModList SEQUENCE (SIZE (1..maxNrofSRI-PUSCH-Mappings)) OF SRI-PUSCH-PowerControl

OPTIONAL, -- Need N

sri-PUSCH-MappingToReleaseList SEQUENCE (SIZE (1..maxNrofSRI-PUSCH-Mappings)) OF SRI-PUSCH-PowerControlId

OPTIONAL -- Need N

}

P0-PUSCH-AlphaSet ::= SEQUENCE {

p0-PUSCH-AlphaSetId P0-PUSCH-AlphaSetId,

p0 INTEGER (-16..15) OPTIONAL, -- Need S

alpha Alpha OPTIONAL -- Need S

}

P0-PUSCH-AlphaSetId ::= INTEGER (0..maxNrofP0-PUSCH-AlphaSets-1)

PUSCH-PathlossReferenceRS ::= SEQUENCE {

pusch-PathlossReferenceRS-Id PUSCH-PathlossReferenceRS-Id,

referenceSignal CHOICE {

ssb-Index SSB-Index,

csi-RS-Index NZP-CSI-RS-ResourceId

}

}

PUSCH-PathlossReferenceRS-r16 ::= SEQUENCE {

pusch-PathlossReferenceRS-Id-r16 PUSCH-PathlossReferenceRS-Id-v1610,

referenceSignal-r16 CHOICE {

ssb-Index-r16 SSB-Index,

csi-RS-Index-r16 NZP-CSI-RS-ResourceId

}

}

PUSCH-PathlossReferenceRS-Id ::= INTEGER (0..maxNrofPUSCH-PathlossReferenceRSs-1)

PUSCH-PathlossReferenceRS-Id-v1610 ::= INTEGER (maxNrofPUSCH-PathlossReferenceRSs..maxNrofPUSCH-PathlossReferenceRSs-1-r16)

SRI-PUSCH-PowerControl ::= SEQUENCE {

sri-PUSCH-PowerControlId SRI-PUSCH-PowerControlId,

sri-PUSCH-PathlossReferenceRS-Id PUSCH-PathlossReferenceRS-Id,

sri-P0-PUSCH-AlphaSetId P0-PUSCH-AlphaSetId,

sri-PUSCH-ClosedLoopIndex ENUMERATED { i0, i1 }

}

SRI-PUSCH-PowerControlId ::= INTEGER (0..maxNrofSRI-PUSCH-Mappings-1)

PUSCH-PowerControl-v1610 ::= SEQUENCE {

pathlossReferenceRSToAddModListSizeExt-v1610 SEQUENCE (SIZE (1..maxNrofPUSCH-PathlossReferenceRSsDiff-r16)) OF PUSCH-PathlossReferenceRS-r16

OPTIONAL, -- Need N

pathlossReferenceRSToReleaseListSizeExt-v1610 SEQUENCE (SIZE (1..maxNrofPUSCH-PathlossReferenceRSsDiff-r16)) OF PUSCH-PathlossReferenceRS-Id-v1610

OPTIONAL, -- Need N

p0-PUSCH-SetList-r16 SEQUENCE (SIZE (1..maxNrofSRI-PUSCH-Mappings)) OF P0-PUSCH-Set-r16 OPTIONAL, -- Need R

olpc-ParameterSet SEQUENCE {

olpc-ParameterSetDCI-0-1-r16 INTEGER (1..2) OPTIONAL, -- Need R

olpc-ParameterSetDCI-0-2-r16 INTEGER (1..2) OPTIONAL -- Need R

} OPTIONAL, -- Need M

...,

[[

sri-PUSCH-MappingToAddModList2-r17 SEQUENCE (SIZE (1..maxNrofSRI-PUSCH-Mappings)) OF SRI-PUSCH-PowerControl

OPTIONAL, -- Need N

sri-PUSCH-MappingToReleaseList2-r17 SEQUENCE (SIZE (1..maxNrofSRI-PUSCH-Mappings)) OF SRI-PUSCH-PowerControlId OPTIONAL, -- Need N

p0-PUSCH-SetList2-r17 SEQUENCE (SIZE (1..maxNrofSRI-PUSCH-Mappings)) OF P0-PUSCH-Set-r16 OPTIONAL -- Need R

]]

}

P0-PUSCH-Set-r16 ::= SEQUENCE {

p0-PUSCH-SetId-r16 P0-PUSCH-SetId-r16,

p0-List-r16 SEQUENCE (SIZE (1..maxNrofP0-PUSCH-Set-r16)) OF P0-PUSCH-r16 OPTIONAL, -- Need R

...

}

P0-PUSCH-SetId-r16 ::= INTEGER (0..maxNrofSRI-PUSCH-Mappings-1)

P0-PUSCH-r16 ::= INTEGER (-16..15)

-- TAG-PUSCH-POWERCONTROL-STOP

-- ASN1STOP

|  |
| --- |
| *P0-PUSCH-AlphaSet* field descriptions |
| ***alpha***  alpha value for PUSCH with grant (except msg3) (see TS 38.213 [13], clause 7.1). When the field is absent the UE applies the value 1. |
| ***p0***  P0 value for PUSCH with grant (except msg3) in steps of 1dB (see TS 38.213 [13], clause 7.1). When the field is absent the UE applies the value 0. |

|  |
| --- |
| *P0-PUSCH-Set* field descriptions |
| ***p0-List***  Configuration of {p0-PUSCH, p0-PUSCH} sets for PUSCH. If SRI is present in the DCI, then one p0-PUSCH can be configured in P0-PUSCH-Set. If SRI is not present in the DCI, and both *olpc-ParameterSetDCI-0-1* and *olpc-ParameterSetDCI-0-2* are configured to be 1 bit, then one p0-PUSCH can be configured in P0-PUSCH-Set. If SRI is not present in the DCI, and if any of *olpc-ParameterSetDCI-0-1* and *olpc-ParameterSetDCI-0-2* is configured to be 2 bits, then two p0-PUSCH values can be configured in P0-PUSCH-Set (see TS 38.213 [13] clause 7 and TS 38.212 [17] clause 7.3.1). |
| ***p0-PUSCH-SetId***  Configure the index of a p0-PUSCH-Set (see TS 38.213 [13] clause 7 and TS 38.212 [17] clause 7.3.1). |

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| --- |
| *PUSCH-PowerControl* field descriptions |
| ***deltaMCS***  Indicates whether to apply delta MCS. When the field is absent, the UE applies Ks = 0 in delta\_TFC formula for PUSCH (see TS 38.213 [13], clause 7.1). |
| ***msg3-Alpha***  Dedicated alpha value for msg3 PUSCH (see TS 38.213 [13], clause 7.1). When the field is absent the UE applies the value 1. |
| ***olpc-ParameterSetDCI-0-1, olpc-ParameterSetDCI-0-2***  Configures the number of bits for Open-loop power control parameter set indication for DCI format 0\_1/0\_2 in case SRI is not configured in the DCI. 2 bits is applicable only if SRI is not present in the DCI format 0\_1. The field *olpc-ParameterSetDCI-0-1* applies to DCI format 0\_1 and the field *olpc-ParameterSetDCI-0-2* applies to DCI format 0\_2 (see TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 11). |
| ***p0-AlphaSets***  Configuration {p0-pusch, alpha} sets for PUSCH (except msg3 and msgA PUSCH), i.e., { {p0,alpha,index1}, {p0,alpha,index2},...} (see TS 38.213 [13], clause 7.1). When no set is configured, the UE uses the P0-nominal for msg3/msgA PUSCH, P0-UE is set to 0 and alpha is set according to either msg3-Alpha or msgA-Alpha (see TS 38.213 [13], clause 7.1). |
| ***p0-NominalWithoutGrant***  P0 value for UL grant-free/SPS based PUSCH. Value in dBm. Only even values (step size 2) allowed (see TS 38.213 [13], clause 7.1). |
| ***p0-PUSCH-SetList***  Configure one additional *P0-PUSCH-Set* per SRI. If present, the one bit or 2 bits in the DCI is used to dynamically indicate among the P0 value from the existing *P0-PUSCH-AlphaSet* and the P0 value(s) from the *P0-PUSCH-Set* (See TS 38.212 [17], clause 7.3.1 and TS 38.213 [13], clause 17). |
| ***p0-PUSCH-SetList2***  For indicating per-TRP OLPC set in DCI format 0\_1/0\_2 with the legacy field, a second p0-PUSCH-SetList-r16 is used. When this field is present the *p0-PUSCH-SetList* corresponds to the first SRS resource set (see TS 38.213). |
| ***pathlossReferenceRSToAddModList, pathlossReferenceRSToAddModListSizeExt, pathlossReferenceRSToAddModListExt***  A set of Reference Signals (e.g. a CSI-RS config or a SS block) to be used for PUSCH path loss estimation. The set consists of Reference Signals configured using *pathLossReferenceRSToAddModList* and *Reference* Signals configured using *pathlossReferenceRSToAddModListSizeExt*. Up to *maxNrofPUSCH-PathlossReferenceRSs* may be configured (see TS 38.213 [13], clause 7.1). When *pathlossReferenceRSToAddModListExt* is included, its number of entries is the number of entries of *pathlossReferenceRSToAddModList* plus the number of entries of *pathlossReferenceRSToAddModListSizeExt-v1610* and its n-th entry corresponds to the n-th entry of the concatenated list made of *pathlossReferenceRSToAddModList* and *pathlossReferenceRSToAddModListSizeExt-v1610*. Network configures the *additionalPCI* only when reference signal is SSB. |
| ***pathlossReferenceRSToReleaseList, pathlossReferenceRSToReleaseListSizeExt***  Lists of reference signals for PUSCH path loss estimation to be released by the UE. |
| ***sri-PUSCH-MappingToAddModList***  A list of *SRI-PUSCH-PowerControl* elements among which one is selected by the SRI field in DCI (see TS 38.213 [13], clause 7.1). |
| ***sri-PUSCH-MappingToAddModList2***  A list of *SRI-PUSCH-PowerControl* elements for second SRS-resource set, among which one is selected by the SRI field in DCI (see TS 38.213 [13], clause 7.1). When this field is present the *sri-PUSCH-MappingToAddModList* corresponds to the first SRS resource set for PUSCH. |
| ***tpc-Accumulation***  If enabled, UE applies TPC commands via accumulation. If not enabled, UE applies the TPC command without accumulation. If the field is absent, TPC accumulation is enabled (see TS 38.213 [13], clause 7.1). |
| ***twoPUSCH-PC-AdjustmentStates***  Number of PUSCH power control adjustment states maintained by the UE (i.e., fc(i)). If the field is present (*n2*) the UE maintains two power control states (i.e., fc(i,0) and fc(i,1)). If the field is absent, it maintains one power control state (i.e., fc(i,0)) (see TS 38.213 [13], clause 7.1). |

|  |
| --- |
| *SRI-PUSCH-PowerControl* field descriptions |
| ***sri-P0-PUSCH-AlphaSetId***  The ID of a *P0-PUSCH-AlphaSet* as configured in *p0-AlphaSets* *in PUSCH-PowerControl*. |
| ***sri-PUSCH-ClosedLoopIndex***  The index of the closed power control loop associated with this *SRI-PUSCH-PowerControl.* |
| ***sri-PUSCH-PathlossReferenceRS-Id***  The ID of *PUSCH-PathlossReferenceRS* as configured in the *pathlossReferenceRSToAddModList* in *PUSCH-PowerControl*. |
| ***sri-PUSCH-PowerControlId***  The ID of this *SRI-PUSCH-PowerControl* configuration. It is used as the codepoint (payload) in the SRI DCI field. |