3GPP TSG-RAN WG2 Meeting #118 Electronic R2-220xxxx

Elbonia, 09 – 20 May 2022

**Agenda item: 6.17.3.1**

**Source: Nokia (Rapporteur)**

**Title: Report of [AT118-e][054][feMIMO] N102 N123 Unified TCI state (Nokia)**

**WID/SID: NR\_feMIMO-Core - Release 17**

**Document for: Discussion and Decision**

# 1 Introduction

This document is the report of the following email discussion:

* [AT118-e][054][feMIMO] N102 N123 Unified TCI state (Nokia)

 Scope: See RIL descriptions N102 N123, illustrated in R2-2206332, further discussed in R2-2206348 P7 (in the body, not conclusions). Task to check for consequences, whether / which of the proposed enhancements/changes can work. Also, opportunity for companies to develop opinions, whether the changes actually enhances maintainability, clarity etc.

 Intended outcome: Report alt agreeable revision of R2-2206332 alt both alt neither (if nothing seems agreeable).

 Deadline: CB online W2 MON (can be extended to W2 WED if needed).

# 2 Contact Points

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

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| --- | --- | --- |
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# 3 Discussion

The documents R2-2205385 (discussion) and R2-2206332 (CR draft) discuss two topics: 1) Handling of simultaneous TCI state update lists and 2) Restructuring of the ASN.1 structure for TCI-State IE(s). However, R2-2206332 also contains some editorial updates e.g. to the names of fields, which were commented not to be part of the original RIL numbers. The online discussion notes were as follows:

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| Option of extending original TCI state IE[R2-2205385](file:///C%3A%5CUsers%5Cmtk65284%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CTSGR2_118-e%5CDocs%5CR2-2205385.zip) [N019, N020, N102, N123] RRC corrections to FeMIMO Nokia, Nokia Shanghai Bell discussion Rel-17 NR\_feMIMO-Core Late[R2-2206332](file:///C%3A%5CUsers%5Cmtk65284%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CTSGR2_118-e%5CDocs%5CR2-2206332.zip) [N102, N123] Corrections to unified TCI state Nokia, Nokia Shanghai Bell draftCR Rel-17 38.331 17.0.0 F NR\_feMIMO-CoreTwo main Changes: 1: 4 lists -> list of lists2: Extend legacy TCI state instead of a new one. DISCUSSION* Intel are ok for the first change but think MAC change is needed as well. For second change, need careful review.
* HW think this need careful review
* MTK agrees this need to be checked.
* LGE think the second change was on the table from beginning, but think there were some reasons for the current structure. Have some sympaty no need to change.
* HW: first point the intention is reasonable, but not sure.
* ZTE think we can check first.
* Samsung think that there is fuctional difference wrt delta signalling, think legacy way is better.
* Separate offline to check this (CB online beg W2 to decide if we want any of this or not)
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## Handling of simultaneousTCI-State lists

Rel-16 introduced the following lists as part of the NR\_eMIMO-Core work item:

 simultaneousTCI-UpdateList1-r16 SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex OPTIONAL, -- Need R

 simultaneousTCI-UpdateList2-r16 SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex OPTIONAL, -- Need R

 simultaneousSpatial-UpdatedList1-r16 SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex OPTIONAL, -- Need R

 simultaneousSpatial-UpdatedList2-r16 SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex OPTIONAL, -- Need R

The 2 lists for UL and DL QCL relations (i.e. TCI state or UL spatial relation) were introduced to allow more efficient TCI state updates e.g. for intra-band or collocated cases, where TCI states change at the same time for multiple serving cells. However, we would note that the type of the list is exactly the same for UL and DL.

With the "unified TCI", the RAN1 discussion started from the need to allow the same functionality for the "new" TCI states, but with Joint TCI states being equated with DL TCI states, it was not clear if new TCI state updated list would be needed. At some point RAN1 then came up that 4 new lists are needed, but this seems to have happened somewhere that is very difficult to trace. In any case, RAN1 has requested the new lists to be introduced, which are currently in RRC as shown below:

 simultaneousU-TCI-UpdateList1-r17 SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex OPTIONAL, -- Need R

 simultaneousU-TCI-UpdateList2-r17 SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex OPTIONAL, -- Need R

 simultaneousU-TCI-UpdateList3-r17 SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex OPTIONAL, -- Need R

 simultaneousU-TCI-UpdateList4-r17 SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex OPTIONAL, -- Need R

Since RAN1 never provided any description for these lists, it's not clear whether there is any UL/DL/Joint TCI state relation between these. While it seems possible such was intended, it's difficult to know so RAN2 likely has to proceed based on latest information. In [R2-2206332](file:///C%3A%5CUsers%5Cmtk65284%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CTSGR2_118-e%5CDocs%5CR2-2206332.zip), it is observed that the type of the lists is exactly the same as for the Rel-16 lists, and that having these lists seems quite sparse and creates difficulties for extensions. Therefore, [R2-2206332](file:///C%3A%5CUsers%5Cmtk65284%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CTSGR2_118-e%5CDocs%5CR2-2206332.zip) proposes to use "list of lists" structure instead as shown below:

 simultaneous-TCI-UpdateList-r17 SEQUENCE (SIZE (1..maxTCI-UpdateLists-r17)) OF TCI-UpdateList-r17 OPTIONAL, -- Need R

TCI-UpdateList-r17 ::= SEQUENCE (SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex

The alternative approach would be to use AddModRelease-list for the lists, which would be something as shown below (and which would then also leave the Rel-16 lists as they are):

 tci-UpdateToAddModList-r17 SEQUENCE (SIZE (1..maxTCI-UpdateLists-r17)) OF TCI-UpdateList-r17 OPTIONAL, -- Need N

 tci-UpdateToReleaseList-r17 SEQUENCE (SIZE (1..maxTCI-UpdateLists-r17)) OF TCI-ListId-r17 OPTIONAL, -- Need N

TCI-UpdateList-r17 ::= SEQUENCE {

 tci-ListId-r17 TCI-ListId-r17,

 simultaneous-TCI-UpdateList-r17 SIZE (1..maxNrofServingCellsTCI-r16)) OF ServCellIndex,

}

TCI-ListId-r17 ::= INTEGER (1..maxTCI-ListId-r17)

maxTCI-ListId-r17 INTEGER ::= 4

The basic question to resolve here is whether there is support to modify the signalling as proposed above - either as proposed in [R2-2206332](file:///C%3A%5CUsers%5Cmtk65284%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CTSGR2_118-e%5CDocs%5CR2-2206332.zip) or using ToAddModRelease-List as above.

**Question A1**: Do you support clarifying the 4 lists to either list of lisets (using plain SEQUENCE) or by using ToAddModRelease-lists?

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| Answers to Question 1 |
| Company | Yes/No | Technical Arguments |
| Ericsson |  | Either is ok |
| Intel |  | We think that Samsung’s point is valid although we are not sure how frequent one of lists need to be modified. If the majority prefer to modify the list, we would prefer the ToAddModRelease-lists. We would be also ok not to change.  |
| OPPO | No | First of all, we think new lists for Rel17 are necessary. It is because some of the serving cells could be configured with Rel17 unified TCI state and some could still follow Rel16 framework. In this case one specific serving cell is either contained within Rel16 list or Rel17 list or neither.From functionality point of view, both alternatives can configure flexible number of simultaneous-TCI-UpdateList-r17. But we think they are not necessary. If a serving cell is configured with joint TCI state, we think actually 2 lists are sufficient since they can be used for both DL and UL jointly. If a serving cell is configured with DL/UL TCI state, then 4 lists are necessary i.e. 2 for DL and 2 for UL. Note whether 2 lists are needed for UL i.e. SRS resource is being discussed in RAN1. In case RAN1 deny MAC CE is needed for SRS resource to signal TCI state, then only two lists are needed.In short we think Rel17 need 2 or 4 lists for simultaneous activation/deactivation of TCI states and the proposed alternatives are not necessary. But we agree some renaming of the IE could be necessary if 4 lists are configured i.e. two for DL/Joint and two for UL. |
| LGE | Yes | We support some changes to avoid having similar fields in a row. Both approaches from Nokia and AddModList and ReleaseList work and hence are fine to us. We slightly prefer having AddModList and ReleaseList since this structure is compact and flexibility has no harm, but again no strong view for preference. We do not need to touch r16 fields by having them refer to R17 IE.  |
| Huawei, HiSilicon | No strong view | A cell index is 5 bits, so there are at most 5x32=160 bits in a list. A ToAddModList adds 2 bits per list and 2 bits for the total length. If there are only 4 lists, that is 4 bits even if there is no list to be added. |
| ZTE | No strong view | After checking, we think both alternatives proposed by rapporteur as well as the original version can work well. And we slightly prefer keep original version since it is readable. And we also believe, the serving cell list will not be changed so frequently.Just for clarification, there are four serving cell list for unified TCI state, because the unified TCI state MAC CE is used for updating either the joint TCI or DL/UL TCI state, we understand there are at most two serving cell lists for serving cells who support the joint TCI, and there are at most two lists for serving cells who support the separate TCI. |
| Samsung | No  | As OPPO and ZTE mentioned, we think the original version has no problem and consistent with the legacy signalling if we clearly add the clarification how these list are used when unified TCI state framework is configured i.e. either joint TCI or DL/UL TCI state. |
| vivo | No strong view | After further checking with our RAN1 colleagues, we prefer to keep the existing structure which provides similar configuration as R16, i.e. 2 for DL and 2 for UL when DL/UL TCI state is configured for the serving cell.  |
| Xiaomi | No strong view | Ether of the above proposals or “no change” is fine to us.Firstly we prefer to have clear specification text in the field description, describing how these new lists are configured for unified TCI state framework. We would also agree with Samsung that once the configuration combination is clearly defined in the specification, it seems that there is no issue. |
| CATT | No strong view | The original version and the proposed options can both work. And the original version is more readable, and the proposed options are better for extensions. |
| Nokia, Nokia Shanghai Bell | Yes (proponent) | As proponent, naturally we prefer to change. The main concern is maintenance and extendibility. In general RAN1 decisions should be better documented as it's impossible to find why 4 lists are needed in general.From overhead perspective, current structure requires 4 bits minimum (4 optional lists) and 164 bits at maximum (4 lists, with total of 32 serving cells over all lists, with 5 bits per serving cell index, so 4+5\*32=164)  |
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**Summary A1**: Majority have no strong views, some support and some think existing structures have no issues. If the change is done, there is slight preference for using ToAddModRelease-lists. If the change is not done, there is some support to make it clearer how the lists are used - i.e. 2 lists for DL/Joint and 2 lists for UL. Moderator thinks that if something is changed, using AddMod-lists wuold be more in line with what RAN2 normally does.

**Proposal A1-1**: Clarify that there are 2 lists for DL/Joint TCI states and 2 lists for UL TCI states.

**Proposal A1-2**: Use ToAddModRelease-lists for the simultaneous TCI state update lists.

NOTE: Since an IE type needs to be defined tpo use list of lists or ToAddModRelease-List, (due to SEQUENCE OF SEQUENCE being not allowed in RRC), the same IE type is also applied to the Rel-16 fields in [R2-2206332](file:///C%3A%5CUsers%5Cmtk65284%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CTSGR2_118-e%5CDocs%5CR2-2206332.zip). This is backward-compatible since the ASN.1 encoding doesn't change, and has been (at rare occasions) done also before. For example, in LTE RRC for CSI-Process as shown below where a Rel-11 field was replaced by IE type in Rel-13:

CSI-Process-r11 ::= SEQUENCE {

 csi-ProcessId-r11 CSI-ProcessId-r11,

 csi-RS-ConfigNZPId-r11 CSI-RS-ConfigNZPId-r11,

 csi-IM-ConfigId-r11 CSI-IM-ConfigId-r11,

 p-C-AndCBSRList-r11 P-C-AndCBSR-Pair-r13a,

## TCI-State restructuring

The current RRC defines 3 different TCI state IEs: The legacy TCI-State, DlorJoint-TCIState and UL-TCIState. These were defined separately since the decision was made to use separate ID-space for UL TCI states, and there was no time to compare the structures and consider how to accomplish the same via the legacy TCI-State. In [R2-2206332](file:///C%3A%5CUsers%5Cmtk65284%5CDocuments%5C3GPP%5Ctsg_ran%5CWG2_RL2%5CTSGR2_118-e%5CDocs%5CR2-2206332.zip), an attempt has been made to extend the legacy TCI state to have just one IE used for all cases - this is also shown below:

#### – *TCI-State*

The IE *TCI-State* associates one or two DL reference signals with a corresponding quasi-colocation (QCL) type.

*TCI-State* information element

-- ASN1START

-- TAG-TCI-STATE-START

TCI-State ::= SEQUENCE {

 tci-StateId TCI-StateId,

 qcl-Type1 QCL-Info,

 qcl-Type2 QCL-Info OPTIONAL, -- Cond DL-JointTCI

 ...,

 [[

 additionalPCI-r17 AdditionalPCI-Index-r17 OPTIONAL, -- Need R

 tci-StateId-r17 UL-TCI-State-Id-r17 OPTIONAL, -- Cond UL-TCI

 pathlossReferenceRS-Id-r17 PUSCH-PathlossReferenceRS-Id OPTIONAL, -- Cond UL-JointTCI

 ul-powerControl-r17 Uplink-powerControlId-r17 OPTIONAL, -- Cond UL-JointTCI

 -- Editor's Note: Check if new id -r17 is needed to cover full ID range

 ]]

}

QCL-Info ::= SEQUENCE {

 cell ServCellIndex OPTIONAL, -- Need R

 bwp-Id BWP-Id OPTIONAL, -- Cond CSI-RS-Indicated

 referenceSignal CHOICE {

 csi-rs NZP-CSI-RS-ResourceId,

 ssb SSB-Index

 },

 qcl-Type ENUMERATED {typeA, typeB, typeC, typeD},

 ...,

 [[

 referenceSignal-r17 PUCCH-SRS OPTIONAL -- Cond UL-JointTCI --Editor's note: Can be discussed if ASN1 overhead reasons should have another way to implement than using this extension.

 --Editor's note: Needed in Rel-15/16 TCI state for mTRP intercell and in Rel-17 TCI state for BM intercell.

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}

-- TAG-TCI-STATE-STOP

-- ASN1STOP

Having this common structure should not change the usage: There are still separate lists for unified TCI states as defined in *BWP-UplinkDedicated* (for UL TCI states) and *PDSCH-Config* (for DL/Joint TCI states). Those just use the same IE type, and the field conditions indicate when the new fields are used and when they are not, as also shown below.

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| *QCL-Info* field descriptions |
| ***bwp-Id***The DL BWP which the RS is located in. |
| ***cell***The UE's serving cell in which the *referenceSignal* is configured. If the field is absent, it applies to the serving cell in which the *TCI-State* is configured. The RS can be located on a serving cell other than the serving cell in which the *TCI-State* is configured only if the *qcl-Type* is configured as *typeC* or *typeD*. See TS 38.214 [19] clause 5.1.5. |
| ***referenceSignal***Reference signal with which quasi-collocation information is provided as specified in TS 38.214 [19] clause 5.1.5. If *referenceSignal-r17* is configured, UE shall ignore the *referenceSignal* (without suffix). |
| ***qcl-Type***QCL type as specified in TS 38.214 [19] clause 5.1.5. For UL TCI states, network only configures value *typeD*. |

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| *TCI-State* field descriptions |
| ***additionalPCI***Indicates that this TCI state refers to an additional PCI different from serving cell PCI, as configured in *ServingCellConfig*. If the parent field configures both *qcl-Info1* and *qcl-Info2*, network configures the same value for *additionalPCI* for both. |
| ***pathlossReferenceRS-Id***The ID of the reference Signal (e.g. a CSI-RS config or a SS block) used for PUSCH path loss estimation. |
| ***qcl-Type1, qcl-Type2***QCL information for the TCI state as specified in TS 38.214 [19] clause 5.1.5.  |
| ***tci-StateId***ID number of the TCI state. If *tci-StateId-r17* is configured, UE shall ignore the *tci-StateId* (without suffix). |
| ***ul-PowerControl***Configures UL power control parameters set ID for this TCI state.  |

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| --- | --- |
| Conditional Presence | Explanation |
| *CSI-RS-Indicated* | This field is mandatory present if *csi-rs* is included, absent otherwise |
| *DL-JointTCI* | This field is optionally present, Need R, for DL and joint TCI states. It is absent, Need R, otherwise. |
| *UL-TCI* | This field is mandatory present for UL TCI states. It is absent, Need R, otherwise. |
| *UL-JointTCI* | This field is optionally present, Need R, for UL and joint TCI states. It is absent, Need R, otherwise. |

The main benefit of having a single UIE would be better extendibility: Instead of extending multiple IEs (as will likely have to be done already in Rel-18 for unified TCI states with mTRP), a single IE can be used and the commonality defined for ICBM unified TCI can be exploited. From RRC perspective, it also appears somewhat simpler and avoids lengthy IE names and encoding purpose in the field names. To better assess the situation, it's good to consider what are the benefits and disadvantages of doing this, to allow better consider whether it makes sense to adopt the changes.

**Question B1**: What are the benefits of restructuring the TCI-State IEs?

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| Answers to Question 1 |
| Company | Yes/No | Technical Arguments |
| Ericsson |  | Less changes to ASN1 code and it keeps one TCI state as effectively the RRC configuration of TCI state of unified TCI state and Rel-15/16 TCI state is not that different. |
| Intel |  | We can try for the better structure. But, we are afraid to make another confusion due to nature of complicated feature. Some questions for clarification. - in case of UL TCI state, RS could be one of CSI-Rs, SSB, SRS. This proposed structure seem to indicate either of CSI-RS and SSB, or SRS. Is it correct? [Nokia] The legacy fields allow CSI-RS or SSB, and the critically extended field allows SRS. That is exactly what the previous UL TCI state structure also allows. So we don't quite understand this comment - it's made3 clear that for UL TCI state, only qcl-Type1 is ever included.- BWP ID in QCL-Info is DL BWP ID. In case of SRS, UL BWP ID would be needed and it is included in PUCCH-SRS. So, DL BWP ID may not be needed for UL TCI State. Is it correct? [Nokia] That is true. Thankfulyl, the bwp-Id field is already optional, so the condition can make it clear it is not used for UL TCI.- Regarding tci-StateId, it will be ignored if tci-StateId-r17 (i.e. UL TCI ID). So, if we have new structure, UL TCI state should include both tci-StateId and tci-StateId-r17. It means that tci-StateID is a kind of dummy for UL TCI state. Is it correct?[Nokia] Correct - this is just to ensure the separate UL TCI state ID - space is used. Alternative would have been to just reuse existing TCI state ID and have network restriction to only use the first 64 IDs.   |
| OPPO | See comment | It is not clear why following IE is needed:tci-StateId-r17 UL-TCI-State-Id-r17 if this is because the value range of UL TCI state is less than legacy one, we can make it clear in the field description of tci-StateId. Any way the field description of tci-StateId should be updated to reflect that it can be reused for Joint/DL TCI state id.[Nokia] That would be also good alternative and we are fine with that if companies think it's clearer.One thing should be also clarified whether the updated TCI state structure could be also applicable for mTRP feature since additional PCI is also needed.[Nokia] mTRPs do not use unified TCI states in R17 yet.Regarding the BWP id, we think Intel raised a valid point. One alternative could be to replace PUCCH-SRS to be SRS-ResourceId and interpret current BWP-Id as UL BWP-Id. Since this is only used when SRS resource is reference signal, there is no backwards compatibility issue.[Nokia] We still don't quite get this: The proposed structure is the same as in tghe UL-TCI-State, which also used PUCCH-SRS. This is of course something to consider but is not related to this proposal as such. |
| LGE |  | We appreciate Nokia efforts on this (in fact we also considered this structure internally in the beginning, of R17 but we concluded that the separation of IEs seems more straightforward even if there may be some redundancy)Our comments for advantage and disadvantage are given as follows:a) The propose restructuring seems to allows for a bit more concise specification on the TCI IE by having only one IE instead of three, which is good. b) Regarding extensibility, whenever extension of r17 TCI states is considered, the extension in the new structure may need to introduce clear description on whether to the extended part is applicable for UL or DL-Joint or both, as already done in the proposed change. So here we see trade-off. c) When we want to distinguish R15/16 TCI state and R17 TCI states, it is easily achieved by referring to the corresponding TCI state IE, However, in the proposed change, it is not straightforward. For instance, see the following:***unifiedtci-StateType***Indicates the unified TCI state type the UE is configured for this serving cell. The value "SeparateULDL" means this serving cell is configured with DLorJoint-TCIState for DL TCI state and UL-TCIState for UL TCI state. The value "JointULDL" means this serving cell is configured with DLorJoint-TCIState for joint TCI state for UL and DL operation.[Nokia] These descriptions are actually not even according to RRC rules: We should always try to avoid referring to IE names. They can be easily replaced by using field names, for which we have separate lists. Seems however that there are not many such cases referring to IEs to distinguish R15/16 and R17 TCI states. So, this may not be a big problem. d) Instead of the proposed structure, we may aim to slightly improve the current structure, by e.g., grouping UL related parameters (*pathlossReferenceRS-Id and ul-PowerControl)* by having a new IE including both for better extensibility. [Nokia] We would be fine with that - good suggestion!  |
| Huawei, HiSilicon |  | This seems not suitable for UL TCI states:- RS is not QCL[Nokia] In R15, UE uses PUCCH spatial relation, which is QCL-D linked to a CSI-RS or SSB. So there is actually always a QCL relation but it's hidden from the view, so this makes it just more visible.- for SRS there is no DL BWP (UL BWP is in PUCCH-SRS, which was proposed to be renamed and this proposal was accepted by the RRC rapporteur)[Nokia] Agree, but the field is optional already so this is not a problem to reflect. So we don't see a problem here.For DL or Joint TCI state, we see no issue.By the way:- PUSCH-PathlossReferenceRS-Id is used here but it is not an IE, and it is a little funny that it has this name while it can be used for PUCCH and SRS[Nokia]True, but this is a general issue and not something related to this. Stil,l, would be good to correct indeed.- we had feedback from RAN1 colleagues that, for this new TCI state, the pathlossReferenceRS could have an additionalPCI, while in PUSCH-PowerControl where these RS are defined, such field is not available[Nokia] Agree this would need to be clarified, but that is again not a problem for this structure. It's in general the lack of completeness of the RAN1 design for PL-RS. |
| ZTE |  | Agree with the comments from Intel.[Nokia] So you have no additional technical concerns? |
| Samsung |  | Agree with the comments from Intel.[Nokia] So you have no additional technical concerns?  |
| vivo |  | Tend to agree with Intel.[Nokia] So you have no additional technical concerns? |
| Xiaomi |  | We are open to improve the ASN.1 structure. However as indicated by Intel/OPPO/LG/Huawei, it seems that the new ASN.1 structure introduces some confusions. Considering the limited time left for the ASN.1 freezing, we would prefer to keep the current ASN.1 structure as it is. [Nokia] So you have no technical concerns, just no time to check? |
| CATT |  | No strong view. But agree if we change then the filed descriptions need to be carefully checked.[Nokia] Fully agree, but those we need to check anyway and it's very likely additional updates will come in the future meetings. ASN.1 structure is what we need to fix now.But at least we propose to move additionalPCI-r17 up one level, i.e., from QCL-Info to TCI-State. |
| Nokia, Nokia Shanghai Bell | Yes | The comments in general seem to be about two things: 1. Lack of time to check the impacts of the structure (without any clear concerns), and some general concerns (not just related to the ASN.1 structure)
2. separation of UL TCI state from the DL/Joint TCI states.

 For the first aspect, we can continue this in 1-week email if needed. For the second one, we tried to provide comments to each question to help, which companies need to still check. |
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**Summary B1**: The benefits are in maintainability and keeping ASN.1 more concise. Several companies do have comments and reservations about the structural change, but the primary concern seems to be lack of time for checking the changes. There are also concerns for the UL TCI state specifically, sinc e it is slightly different from the DL TCI state.

**Proposal B1**: Move the field *additionalPCI* from *QCL-Info* IE to parent IE.

**Question B2**: What are the disadvantages of restructuring the TCI-State IEs?

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| Answers to Question 1 |
| Company | Yes/No | Technical Arguments |
| Ericsson |  | Conceptually there is difference such that Unified TCI state has different operation across RRC, MAC CE, DCI. It is also such that mTRP should be configured in Rel-17 with old rel-15/16 ASN1, and hence has Rel-15/16 operation, whereas BM is configured with Unified TCI state and assumes unified TCI state operation described in TS 38.314.For this reason, it might be clearer to have new IEs for the Rel-17 unified TCI states after all. In RRC there is field in servingcellConfig that currently makes use of the new IEs. This needs careful rewording if we do the structural change.[Nokia] We generally avoid referring to IEs in RRC: Please see RRC guidelines, A.3.1.3*.* The reason we do that is that IE bnames are generic and can be used in many places, while field names are specific. Since we have separate lists, we can refer to the field names of those. That is the reason why we provided the changes in R2-2206332 to show what the impacts are.***unifiedtci-StateType***Indicates the unified TCI state type the UE is configured for this serving cell. The value "SeparateULDL" means this serving cell is configured with DLorJoint-TCIState for DL TCI state and UL-TCIState for UL TCI state. The value "JointULDL" means this serving cell is configured with DLorJoint-TCIState for joint TCI state for UL and DL operation.The suggested change is as below and it seems ok for separate case but unsure if the joint TCI state description is explicit enough.***unifiedTCI-State***Indicates the unified TCI state type the UE is configured for this serving cell. The value "separate" means this serving cell is configured with DL TCI states and UL TCI states. The value "joint" means this serving cell is configured with joint TCI state for UL and DL operation. [Nokia] Presumably this refers to the actual TCI state definition not being very clear, which is true. But that is then a different sort of problem - if needed, the above can also refer to the field names configuring the TCI states.Further, it might be easier in Stage-2 to use simply new IE names when distinguishing between Rel-15/16 TCI state configuration and Rel-17 TCI state configuration.[Nokia] Stage-2 should NOT refer to IE names, so was the intent to say Stage-3 here? |
| LGE |  | See other comments for B1 |
| Huawei, HiSilicon |  | See previous comments for ULFor DL or joint, we tend to agree with Ericsson |
| Xiaomi |  | Same comments as given in B1. |
| CATT |  |  |
| Nokia, Nokia Shanghai Bell |  | The main disadvantage is that the field conditions need to make it explicit whether some fields can be used in UL, DL or Joint TCI states. But that is what we do in all other cases in RRC, so we don't see that as a big disadvantage. |
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**Summary B2**: Some concerns are raised for how to capture the field conditions: It is claimed referring to the IEs becomes more difficult with one IE type only. Moderator thinks this is not a blocking argument as normally RAN2 anyway avoids referring to IEs, but careful checking is needed for making sure the field descriptions are correct.

**Proposal B2**: Change the field descriptions related to unified TCI states so that they refer to field names and not IE names.

**Question B3**: Should RAN2 proceed with the TCI-State restructing as proposed in 6332?

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| Answers to Question 1 |
| Company | Yes/No | Technical Arguments |
| Ericsson | No | After further thinking, the existing seems more safe and clear. |
|  Intel |  | We would like to review more especially some question we provided in B1.  |
| OPPO |  | We can discuss the signaling detail after RAN2 make decision |
| LGE |  | More discussion is needed before taking actions, but time available is too tight.. |
| Huawei, HiSilicon |  | Not for uplink, see comments above.For DL or joint, we need more review. |
| Samsung | No | Agree with Ericsson. |
| vivo | No | See comment above. |
| Xiaomi |  | Same comments as given in B1. |
| CATT |  | If the existing structure (which has been reviewed for quite some time) is not broken then perhaps it is safe to keep it.  |
| Nokia, Nokia Shanghai Bell | Yes | The existing structures have problems: - No extension markers (so parallel lists will be used in Rel-18)- Functionality encoded in names, duplication in fields- RRC naming rules are not followedWe understand time is short, but it's disappointing that this seems the main argument against. The first try should never be the reason not to change. When this was first discussed, nobody except us was willing to even entertain thinking about this in terms of Stage-3. Now that it is time, they don't have time. That should not be the reason for sub-par ASN.1. |
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**Summary B3**: Majority would like more time to review, or do not wish to do the change. Most technical comments are either minor or concern UL TCI states and the main factor seems to be in not having time to review. Moderator thinks it seems safest to unify the DL/Joint but not the UL TCI state, given that most comments concern that.

**Proposal B3-1**: Use legacy TCI-State IE (with extensions) for DL/Joint TCI states and have separate IE for UL TCI states and add extension marker to UL-TCI-State IE.

**Proposal B3-2**: If B3-1 is not agreed, add extension markers to existing TCI state IEs and rename them according to ASN.1 naming rules (i.e. correct use hyphens and capitalization).

## Other changes in R2-2206332

There are also several other editorial changes in the draftCR 6332:

* **Field names have been shortened** and made follow ASN.1 naming rules (e.g. *followUnifiedTCI-State* has been shortened to *unifiedTCI-State*).
* **Conditions have been defined** for some fields to better match cases where presence conditions are complex
* **Used "network only configures"** instead of "network should configure"
* **Some field descriptions** have been simplified and unnecessary parts have been removed

**Question C1**: Are there any issues spotted with the additional changes in R2-2206332?

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| Answers to Question 1 |
| Company | Yes/No | Technical Arguments |
| ERricsson |  | Would not do this change: *followUnifiedTCI-State* has been shortened to *unifiedTCI-State*This is because with the change it looks like a specific unified TCItstae is configured for the resource while it is actually a functionality. If current name is not good, can it be changed something like “enableUnifiedTCI-State?” that does not really shorten though..Similra in servinghcellConfig when unifiedTCI-StateType is shortened to unifiedTCI-State. It seems it removes information from the parameter name. It is ok to shorten the value names to separate and joint.Condition for ul-powerControl in IE BWP-UplinkDedicated seems ok. And here as well, terms UL TCI state and Joint TCI state are used but definition remain unclear if the new IEs for those are removed.Condition for csi-SSB-ResourceSet2 in IE CSI-AperiodicTriggerStateList seems fine as well.Field description change for ***qcl-InfoPeriodicCSI-RS*** seems ok but would keep the IE names.Name change for dl-OrJoint-TCIState to dl-Joint-TCIList seems ok.Field description change for ***refUnifiedTCIStateList*** seems ok for the second change but the first change makes it more vague? |
| Intel |  | We agree with Ericsson’s comments especially about *followUnifiedTCI-State.*Regarding condition on csi-SSB-ResourceSet2, do we really need it? In Rel-18, BM+mTRP might be supported. For forward compatibility, we can live it for gNB implementation instead of mandating in ASN.1 signaling structure? We could describe such restriction in the field description.  |
| OPPO |  | We can review in phase. As for *followUnifiedTCI-State* we also intend agree with E/// and Intel. |
| Huawei, HiSilicon |  | Similar views like Ericsson. We need more checking on other things. Besides, it may be better to ensure that shortening of names does not result in inconsistencies in the way to refer to the same thing. |
| ZTE |  | We tend to agree with Ericsson on the issue about the *followUnifiedTCI-State.* |
| Xiaomi |  | We are fine with the above changes. No strong view on the naming change. |
| CATT |  | About the issue of f*ollowUnifiedTCI-State* we intend to agree Ericsson. |
| Nokia, Nokia Shanghai Bell | Yes (proponent) | The "follow" in the parameter name is actually a misnomer: UE doesn't follow "unified" TCI state - UE follows indicated TCI state in DCI codepoint. In actuality the parameter is only called like this because RAN1 doesn't often use time to consider what the parameters do, and they are whatever they first thought. We think using "*indicatedTCI-State*" would be even better, but tried to not do too many changes. |
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**Summary C1**: Most companies do not want to change the "followUnifiedTCI-State" name, but there are few comments to anything else. So moderator thinks it's easiest to just keep the name but adopt the rest of the changes.

**Proposal C1**: Retain the name of "*followUnifiedTCI-State*" but adopt the rest of the miscellaneous changes in R2-2206332.

# 4 Conclusion

**Proposal A1-1**: Clarify that there are 2 lists for DL/Joint TCI states and 2 lists for UL TCI states.

**Proposal A1-2**: Use ToAddModRelease-lists for the simultaneous TCI state update lists.

**Proposal B1**: Move the field *additionalPCI* from *QCL-Info* IE to parent IE.

**Proposal B2**: Change the field descriptions related to unified TCI states so that they refer to field names and not IE names.

**Proposal B3-1**: Use legacy TCI-State IE (with extensions) for DL/Joint TCI states and have separate IE for UL TCI states and add extension marker to UL-TCI-State IE.

**Proposal B3-2**: If B3-1 is not agreed, add extension markers to existing TCI state IEs and rename them according to ASN.1 naming rules (i.e. correct use hyphens and capitalization).

**Proposal C1**: Retain the name of "*followUnifiedTCI-State*" but adopt the rest of the miscellaneous changes in R2-2206332.