**3GPP TSG-RAN WG2 Meeting #116bisR2-2xxxxx**

**Electronic January 2022**

**Title: DRAFT**LS on feMIMO RRC parameters

**Response to: -**

**Release:** Rel-17

**Work Item:** NR\_feMIMO-Core

**Source:** ERICSSON to be replaced by 3GPP TSG-RAN WG2

**To:** 3GPP TSG-RAN WG1

**Cc:** RAN3, RAN4

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**Attachments:** None

**1. Overall Description:**

RAN2 has been discussing several L1 parameter related open issues left to RAN2 as well as overall the implementation of all L1 feMIMO RRC parameters. RAN2 would like feedback from RAN1 about the following aspects.

**1. MultiBeam**

**CORESET** **to follow Unified TCI state**

RAN2 has discussed the per CORESET RRC based indication based on RAN1 agreements.

* + *For any PDCCH reception on a ‘CORESET B’ and the respective PDSCH reception, whether or not UE to apply the indicated Rel-17 TCI state associated with the serving cell is determined per CORESET by RRC*

RAN2 understands that the 1 bit RRC indication “*followUnifiedTCI-State*” would be needed for CORESET type “B”. RAN2 understanding is that it seems to indicate how the CORESET behaves with respect to the TCI state of PDSCH depending on the type (i.e. CSS or USS) of the SearchSpace that is linked to that CORESET. However, as in RRC there is no types of CORESETs RAN2 would like to ask RAN1 to clarify the intention of the indication in more details.

**Question 1.1:** What is the intent behind this indication and why was it put to CORESET but not per SearchSpace?

**Question 1.2:** Are there any limitation or conditions needs to specified for the "*followUnifiedTCI-State*" parameter?

**Question 1.3:** How are the “DM-RS for non-UE dedicated PDCCH” in parameter "*applyTCI-State-DL-List-r17"* and the CORESET B “*followUnifiedTCI-State*” related?

**Parameter *applyTCI-StateDL-List-r17***

RAN2 notes there is discrepancy with the description and comment related to *applyTCI-State-DL-List-r17*. RAN2 has baseline implementation for this functionality where 1 bit “followUnifiedTCI-State" indication is added to “AssociatedReportConfigInfo” IE where QCL peran aperiodic resource set is currently configured i.e. all resource within NZP-CSI-RS resource set follow unified TCI state in DCI.

**Question 1.4:** Is this RRC parameter implementation is according to intended functionality or should the indication be placed per NZP-CSI-RS resource set or resource. Note that these set and resource configurations are not specific to AP.?

Note that it will be RAN2 signalling design whether supporting this functionality is 1 bit indication per field X, or by maintaining lists of field X.

**Parameter ApplyTCI-State-r17forSRS**

RAN2 intends to add the parameter “*followUnifiedTCI-State-r17*” (*ApplyTCI-State-r17forSRS* in RAN1 RRC parameter list) to *SRS-ResourceSet* IE according to RAN1 guidance.

**Question 1.5:** Are the stated restrictions indicated in the L1 parameter excel (i.e. “This applies to the following: 1) Aperiodic SRS for BM, 2) SRS (of any time-domain behavior) for codebook, non-codebook, and antenna switching “) should be placed in TS 38.331 or these will be specified by RAN1? If they should be specified in RAN2, are there any additional restrictions that have not yet been communicated e.g. whether SRS of any time-domain will follow unified TCI state in DCI or some coordination between RRC signalling, MAC CE and DCI is needed etc.?

**MPE**

In RAN2#116, RAN2 agreed the following

* + *4: Rel-17 MPE configuration can be included in PHR-Config. Will ask R1 whether MPE information can apply to both ICBM and mTRP*

This will impact at least the corresponding MAC CE design but potentially also configuration. Further, the parameter excel has TBD on the range for configuring the MPE resource pool. RAN2 understanding is that the MPE-ResourcePool may be a list of SSB or CSI-RS resources, which will be configured by RRC but for which RAN1 has not yet indicated maximum number. RAN2 would need to know this to derive the number of bits needed for the resource IDs in the MPE resource pool.

**Question 1.6:** Please clarify the structure of the *mpe-ResourcePool*: Is it a list of SSB or CSI-RS resources (i.e. SSBRI or CRI), and what is the maximum number of resources configured in the pool?

RAN2 was also not clear on whether the MPE reporting would apply for the mTRP PHR and whether *mpe-Reporting-FR2* can apply to both single TRP case and mTRP case to activate the reporting, so RAN2 would like RAN1 to clarify this.

**Question 1.7:** Does the enhanced MPE reporting applies also to mTRP operation, and, if it does, will this be activated by *mpe-Reporting-FR2* or is another RRC parameter needed?

**Question 1.8:** RAN1 to confirm whether the RAN2 should decide about including the MPE-Config-FR2-r17 between in the PHR-Config IE, which is per cell group, and (per-cell) per BWP as indicated in L1 parameter excel?

**Question 1.10:** Is reporting of PCMax,f,c needed for MPE information and if it is, should it be included per indicated SSBRI/CRI value or is it cell-specific?

**BeamAppTime value range**

**Question 1.11:** Please indicate what should be the value range for parameter *beamAppTime-r17?*

**Question1.12: RAN2 would like to further confirm whether this parameter is per-UE (i.e. applicable to all cell groups per SCS), per cell group (i.e. within the same cell group, all cells use the same values per SCS), per cell (i.e. different cells may use different value per SCS), or something else***?* RAN2 understands that for a given SCS is configured for all the CCs configured with the common TCI state ID update. However, it is not clear what “common TCI state ID update” means. Is it correct understanding that the common TCI state ID update is when the same TCI state list is configured for multiple CCs with reference BWP/CC?

**CSI-SSB-ResourceSet**

**Question 1.13: Should it be possible for different SSB indexes in the same *CSI-SSB-ResourceSet* to be associated with different *additionalPCI*?**

**Simultaneous usage of different operation for different serving cells**

**RAN2 undestanding is that all channels and RS in one serving cell have to follow one TCI state framework, either Rel-17 or Rel 15/16.**

**Question 1.1x: Please confirm whether above RAN2 understanding is correct.**

**Question 1.14: can different serving cells in a cell group use different TCI framework (Rel-16 or Rel-17)?**

**Question 1.15: can different serving cells in a cell group use different TCI mode (joint or separate) if Rel-17 unified TCI framework is configured?**

**BM power control configuration**

In current running RRC CR the PO set(P0, alpha, closed loop index) is encoded in both UL TCI state as well in *BWP-UL-Dedicated* (that is outside of UL TCI state) and different values are enabled for each UL channel PUSCH, PUCCH, SRS. UE receives the UL pc configuration in either UL TCI states or in BWP UL-dedicated.

**Question 1.15:** Is it correct understanding that network may provide UE the UL pc configuration in either UL TCI states or in *BWP-UL-dedicated* or should RAN2 choose one? If UL PC configuration is signalled in BWP-UL-dedicated only, how can the specific PC configuration (actually applied) be decided in PHY layer?

**2. mTRP (PUCCH, PDCCH)**

For mTRP PUCCH, RAN2 has agreed to add a new IE for power control for mTRP FR1 operation. However, RAN2 would need information on the number of power control sets to be configured with respect to the each TRP and then in relation to the corresponding MAC CE.

**Question 2.1:** How many power control sets needs to be configured with respect to the each TRP and then in relation to the corresponding MAC CE per UE/cell/BWP?

For mTRP PDCCH, RAN1 indicates that parameter *searchSpaceLinking* is suppposed to link two SearchSpace sets by RRC configuration with various limitations. However, it was not clarified whether the linking should be applied to all SearchSpaces set of Rel-15 and Rel-16.

**Question 2.2:** Should the *searchSpaceLinking* be applied to all or selected set of SearchSpaces of Rel-15 and Rel-16?

RAN2 agreed to have separate MAC CEs for PUSCH pathloss reference RS update:

* [060] To revise the legacy PUSCH Pathloss Reference RS Update MAC CE with additional field(s) to differentiate the TRP for mTRP PUSCH repetition, replace the Reserve bit (‘R’) to a TRP index field (‘T’) so that the MAC CE can indicate which TRP the PUSCH pathloss reference RS update can apply for.

**Question 2.3:** How is the "TRP identity" defined for this MAC CE or other potential per TRP MAC CEs?- is it based on *SRS-ResourceSet* ID, BFD RS SET ID or something else? Note that current ASN1 does not have yet BFD RS SETs implemented.

The L1 parameter excel does not have input on how to implement beam failure detection RS sets for mTRP. There is also not information on what is the maximum number of detection resources to be configured per UE per cell or per TRP. There is also not information on what is the maximum number of recovery resources to be configured per UE per cell or per TRP.

**Question 2.4:** Please inform how to implement beam failure detection RS sets for mTRP. Also what is the maximum number of detection resources to be configured per UE per cell or per TRP? What is the maximum number of recovery resources to be configured per UE per cell or per TRP?

**3. CSI mTRP**

For mTRP CSI, RAN2 was instructed to configure two codebook subset restrictions (CBSRs) per *CodebookConfig*, and two RI restrictions per *CodebookConfig*. However, it is not clear which CBSRs are intended to be used and whether there are specific restrictions to be applied for the RRC configuration.

**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?

**4. SRS**

RAN2 also noted that the parameter *startPosition* was not included in the indicated Rel-17 *resourceMapping* for SRS, but it was not clear if this was intentionally or accidentally omitted from the Rel-17 SRS configuration.

**Question 4.1:** Should the parameter *startPosition* should be included in *resourceMapping* also for Rel-17 (similarly as it was there in Rel15 and Rel 16 configurations)?

**2. Actions:**

**To RAN1 group:**

**ACTION:** RAN2 respectfully asks RAN1 to provide responses to above questions.

**3. Date of Next TSG-RAN WG2 Meetings:**

TSG-RAN WG1 Meeting #117-e 21 February - 3 March 2022 Electronic

ASN1 review April 2022 Electronic

TSG-RAN WG1 Meeting #118-e 16 – 27 May 2022 Electronic