**3GPP TSG-RAN WG2 Meeting #117R2-220xxxx**

**Electronic February 2022**

**Title: DRAFT**LS on further questions 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

**Contact Person:**

#### Name: Helka-Liina Määttänen

E-mail Address: Helka-liina.maattanen@ericsson.com

**Send any reply LS to: 3GPP Liaisons Coordinator,** [**mailto:3GPPLiaison@etsi.org**](mailto:3GPPLiaison@etsi.org)

**Attachments:** None

**1. Overall Description:**

[RAN2 agreed question:]

**1. Inter-cell operation for BM and mTRP**

RAN2 has further discussed the implementation of L1 parameters based on R1-2112976. One of the parameters is “*[AdditionalPCIInfo…]* ” (row 52) under Inter-cell mTRP with description “*to support inter-cell mTRP operation, to associate SSB from the cell having different PCI than serving cell.*” Further the excel has under Inter-cell mTRP [NumberOfAdditionalPCI] (row 53) on maximum number of these additional SSB/PCIs to be configured. Additionally, under MultiBeam there is row 12 which advices “*A CSI-SSB-ResourceSet configured for L1-RSRP measurement/reporting includes at least a set of SSB indices where PCI indices are associated with the set of SSB indices, respectively. The PCI indices refer to PCIs within the set of PCIs configured for inter-cell beam management or inter-cell multi-TRP.*”

There is also consensus that the additional SSB/PCI used for inter-cell operation for both BM and mTRP share the IE introducing the additional SSB/PCI configuration.

Some companies were claiming in RAN2 that mTRP would not support inter-cell operation for UL, but it was not clear to RAN2 if this is really what RAN1 has agreed. Specifically, in current RRC running CR, IE SSB-MTCAdditionalPCI-r17 giving the added physical cell identification, timing information, information on which SSB beams are present, and transmission power(to be added) is introduced. Using this IE, a list(depending on [NumberOfAdditionalPCI]) of these added SSB/PCIs configured for the UE under IE ServingCellConfig. Then, using index AdditionalPCIIndex the added SSB/PCI is linked to the following IE.

* QCL-Info for inter-cell BM (DL-only/Joint TCI state) and inter-cell mTRP(implementation of row 52)
* UL-TCIState-r17 for inter-cell BM (UL-only TCI state)
* CSI-SSB-ResourceSet (implementation of row 12)
* PUCCH-SpatialRelationInfoExt-r16 for inter-cell mTRP (implementation of row 52)

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***Question 1.*** RAN2 would like to ask whether additional PCI is needed in PUCCH-SpatialRelationInfo for inter-cell mTRP operation, or in any other place to support BM and mTRP inter-cell operation?

[Other suggested questions:]

**2. Reference CC/BWP for TCI state list configurations**

RAN2 further discussed row 18 of the excel that advices “PDSCH configuration for each CC/BWP. The current QCL configuration included in legacy TCI-State IE already allows to indicate that the RS used for the QCL is linked to another serving cell than where the TCI state is configured.The reference CC/BWP includes the Rel-17 TCI state pool (a list of TCI states) for PDSCH”. This is understood as signalling optimization for DL/joint TCI state list configuration when UE is configured with unified TCI state operation, allowing for the TCI pool to be defined in as part of one serving cell's configuration, and referred to by another cell/BWP, thus saving network from signalling the same TCI state pool twice. However, it was not clear if this "TCI state pool" signalling indicated by the reference CC/BWP applies only to DL/joint TCI states, or also to UL TCI states, or whether there could be e.g. different TCI state pool for UL TCI states.

***Question 2.1.*** RAN2 would like to ask whether the Rel-17 UL TCI state configuration (given per UL BWP) can have a TCI state pool configuration, i.e. a reference CC/BWP parameter, where the indicated reference CC/BWP includes the Rel-17 UL TCI state pool (a list of TCI states) for this UL BWP ? Or, whether same reference CC/BWP as in DL is to be assumed for UL, or whether this was only designed for DL?

***Question 2.2:*** RAN2 assumes that reference BWP/CC information can be configured instead of explicit unified TCI state list for signaling optimization. That is, if the explicit Rel-17 TCI state list is absent in the corresponding cell/BWP, RAN2 assumes that a reference BWP/CC needs to be configured to UE RAN2 would like RAN1 to confirm whether this is correct assumption?

**3. BFR for inter-cell mTRP and BM**

RAN2 discussed about BFR and would like to ask the following questions:

***Question 3.1:*** Is the new per-TRP BFR operation applicable for both inter-cell mTRP and inter-cell BM? That is, can the new per-TRP BFR be used with either Release 15/16 TCI state configuration or Release-17 unified TCI state configuration?

***Question 3.2:*** If the response to Q3.1 is yes: should the new per-TRP BFR mechanism (i.e. new BFR MAC CE, two configured BFD RS sets) be supported also for the case when additional PCI is configured for inter-cell BM? If yes, please explain how it works e.g.

* Is there is any relation between a BFD RS set and a PCI (e.g. one set associated with RS of this serving cell and another associated with RS associated with the additional PCI)?
* Is there any impact to BFD/BFR with two BFD sets if switching towards beams associated with different PCI occurs?

***Question 3.3:*** When a serving cell is configured with inter-cell BM operation (i.e. UE is configured with an additional PCI ) and includes only a single BFD RS set, can the BFD RS set include both 1) RS of the serving cell and 2) RS associated with the additional PCI?

***Question 3.4:*** When a serving cell use inter-cell mTRP, can the UE be configured with two BFD RS sets? If yes, please explain if there is any relation between a BFD RS set and a PCI (e.g. one set associated with RS of this serving cell and another associated with RS associated with an additional PCI).

**4. Common TCI state ID update**

RAN2 understands that there are two types of common TCI state ID update.

1. Type 1: Rel-16 simultaneous TCI state update based on simultaneousTCI-UpdateList1-r16 and simultaneousTCI-UpdateList2-r16.
2. Type 2: Same Rel-17 unified TCI state list across multiple serving cells based on reference BWP/CC parameters.

***Question 4.1:*** Is it correct understanding that Type 1 can be supported for Rel-17 TCI state update? In addition, is it correct understanding that Type 1 can be also applicable simultaneously with Type 2?

In RAN2 meeting, it was proposed to use different RRC parameter (e.g. simultaneousTCI-UpdateList1-r17 and simultaneousTCI-UpdateList2-r17). The main motivation is to apply common TCI state update when Rel-16 TCI state list and Rel-17 unified TCI state list are configured for different serving cells. For example, Rel-17 unified TCI state list is configured in serving cell #1- #4, while Rel-16 TCI state list is configured in serving cell #5-#8. In this case, simultaneousTCI-UpdateList1-r17 and simultaneousTCI-UpdateList2-r17 are used to group serving cell #1-#4, while simultaneousTCI-UpdateList1-r16 and simultaneousTCI-UpdateList2-r16 are used to group serving cell #5-8 for simultaneous TCI state update.

***Question 4.2:*** Is operation with both Rel-16 and Rel-17 unified TCI state list configured (i.e. the configuration in the above example)? If yes, does RAN2 need to introduce different RRC parameter (e.g. simultaneousTCI-UpdateList1-r17 and simultaneousTCI-UpdateList2-r17) to enable Type 1 scheme for serving cells configured with Rel-16 TCI state list and serving cells configured with Rel-17 unified TCI state list separately?

***Question 4.3:*** Is there any restriction in configuring Type 1 and Type 2 simultaneously in the unified TCI state framework?

***Question 4.4*** Does Type 1 apply only to DL-only/Joint TCI state or also for UL-TCIState?

**2. Actions:**

**To RAN1 group:**

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

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

ASN1 review April 2022 Electronic

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

TSG-RAN WG1 Meeting #119-e August 2022 Electronic