**3GPP TSG-RAN WG1 Meeting #108-e R1-220xxxx**

**e-Meeting, February 21st – March 3rd, 2022**

**Agenda item:** 8.1.1

**Source:** Moderator (Nokia)

**Title:** Moderator summary for LS reply to RAN2 on MPE information signalling

**Document for:** Discussion and Decision

## Introduction

This summary includes the following:

* Proposed LS reply to the LSs from RAN2 R2-2111600
* Summary of companies’ inputs provided in the submitted tdocs in RAN1#108e
1. Proposed LS reply to the LSs from RAN2 R2-2111600

During RAN1#108e, 10 companies provided draft answers to the RAN2 LS (see next section). RAN2 had the following message:

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| RAN2 has discussed the RAN1 parameter list for the Rel-17 FeMIMO WI and noted that there are new signalling aspects (i.e. parameters *mpe-Reporting-FR2-r17*, *numberOfN* and *mpe-ResourcePool* for the sub-feature "MultiBeam") for the MPE RRC configuration and corresponding changes to MAC CE signallling (i.e. P-MPR reporting in MAC CE for multiple beams according to RRC configuration).RAN2 understands that these parameters apply to the inter-cell beam management (ICBM) framework, but would like to understand if these MPE reporting changes would also apply to the multi-TRP (mTRP) framework? |

The initial situation based on the submitted contribution was the following. Out of the 10 companies’ answers, 6 companies believe the Rel.17 MPE reporting changes are not applicable to Rel17 mTRP framework while 4 companies think that these are applicable. Based on the company inputs, the LS reply in Table 1 is proposed:

Table 1 Proposed reply to RAN2

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| RAN1 would like to thank RAN2 for the question in LS in R2-2201600 on MPE related signaling, whether those are also applicable for mTRP framework. RAN1 has the following reply to the RAN2 questions:* Regarding inter-cell beam management (ICBM), RAN1 confirms that these RRC parameters including *mpe-Reporting-FR2-r17*, *numberOfN* and *mpe-ResourcePool* apply to the ICBM framework as well.
* Regarding mTRP framework, RAN1 has not discussed whether these MPE reporting changes would also apply to mTRP framework.
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Table 2 Companies’ inputs on the proposed LS answer

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| **Company** | **Input** |
| Mod V0 | **Please share your inputs on the above** |
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## Summary of companies’ inputs

The following input Tdocs were submitted:

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| --- | --- | --- |
| R1-2201041 | Draft reply LS on MPE information signaling | vivo |
| R1-2201202 | Draft reply LS on MPE information signalling | ZTE |
| R1-2201234 | Discussion on LS on MPE information signalling  | OPPO |
| R1-2201563 | Draft reply LS on MPE information signalling | LG Electronics |
| R1-2201749 | Draft reply LS on MPE Information Signaling | Apple |
| R1-2201835 | Discussion on RAN2 LS on MPE information signaling | CMCC |
| R1-2201976 | Draft Reply LS on MPE information signalling | Samsung |
| R1-2202313 | Draft LS reply on MPE information signalling | Nokia,  |
| R1-2202324 | Draft reply to LS on MPE information signalling | Ericsson |
| R1-2202466 | Views on MPE information signalling | Huawei, HiSilicon |

Table 3 Companies’ inputs based on the submitted tdocs in RAN1#108b

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| **Company** | **Input** |
| Vivo | In agenda item 8.1.1 of Rel-17 feMIMO, the multi-beam operation is mainly targeting single TRP case, which includes unified TCI framework, L1/L2-centric inter-cell beam management, MPUE and MPE. There is no specific agreement in RAN1 whether the enhanced MPE reporting agreed in AI 8.1.1 is applicable for AI 8.1.2.2 (inter-cell mTRP) in Rel-17.  |
| ZTE | RAN1 has the following reply to the above questions:* Regarding inter-cell beam management (ICBM), RAN1 confirms that these RRC parameters including *mpe-Reporting-FR2-r17*, *numberOfN* and *mpe-ResourcePool* apply to the ICBM framework as well.
* Regarding mTRP framework, RAN1 has not discussed whether these MPE reporting changes would also apply to mTRP framework. Once applying to mTRP framework, we may need to consider two parameter combinations of {*numberOfN*, *mpe-ResourcePool}* corresponding to respective TRPs, which is analogous to the enhanced group based beam reporting in Rel-17.
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| OPPO | During the WI of Rel.17 FeMIMO in RAN1, the MPE reporting was comprehensively discussed and designed under single-TRP scenario for multi-beam operation (under AI 8.1.1). Consequently, all the progresses on MPE-related configuration, UE features and event-triggered (based on PHR MAC CE) MPE reporting are for single-TRP operation only. Different from PHR for PUSCH repetition toward multi-TRP in Rel.17, the MPE reporting tries to reuse the format of PHR MAC CE by adding new fields along with existing fields. The new fields include up to N = 4 CRI(s)/SSBRI(s) with each associated with a P-MPR. But it doesn’t include PCMAX, f, c, which is deemed as unnecessary in RAN1’s decision. Assume the MPE reporting can be apply to multi-TRP, then RAN1 has to carefully re-consider the design of MPE reporting. This will involve cross agenda item discussions, i.e. multi-beam AI and PUSCH repetition AI. Unfortunately, there is no TU to do so after Rel.17 feMIMO functional freeze in RAN1. Therefore, we would like to have the following proposal.*Proposed reply:* *The Rel.17 MPE reporting changes are not applicable to mTRP framework.* |
| LGE | RAN1 would like to thank RAN2 for the question on MPE information signalling. In the LS, it was mentioned that MPE signaling parameters apply to the inter-cell beam management (ICBM) framework. One of the main use cases of the enhanced MPE feature is for multi-panel UE, e.g. for when MPE event occurs to one UE panel but not for the other UE panel. Therefore, the enhanced MPE reporting is not only for inter-cell BM but also for intra-cell BM. Regarding the question about the applicability to mTRP framework, RAN1 understands that ‘mTRP framework’ in this question refers to Rel-17 mTRP UL transmission where enhanced PHR reporting is introduced for mTRP PUSCH repetition. RAN1 has discussed these two features, i.e. the MPE enhancement for multi-panel UE and the PHR enhancement for mTRP, separately, and has not considered combined operation of the enhanced MPE feature and the mTRP PUSCH transmission. |
| Apple | A: It is RAN1’s understanding that the MPE reporting changes are also applicable to mTRP framework. |
| CMCC | In the FeMIMO WID, the objective description related to MPE is as follows [2]:* Identify and specify features to facilitate UL beam selection for UEs equipped with multiple panels, considering UL coverage loss mitigation due to MPE, based on UL beam indication with the unified TCI framework for UL fast panel selection

From the WID description, the MPE reporting is based on unified TCI framework. In Rel-17, unified TCI can be only applied to single-TRP. Therefore, we think these MPE reporting changes cannot apply to mTRP framework.Proposal 1: Reply to RAN2 as follows:* These MPE reporting changes cannot apply to mTRP framework.
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| Samsung | RAN1 has discussed question and came to the following answer:The MPE configuration parameters designated for sub-feature “MultiBeam” and corresponding MAC CE signaling only apply to the Rel-17 unified TCI framework including inter-cell beam management. These parameters and corresponding signaling, are not applicable to multi-TRP.  |
| Nokia | MPE Rel-17 in FeMIMO WI agreed on the following parameters: *mpe-Reporting-FR2-r17*, *numberOfN* and *mpe-ResourcePool* subsequent from P-MPR reporting in MAC CE for multiple beams according to RRC configuration. While it is the case that this was discussed and agreed under the “Multi-Beam feature”, we do not see reasons why it should not be extended to mTRP framework.The goal of MPE Rel-17 feature is to enable the UE to report an alternative candidate beam which has better UL condition (i.e. no or less P-MPR). This may likely be a beam in a different direction. Therefore, extending the feature to mTRP provides more diversity for the pool and candidate beams, thus increases the likelihood that the UE can find a better suited beam. The benefit of the MPE Rel-17 feature is clearly enhanced by extending the pool of candidate beams to mTRP. The RAN1 impact of applying MPE reporting changes to mTRP framework is viewed as manageable since any configuration can be part of the resource pool, this is detailed below for the different use cases:1. mTRP intra-cell
	* single DCI: the beam indexing is up to gNB implementation and the relation to each TRP is transparent to UE. UE can report candidate beams with SSBRI/CRI independently of TRP association knowledge. This extension is straightforward from the current RAN1 MPE agreement.
	* multi-DCI: this may be enabled with the *coresetPoolIndex for* the SSBRI/CRI MPE reporting. This is controlled in gNB implementation by configuring the CORESET Pool. As such, small changes from current framework are required and only minor changes to MPE resource pool configuration are needed.
2. mTRP inter-cell: with different PCI, this extension is similar to inter-cell beam management framework and is straightforward to implement as already agreed.

Therefore, RAN1 does not see any reasons for not applying MPE reporting changes to the mTRP framework and recommends implementing such extension in Rel-17 in RAN2. |
| Ericsson | Answer from RAN1: The MPE reporting enhancements agreed in Rel-17 are a separate feature and does not apply to multi-TRP framework. The PHR reporting enhancements introduced for multi-TRP in Rel-17 is separate from the Rel-17 MPE reporting enhanements. |
| Huawei/HiSilion | The major enhancement for MPE in Rel-17 compared to Rel-16 is to allow beam based MPE reporting. No matter the UE is configured with sTRP or mTRP, the UL transmission can always be based on the configured DL RS, and the UE does not need to know the DL RS is transmitted from which TRP. For example, just as sTRP case, the NW configures MPE related parameters including MPE reporting configuration and the resource pool which can include DL RS transmitted from both TRPs. Hence the Rel-17 MPE reporting enhancements are also applicable to mTRP case. *Proposal 1: Send a reply LS to RAN2 to clarify that MPE reporting enhancements in Rel-17 can also apply to multi-TRP case.* |