**3GPP TSG RAN WG1 Meeting #92 R1-1801316**

**Athens, Greece, February 26th – March 2nd, 2018**

**3GPP TSG-RAN WG2 NR Ad hoc 1801 R2-1801555**

**Vancouver, Canada, 22 – 26 January 2018**

**Title:** LS to RAN1 on MAC CE for MIMO

**Response to:** -

**Release:** Rel-15

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

**Source:** RAN2

**To:** RAN1

**Cc:**

**Contact Person:**

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**Attachments:** -

**1. Overall Description:**

RAN2 has discussed the introduction of the MAC CEs for NR MIMO as requested by RAN1 in their LSs in R1-1721663 / R2-1714236 and R1-1721734 / R2-1800013. Besides the questions asked in a response LS in R2-1714246, RAN2 has additional questions and would like to ask RAN1 for clarifications:

**TCI State Indication for UE-specific PDCCH**

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| RAN1 specification | Section | MAC CE message | Description | Value range |
| TS38.214 | 5.1.5 | Indication of TCI state for UE specific NR-PDCCH per CORESET | Out of the K TCI states configured per CORESET, the MAC-CE selects one out of K. | Bitmap to select one out of K (up to M) states |

**Question 1:** Since the signaling is per CORESET, is it correct understanding that the MAC CE will have to indicate CORESET ID which the MAC CE refers to?

**Question 2:** If the MAC CE has to indicate the CORESET ID, what is the maximum number of CORESETs that can be configured in the UE.

**Question 3:** Since RAN1 indicated that only a single out of K states is indicated with a MAC CE, can an indication of a single TCI state’s identifier be used instead of a bitmap? With K up to 128 the signalling with a bitmap would require up to 16 octets and additional octet for length field of MAC CE while with the signalling of a single TCI state ID only a single octet would be required and overhead could be reduced significantly.

**Semi-persistent CSI reporting (on PUCCH) activation**

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| RAN1 specification | Section | MAC CE message | Description | Value range |
| TS38.214 | 5.2.4 | Semi-persistent CSI reporting (on PUCCH) activation | Activates a SP CSI Report | Bitmap with length of the number of SP CSI reporting settings |

**Question 4:** Only activation is mentioned for this MAC CE, should it allow for deactivation as well?

**Question 5:** “Activation” is mentioned in RAN1 LS while TS 38.214 refers to “selection” – what should be the proper name for this MAC CE?

RAN2 has also noticed that certain fragments of TS 38.214 refer to “corresponding actions” of UE described in TS 38.321, e.g.:

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| For a UE configured with one or more SRS resource configuration(s), and when the higher layer parameter *SRS-ResourceConfigType* is set to ‘semi-persistent’:  - when a UE receives an activation command [10, TS 38.321] for SRS resourceset in slot n, the corresponding actions in [10, TS 38.321] and the UE assumptions on SRS transmission corresponding to the configured SRS resource set shall be applied no later than the minimum requirement defined in [11, TS 38.133].  - when a UE receives a deactivation command [MAC spec citation, 38.321] for activated SRS resourceset in slot n, the corresponding actions in [10, TS 38.321] and UE assumption on cessation of SRS transmission corresponding to the deactivated SRS resource set shall apply no later than the minimum requirement defined in [11, TS 38.133]. |

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| For a UE configured with the higher layer parameter *ResourceConfigType* set to ‘semi-persistent’.  - when a UE receives an activation command [10, TS 38.321] for CSI-RS resource(s) for channel measurement and CSI-IM/NZP CSI-RS resource(s) for interference measurement associated with configured CSI resource setting(s) in slot n, the corresponding actions in [10, TS 38.321] and the UE assumptions (including quasi-co-location assumptions provided by a reference to a *TCI-RS-SetConfig*) on CSI-RS/CSI-IM transmission corresponding to the configured CSI-RS/CSI-IM resource configuration(s) shall be applied no later than the minimum requirement defined in [10, TS 38.133].  - when a UE receives a deactivation command [10, TS 38.321] for activated CSI-RS/CSI-IM resource(s) associated with configured CSI resource setting(s) in slot n, the corresponding actions in [10, TS 38.321] and UE assumption on cessation of CSI-RS/CSI-IM transmission corresponding to the deactivated CSI-RS/CSI-IM resource(s) shall apply no later than the minimum requirement defined in [10, TS 38.133]. |

RAN2 intends to minimize specification of UE behaviour upon reception of MAC CEs for NR MIMO in RAN2 specifications. Therefore, RAN2 would like to ask the following question:

**Question 6:** What is RAN1 expectation towards the UE behaviour to be described in TS 38.321, considering that the corresponding actions are related to physical layer procedures and that UE behaviour seems to be already captured in TS 38.214?

**Semi-persistent CSI-RS / CSI-IM**

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| RAN1 specification | Section | MAC CE message | Description | Value range |
| TS38.214 | 5.2.2.3.4 | Semi-persistent CSI-RS / CSI-IM | Activates/deactivates a SP CSI-RS resource set and a SP CSI-IM resource set. Provides the QCL relationship (if activated) | SP CSI-RS Resoruce Set Id | SP CSI-IM Resource Set Id | TCI\_State\_Id |

**Question 7:** Is SP CSI-IM Resource Set Id always required to be signalled?

RAN2 has also discussed the relation between MAC CEs and Bandwidth Parts and between MAC CEs and Supplementary Uplink and has the following questions:

**Question 8:** For Semi-persistent SRS activation MAC CE – does the MAC CE need to distinguish whether the included SP semi-persistent SRS resource set is for SUL or for UL?

**Question 9:** ForTCI State Indication for UE-specific PDCCH – sincePDCCH-Config is inside the BWP configuration and hence a particular TCI state can only be identified uniquely if also the (CORESET's) BWP ID is known. Is RAN1's understanding that the BWP ID should also be signalled in the MAC CE? Or is the assumption that the UE interprets a received MAC CE based on the currently active BWP?

**Question 10:** Regardless of the answer to Q9, does the UE have to maintain the history of previously received MAC CEs (when another BWP was active) or does the network have to send such MAC CE upon every BWP switch?

**Question 11:** Does RAN1 think Q9 and Q10 are also relevant for any other MAC CE related to NR MIMO?

**2. Actions:**

**To:** RAN1

**ACTION:** RAN2 respectfully asks RAN1 to provide additional information as requested above.

**3. Date of Next TSG-RAN2 Meetings:**

TSG-RAN WG2 Meeting #101 26th February – 2nd March 2018 Athens, Greece

TSG-RAN WG2 Meeting #101-Bis 16th – 20th April 2018 Sanya, China