**3GPP TSG RAN WG1 #105-e R1-2105987**

**e-Meeting, May 10th – 27th, 2021**

**Agenda item:** 7.2.6

**Source:** Moderator (LG Electronics)

**Title:** Summary of [105-e-NR-eMIMO-01]

**Document for:** Discussion and Decision

# Introduction

This contribution summaries discussion of email thread [105-e-NR-eMIMO-01].

# MB.2 (E-rated issue)

Reason for change:

Current TS 38.214 is not aligned with the corresponding paragraph for simultaneous multi-CC TCI state update for PDSCH captured as follows.

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| ***TS 38.214, 5.1.5 Antenna ports quasi co-location***  The UE receives an activation command, as described in clause 6.1.3.14 of [10, TS 38.321], used to map up to 8 TCI states to the codepoints of the DCI field *'Transmission Configuration Indication'* in one CC/DL BWP or in a set of CCs/DL BWPs, respectively. When a set of TCI state IDs are activated for a set of CCs/DL BWPs, where the applicable list of CCs is determined by indicated CC in the activation command, the same set of TCI state IDs are applied for all DL BWPs in the indicated CCs. |

Text proposal:

In R1-2104582, ZTE proposed the following TP for clause 6.2.1 of TS 38.214.

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| ***TS38.214, 6.2.1 UE sounding procedure***  **<Unchanged part is omitted>**  When a *spatialRelationInfo* is activated/updated for a semi-persistent or aperiodic SRS resource configured by the higher layer parameter *SRS-Resource* by a MAC CE for a set of CCs/BWPs, where the applicable list of CCs provided by higher layer parameter *simultaneousSpatial-UpdatedList1* or *simultaneousSpatial-UpdatedList2* is determined by the indicated CC in the MAC-CE, the *spatialRelationInfo* is applied for the semi-persistent or aperiodic SRS resource(s) with the same SRS resource ID for all the BWPs in the indicated CCs.  **<Unchanged part is omitted>** |

**Companies’ inputs (if any)**

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| Company name | View |
| vivo | Fine with the update. It makes spec clearer. |
| ZTE | Support |
| OPPO | Ok with the update and the update does make the spec clearer.  Furthermore, suggest one more wording change: suggest to change the ‘indicated CCs’ to “determined CCs” in the last sentence since the wording in previous sentence is changed to “CCs … is determined…”  When a *spatialRelationInfo* is activated/updated for a semi-persistent or aperiodic SRS resource configured by the higher layer parameter *SRS-Resource* by a MAC CE for a set of CCs/BWPs, where the applicable list of CCs provided by higher layer parameter *simultaneousSpatial-UpdatedList1* or *simultaneousSpatial-UpdatedList2* is determined by the indicated CC in the MAC-CE, the *spatialRelationInfo* is applied for the semi-persistent or aperiodic SRS resource(s) with the same SRS resource ID for all the BWPs in the ~~indicated~~ determined CCs. |
| Samsung | Support the updated proposal from OPPO. |
| Apple | Support |
| DOCOMO | Fine with the update from OPPO. |
| Nokia | OK with the update |
| Ericsson | Support, both the original and Oppo’s versions are OK |
| Huawei, HiSilicon | Fine with OPPO’s suggestion. |
| Intel | OK with original CR. |
| Qualcomm | OPPO’s version is clearer |
| FL | It seems OPPO’s further revision is fine to all. TP is modified accordingly.  **Companies please check the TP below per OPPO’s further revision.** |

Proposal: Adopt the following TP(TP#1)

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| ***TS38.214, 6.2.1 UE sounding procedure***  **<Unchanged part is omitted>**  When a *spatialRelationInfo* is activated/updated for a semi-persistent or aperiodic SRS resource configured by the higher layer parameter *SRS-Resource* by a MAC CE for a set of CCs/BWPs, where the applicable list of CCs provided by higher layer parameter *simultaneousSpatial-UpdatedList1* or *simultaneousSpatial-UpdatedList2* is determined by the indicated CC in the MAC-CE, the *spatialRelationInfo* is applied for the semi-persistent or aperiodic SRS resource(s) with the same SRS resource ID for all the BWPs in the determined CCs.  **<Unchanged part is omitted>** |

# MB.3 (H-rated issue)

Reason for change:

In TS38.321, CORESET#0 is applicable for simultaneous multi-CC TCI indication as captured below:

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| ***TS38.321, 6.1.3.15 TCI State Indication for UE-specific PDCCH MAC CE***  The TCI State Indication for UE-specific PDCCH MAC CE is identified by a MAC subheader with LCID as specified in Table 6.2.1-1. It has a fixed size of 16 bits with following fields:  - Serving Cell ID: This field indicates the identity of the Serving Cell for which the MAC CE applies. The length of the field is 5 bits. If the indicated Serving Cell is configured as part of a *simultaneousTCI-UpdateList1* or *simultaneousTCI-UpdateList2* as specified in TS 38.331 [5], this MAC CE applies to all theServing Cells in the set *simultaneousTCI-UpdateList1* or *simultaneousTCI-UpdateList2*, respectively;  - CORESET ID: This field indicates a Control Resource Set identified with *ControlResourceSetId* as specified in TS 38.331 [5], for which the TCI State is being indicated. In case the value of the field is 0, the field refers to the Control Resource Set configured by *controlResourceSetZero* as specified in TS 38.331 [5]. The length of the field is 4 bits;  - TCI State ID: This field indicates the TCI state identified by *TCI-StateId* as specified in TS 38.331 [5] applicable to the Control Resource Set identified by CORESET ID field. If the field of CORESET ID is set to 0, this field indicates a *TCI-StateId* for a TCI state of the first 64 TCI-states configured by *tci-States-ToAddModList* and *tci-States-ToReleaseList* in the *PDSCH-Config* in the active BWP. If the field of CORESET ID is set to the other value than 0, this field indicates a *TCI-StateId* configured by *tci-StatesPDCCH-ToAddList* and *tci-StatesPDCCH-ToReleaseList* in the *controlResourceSet* identified by the indicated CORESET ID. The length of the field is 7 bits. |

In TS38.213, however, it is unclear whether CORESET#0 is applicable for simultaneous multi-CC TCI indication because the CORESET index p is greater than 0 in the corresponding paragraph as captured below:

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| ***TS38.213, 10.1 UE procedure for determining physical downlink control channel assignment***  For each CORESET, the UE is provided the following by *ControlResourceSet*:  - a CORESET index , by *controlResourceSetId*  or by *controlResourceSetId-v1610*, where  - if *coresetPoolIndex* is not provided, or if a value of *coresetPoolIndex* is same for all CORESETs if *coresetPoolIndex* is provided;  - if *coresetPoolIndex* is not provided for a first CORESET, or is provided and has a value 0 for a first CORESET, and is provided and has a value 1 for a second CORESET;  - a DM-RS scrambling sequence initialization value by *pdcch-DMRS-ScramblingID*;  - a precoder granularity for a number of REGs in the frequency domain where the UE can assume use of a same DM-RS precoder by *precoderGranularity*;  - a number of consecutive symbols provided by *duration*;  - a set of resource blocks provided by *frequencyDomainResources*;  - CCE-to-REG mapping parameters provided by *cce-REG-MappingType*;  - an antenna port quasi co-location, from a set of antenna port quasi co-locations provided by *TCI-State*, indicating quasi co-location information of the DM-RS antenna port for PDCCH reception in a respective CORESET;  - if the UE is provided by *simultaneousTCI-UpdateList1* or *simultaneousTCI-UpdateList2* up to two lists of cells for simultaneous TCI state activation, the UE applies the antenna port quasi co-location provided by *TCI-States* with same activated *tci-StateID* value to CORESETs with index in all configured DL BWPs of all configured cells in a list determined from a serving cell index provided by a MAC CE command  - an indication for a presence or absence of a transmission configuration indication (TCI) field for a DCI format, other than DCI format 1\_0, that schedules PDSCH receptions or indicates SPS PDSCH release or indicates SCell dormancy or indicates a request for a Type-3 HARQ-ACK codebook report without scheduling PDSCH and is transmitted by a PDCCH in CORESET , by *tci-PresentInDCI* or tci-PresentDCI-1-2. |

Discussion:

In R1-2105469, a TP is proposed to change CORESET index from p to q to include CORESET#0 as below.

Text proposal from Vivo (R1-2105469):

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| ------------------------------------------Start of Text Proposal ----------------------------------  **10.1 UE procedure for determining physical downlink control channel assignment**  < Unchanged parts are omitted >  - if the UE is provided by *simultaneousTCI-UpdateList1* or *simultaneousTCI-UpdateList2* up to two lists of cells for simultaneous TCI state activation, the UE applies the antenna port quasi co-location provided by *TCI-States* with same activated *tci-StateID* value to CORESETs with index *q* in all configured DL BWPs of all configured cells in a list determined from a serving cell index provided by a MAC CE command  < Unchanged parts are omitted >  --------------------------------------- End of Text Proposal ------------------------------------ |

In FL’s view, the issue is valid as several companies understand that CORESET#0 is excluded by current TS38.213 based on inputs during pre-phase. It is suggested to revise TS38.213 to be aligned with TS38.321 but the TP from Vivo could create another issue since it proposes to use an undefined CORESET index q. Alternatively, the following TP is suggested by FL on this issue.

Text proposal from FL:

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| ***TS38.213, 10.1 UE procedure for determining physical downlink control channel assignment***  For each CORESET, the UE is provided the following by *ControlResourceSet*:  - a CORESET index , by *controlResourceSetId*  or by *controlResourceSetId-v1610*, where  - if *coresetPoolIndex* is not provided, or if a value of *coresetPoolIndex* is same for all CORESETs if *coresetPoolIndex* is provided;  - if *coresetPoolIndex* is not provided for a first CORESET, or is provided and has a value 0 for a first CORESET, and is provided and has a value 1 for a second CORESET;  - a DM-RS scrambling sequence initialization value by *pdcch-DMRS-ScramblingID*;  - a precoder granularity for a number of REGs in the frequency domain where the UE can assume use of a same DM-RS precoder by *precoderGranularity*;  - a number of consecutive symbols provided by *duration*;  - a set of resource blocks provided by *frequencyDomainResources*;  - CCE-to-REG mapping parameters provided by *cce-REG-MappingType*;  - an antenna port quasi co-location, from a set of antenna port quasi co-locations provided by *TCI-State*, indicating quasi co-location information of the DM-RS antenna port for PDCCH reception in a respective CORESET;  - if the UE is provided by *simultaneousTCI-UpdateList1* or *simultaneousTCI-UpdateList2* up to two lists of cells for simultaneous TCI state activation, the UE applies the antenna port quasi co-location provided by *TCI-States* with same activated *tci-StateID* value to CORESETs with a same index in all configured DL BWPs of all configured cells in a list determined from a serving cell index, where *tci-StateID*, the CORESET index and the serving cell index are provided by a MAC CE command  - an indication for a presence or absence of a transmission configuration indication (TCI) field for a DCI format, other than DCI format 1\_0, that schedules PDSCH receptions or indicates SPS PDSCH release or indicates SCell dormancy or indicates a request for a Type-3 HARQ-ACK codebook report without scheduling PDSCH and is transmitted by a PDCCH in CORESET , by *tci-PresentInDCI* or tci-PresentDCI-1-2. |

**Please share your view on above TP. Any other alternative proposal to handle this issue would also be welcomed.**

**Companies’ inputs**

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| Company name | View |
| vivo | We are fine with either original proposal or FL proposal.  Re the understanding on CORESET #0 is not included in the updated TCI states for cells within the CC list, the following agreement when achieved is applicable for all CORESETs. Not agreeing this basic understanding is reverting agreement almost two years ago.  **Agreement**  When a TCI-state ID is activated for a CORESET by a MAC CE for a set of CCs/BWPs at least for the same band, where the applicable list of CCs is indicated by RRC signalling, the TCI-state ID is applied for the CORESET(s) with the same CORESET ID for all the BWPs in the indicated CCs.   * Further signaling details are up to RAN2. * Whether to support the inter-band CA for this feature will be decided in RAN1#99. * Whether to indicate the applicable list of bands for the feature of single MAC-CE to activate the same PDCCH TCI state IDs for multiple CCs/BWPs is up to capability discussion.   + FFS on the UE capability signaling details * Note: This at least applies to single TRP case. |
| ZTE | We share the same view with vivo that CORESET#0 should be involved. In our views, the FL proposal is slightly preferred. |
| OPPO | In our understanding, CORESET#0 is not part of the multi-CC operation. Only the PCell has CORESET#0, then why we need include it in the multi-CC TCI state indication? |
| Samsung | We have same view with vivo and ZTE, and support FL proposal. |
| Apple | It looks current spec preclude CORESET #0. Regarding the agreement, it depends how we interpret the CORESET ID. If it is “CORESET index” as defined in 38.213, CORESET #0 is precluded in the agreement.  Since there is only 1 CC with CORESET #0, we would like to understand why it is needed to be included for multi-CC beam indication. We are open to fix the issues if any. |
| DOCOMO | We have same view with vivo/ZTE/Samsung, and support FL proposal. As vivo commented, we have explicit agreement to include all CCs.  Even in case there is only 1 CC with CORESET#0, the FL proposal does not harm anything. |
| Nokia | We appreciate the effort from the FL proposal, but we are not sure it solves/clarifies the problem as such. Not mentioning that the index is *p* (something which is stated in that paragraph above) would still allow the reader to have the interpretation that *p* is used. It is better to be specific, and if something else than *p* needs to be used, then we should do that. If we use *q* instead of *p*, we need to state that *q* refers to CORESET#0. |
| Ericsson | Support the FL proposal. By removing *p* we feel that the risk of misunderstanding is low, and would seem to be the simplest way to solve it. However, the whole paragraph is in the wrong place: the bulleted list describes the content of a CORESET, and the paragraph we are editing describes the MAC CE across CCs. |
| Huawei, HiSilicon | Prefer FL proposal. |
| Intel | Support wording from FL proposal |
| Qualcomm | FL’s proposal is clearer |
| FL | It seems most companies are fine with the FL’s wording. Per Nokia and Ericsson’s comments, it seems better to move the text to other place to decouple with the description of the content of a CORESET.  **Companies please check the revised TP(TP#2) to address Nokia/Ericsson’s comments.** |

Proposal: Adopt the following TP(TP#2)

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| ***TS38.213, 10.1 UE procedure for determining physical downlink control channel assignment***  For each CORESET, the UE is provided the following by *ControlResourceSet*:  - a CORESET index , by *controlResourceSetId*  or by *controlResourceSetId-v1610*, where  - if *coresetPoolIndex* is not provided, or if a value of *coresetPoolIndex* is same for all CORESETs if *coresetPoolIndex* is provided;  - if *coresetPoolIndex* is not provided for a first CORESET, or is provided and has a value 0 for a first CORESET, and is provided and has a value 1 for a second CORESET;  - a DM-RS scrambling sequence initialization value by *pdcch-DMRS-ScramblingID*;  - a precoder granularity for a number of REGs in the frequency domain where the UE can assume use of a same DM-RS precoder by *precoderGranularity*;  - a number of consecutive symbols provided by *duration*;  - a set of resource blocks provided by *frequencyDomainResources*;  - CCE-to-REG mapping parameters provided by *cce-REG-MappingType*;  - an antenna port quasi co-location, from a set of antenna port quasi co-locations provided by *TCI-State*, indicating quasi co-location information of the DM-RS antenna port for PDCCH reception in a respective CORESET;  - an indication for a presence or absence of a transmission configuration indication (TCI) field for a DCI format, other than DCI format 1\_0, that schedules PDSCH receptions or indicates SPS PDSCH release or indicates SCell dormancy or indicates a request for a Type-3 HARQ-ACK codebook report without scheduling PDSCH and is transmitted by a PDCCH in CORESET , by *tci-PresentInDCI* or tci-PresentDCI-1-2.  < Unchanged parts are omitted >  For a CORESET other than a CORESET with index 0,  - if a UE has not been provided a configuration of TCI state(s) by *tci-StatesPDCCH-ToAddList* and *tci-StatesPDCCH-ToReleaseList* for the CORESET, or has been provided initial configuration of more than one TCI states for the CORESET by *tci-StatesPDCCH-ToAddList* and *tci-StatesPDCCH-ToReleaseList* but has not received a MAC CE activation command for one of the TCI states as described in [11, TS 38.321], the UE assumes that the DM-RS antenna port associated with PDCCH receptions is quasi co-located with the SS/PBCH block the UE identified during the initial access procedure;  - if a UE has been provided a configuration of more than one TCI states by *tci-StatesPDCCH-ToAddList* and *tci-StatesPDCCH-ToReleaseList* for the CORESET as part of Reconfiguration with sync procedure as described in [12, TS 38.331] but has not received a MAC CE activation command for one of the TCI states as described in [11, TS 38.321], the UE assumes that the DM-RS antenna port associated with PDCCH receptions is quasi co-located with the SS/PBCH block or the CSI-RS resource the UE identified during the random access procedure initiated by the Reconfiguration with sync procedure as described in [12, TS 38.331].  For a CORESET with index 0, the UE assumes that a DM-RS antenna port for PDCCH receptions in the CORESET is quasi co-located with  - the one or more DL RS configured by a TCI state, where the TCI state is indicated by a MAC CE activation command for the CORESET, if any, or  - a SS/PBCH block the UE identified during a most recent random access procedure not initiated by a PDCCH order that triggers a contention-free random access procedure, if no MAC CE activation command indicating a TCI state for the CORESET is received after the most recent random access procedure.  For a CORESET other than a CORESET with index 0, if a UE is provided a single TCI state for a CORESET, or if the UE receives a MAC CE activation command for one of the provided TCI states for a CORESET, the UE assumes that the DM-RS antenna port associated with PDCCH receptions in the CORESET is quasi co-located with the one or more DL RS configured by the TCI state. For a CORESET with index 0, the UE expects that a CSI-RS configured with *qcl-Type* set to 'typeD' in a TCI state indicated by a MAC CE activation command for the CORESET is provided by a SS/PBCH block  - if the UE receives a MAC CE activation command for one of the TCI states, the UE applies the activation command in the first slot that is after slot where is the slot where the UE would transmit a PUCCH with HARQ-ACK information for the PDSCH providing the activation command and is the SCS configuration for the PUCCH. The active BWP is defined as the active BWP in the slot when the activation command is applied.  If the UE is provided by *simultaneousTCI-UpdateList1* or *simultaneousTCI-UpdateList2* up to two lists of cells for simultaneous TCI state activation, the UE applies the antenna port quasi co-location provided by *TCI-States* with same activated *tci-StateID* value to CORESETs with a same index in all configured DL BWPs of all configured cells in a list determined from a serving cell index, where *tci-StateID*, the CORESET index and the serving cell index are provided by a MAC CE command. |

# Conclusion

TBD