**3GPP TSG- RAN WG1 Meeting #104b-e R1-2103084**

**e-Meeting, April 12th – 20th, 2021**

Agenda Item: 7.2.6

Source: Moderator (Apple Inc.)

Title: Summary on 104bis-e-NR-eMIMO-01

Document for: Discussion/Decision

# Introduction

In this contribution, we provide a summary on 104bis-e-NR-eMIMO-01.

# MB.8

In R1-2102657, ZTE proposes two TPs to clarify the SCS to determine the 28 symbols for UE to apply the newly identified beam after receiving BFR response.

***Proposal for discussion: Regarding SCS determination for 28 symbols for a failed cell in SCell-BFR, down-selecting one of the following interpretations:***

* ***Interpretation-1: Determining SCS of 28 symbols is per failed cell (i.e., based on the smallest SCS of the response receiving cell and a respective failed cell).***
* ***Interpretation-2: Determining SCS of 28 symbols is based on the smallest SCS of the response receiving cell and all failed cells.***

***TP 2-1 for interpretation 1: {****38.213: 6 Link recovery procedures}*

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| **<Unchanged part is omitted>**  A UE can be provided, by *schedulingRequestID-BFR-SCell-r16*, a configuration for PUCCH transmission with a link recovery request (LRR) as described in Clause 9.2.4. The UE can transmit in a first PUSCH MAC CE providing index(es) for at least corresponding SCell(s) with radio link quality worse than Qout,LR, indication(s) of presence of for corresponding SCell(s), and index(es) for a periodic CSI-RS configuration or for a SS/PBCH block provided by higher layers, as described in [11, TS 38.321], if any, for corresponding SCell(s). After 28 symbols from a last symbol of a PDCCH reception with a DCI format scheduling a PUSCH transmission with a same HARQ process number as for the transmission of the first PUSCH and having a toggled NDI field value, the UE  - monitors PDCCH in all CORESETs on the SCell(s) indicated by the MAC CE using the same antenna port quasi co-location parameters as the ones associated with the corresponding index(es) , if any  - transmits PUCCH on a PUCCH-SCell using a same spatial domain filter as the one corresponding to for periodic CSI-RS or SS/PBCH block reception, as described in Clause 9.2.2, and using a power determined as described in Clause 7.2.1 with , , and , if  - the UE is provided *PUCCH-SpatialRelationInfo* for the PUCCH,  - a PUCCH with the LRR was either not transmitted or was transmitted on the PCell or the PSCell, and  - the PUCCH-SCell is included in the SCell(s) indicated by the MAC-CE  where the SCS configuration for the 28 symbols is determined for each SCell indicated by the MAC CE and is the smallest of the SCS configurations of the active DL BWP for the PDCCH reception and of the active DL BWP of each SCell indicated by the MAC-CE. |

***TP 2-2 for interpretation 2: {****38.213: 6 Link recovery procedures}*

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| **<Unchanged part is omitted>**  A UE can be provided, by *schedulingRequestID-BFR-SCell-r16*, a configuration for PUCCH transmission with a link recovery request (LRR) as described in Clause 9.2.4. The UE can transmit in a first PUSCH MAC CE providing index(es) for at least corresponding SCell(s) with radio link quality worse than Qout,LR, indication(s) of presence of for corresponding SCell(s), and index(es) for a periodic CSI-RS configuration or for a SS/PBCH block provided by higher layers, as described in [11, TS 38.321], if any, for corresponding SCell(s). After 28 symbols from a last symbol of a PDCCH reception with a DCI format scheduling a PUSCH transmission with a same HARQ process number as for the transmission of the first PUSCH and having a toggled NDI field value, the UE  - monitors PDCCH in all CORESETs on the SCell(s) indicated by the MAC CE using the same antenna port quasi co-location parameters as the ones associated with the corresponding index(es) , if any  - transmits PUCCH on a PUCCH-SCell using a same spatial domain filter as the one corresponding to for periodic CSI-RS or SS/PBCH block reception, as described in Clause 9.2.2, and using a power determined as described in Clause 7.2.1 with , , and , if  - the UE is provided *PUCCH-SpatialRelationInfo* for the PUCCH,  - a PUCCH with the LRR was either not transmitted or was transmitted on the PCell or the PSCell, and  - the PUCCH-SCell is included in the SCell(s) indicated by the MAC-CE  where the SCS configuration for the 28 symbols is the smallest of the SCS configurations of the active DL BWP for the PDCCH reception and of the active DL BWP(s) of the SCell(s) indicated by the MAC-CE. |

**Companies’ views and comments**

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| Company | View |
| Apple | Slightly prefer Alt2 to have a unified timeline for all SCells |
| Vivo | Supportive of Alt2.  If we go with Alt1, we would like to add in the CR that this is NBC. |
| OPPO | Alt 2 is preferred. All the failed SCells reported in the same MAC CE follows the same timeline. |
| LG | Based on the discussion in the last meeting, either alt is acceptable to us. |
| DOCOMO | Prefer Alt.1. But, Alt.2 is also acceptable for us. |
| Ericsson | Either option is fine. |
| Intel | Slightly prefer Alt 2 |
| Samsung | Support Alt2. |
| ZTE | We slightly prefer Alt 2, but we can live with Alt.1. |
| CATT | Fine with either alternative. |
| Huawei, HiSilicon | Support Alt-2. |
| Spreadtrum | Support Alt-2 |
| Lenovo, MotM | Support Alt-2 |

# MB.11

In R1-2103084, Apple proposes to define the BFD RS counting rule so as to avoid potential ambiguity for RS counting for FG 16-1g/16-1g-1. During the discussion, there are 3 alternatives mentioned by companies to solve the issue.

***Proposal for discussion:***

* ***Down-select one of the following alternatives for implicit BFD RS selection***
  + ***Alt1: Reuse the rule of RLM RS selection for BFD RS selection***
  + ***Alt2: BFD RS is selected based on the CORESET ID, where the CORESET with lowest ID is with higher priority***
  + ***Alt3: The BFD RS in FG 16-1g/16-1g-1 is always counted based on all CORESETs in the active BWP if the number of CORESETs is more than 2 and explicit BFD RS is not provided by RRC***

***TP 3-1 for Alt1***

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| 6 Link recovery procedures A UE can be provided, for each BWP of a serving cell, a set  of periodic CSI-RS resource configuration indexes by *failureDetectionResources* and a set  of periodic CSI-RS resource configuration indexes and/or SS/PBCH block indexes by *candidateBeamRSList* or *candidateBeamRSListExt* or *candidateBeamRSSCellList* for radio link quality measurements on the BWP of the serving cell. If the UE is not provided  by *failureDetectionResources* for a BWP of the serving cell, the UE determines the set  to include periodic CSI-RS resource configuration indexes with same values as the RS indexes in the RS sets indicated by *TCI-State* for respective CORESETs that the UE uses for monitoring PDCCH and, if there are two RS indexes in a TCI state, the set  includes RS indexes configured with *qcl-Type* set to 'typeD' for the corresponding TCI states. The UE expects the set  to include up to two RS indexes. If the UE is not provided  by *failureDetectionResources* for a BWP of the serving cell, the UE selects the CSI-RS provided for active TCI states for PDCCH receptions in CORESETs associated with the search space sets in an order from the shortest monitoring periodicity. If more than one CORESETs are associated with search space sets having same monitoring periodicity, the UE determines the order of the CORESET from the highest CORESET index as described in Clause 10.1. The UE expects single port RS in the set . The UE expects single-port or two-port CSI-RS with frequency density equal to 1 or 3 REs per RB in the set .  <unrelated part omitted> |

***TP 3-2 for Alt2***

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| 6 Link recovery procedures A UE can be provided, for each BWP of a serving cell, a set  of periodic CSI-RS resource configuration indexes by *failureDetectionResources* and a set  of periodic CSI-RS resource configuration indexes and/or SS/PBCH block indexes by *candidateBeamRSList* or *candidateBeamRSListExt* or *candidateBeamRSSCellList* for radio link quality measurements on the BWP of the serving cell. If the UE is not provided  by *failureDetectionResources* for a BWP of the serving cell, the UE determines the set  to include periodic CSI-RS resource configuration indexes with same values as the RS indexes in the RS sets indicated by *TCI-State* for respective CORESETs that the UE uses for monitoring PDCCH and, if there are two RS indexes in a TCI state, the set  includes RS indexes configured with *qcl-Type* set to 'typeD' for the corresponding TCI states. The UE expects the set  to include up to two RS indexes. If the UE is not provided  by *failureDetectionResources* for a BWP of the serving cell, the UE selects the CSI-RS provided for active TCI states for PDCCH receptions in CORESETs with the order of the CORESET from the lowest CORESET index as described in Clause 10.1. The UE expects single port RS in the set . The UE expects single-port or two-port CSI-RS with frequency density equal to 1 or 3 REs per RB in the set .  <unrelated part omitted> |

**Companies’ views and comments**

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| Company | View |
| Apple | We are open to Alt1 and Alt2.  Alt3 would cause the under-report issue for UE capability and Alt3 may not handle issues other than UE capability counting. For example, RAN4 defines scheduling restriction for BFD RS and other DL signal, but if the BFD RS is unknown, network has to always assume the scheduling restriction should be kept although UE does not monitor such BFD RS. |
| vivo | According to the discussion when number of BFD RS is determined, the understanding is to at most two RS would be configured for all the CORSETs. We would like to add Alt4.  Alt4: UE does not expect larger than 2 RS QCL-D’ed with configured CORESETs. |
| OPPO | The CSI-RS resources selected shall be periodic CSI-RS resource. So we prefer a revised Alt 2’:  **Alt2’: BFD RS is selected from CORESET with periodic CSI-RS as QCL-TypeD RS. If there are more than 2 CORESETs with periodic CSI-RS as QCL-TypeD, then BFD RS is selected based on the CORESET ID, where the CORESET with lowest ID is with higher priority** |
| LG | To our understanding, it is not a typical case to configure three different QCL type-D RSs with three different CORESETs in Rel-15, similarly as Vivo. We prefer Alt3(revised below) or Alt4 (provided by Vivo) to avoid NBC issue.   * + ***Alt3: The BFD RS in FG 16-1g/16-1g-1 is always counted based on all CORESETs in the active BWP if the total number of different QCL type-D RS resources of the CORESETs is more than 2 and explicit BFD RS is not provided by RRC*** |
| DOCOMO | Alt.4 is not acceptable for us, considering it would restrict gNB configuration.  Alt.1~3 are fine with us. We prefer Alt.2, because the lowest CORESET ID would used in most of cases for default beams of UL/DL in Rel.16. Our interested scenario in Rel.16 is default beam operation for UL/DL, so the lowest CORESET ID is more important. |
| Ericsson | It would seem natural to reuse the RLM rule (Alt1), since the UE performs that selection anyway. |
| Intel | Prefer Alt 1. Also OK with Alt 2. |
| Nokia | ***Alt1: Reuse the rule of RLM RS selection for BFD RS selection***  This rule has been already in rel15 spec so it is preferred that same rule would be used. Otherwise, the selected RS may be different for RLM and BFD in implicit configuration (we see no benefit in that). |
| Samsung | Alt1 or Alt2 is okay with us. |
| ZTE | We support Alt 2. Besides sharing the same comments as DOCOMO, we also think that Alt 1 is over-designed. |
| Huawei, HiSilicon | As Rel-16 has been frozen for over 1 year, we prefer not to add additional UE behavior, and we have concerns on Alt-1/2.  As UE FG 16-1g/16-1g-1 are still being discussed, which has some flexibility for re-interpretation, we support revised Alt-3 from LG. |
| Spreadtrum | We support Alt-4 added by VIVO or revised Alt-3 from LG. Alt1 and Alt2 will result in NBC. |
| Lenovo, MotM | We support revised Alt-3 from LG. |

# Possible Conclusion for PL-RS selection for Type2 CG-PUSCH

In R1-2103084, Apple proposes to clarify the PL-RS selection for Type2 CG-PUSCH. During the discussion, it seems all companies share the same understanding that interpretation 1 is more aligned with current specification, where the UE should keep using the same PL-RS indicated by SRI in the activating DCI, no matter whether the association between SRI and PL-RS is changed.

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| 7.1.1 UE behaviour <unrelated part omitted>  For a PUSCH transmission configured by *ConfiguredGrantConfig* that does not include *rrc-ConfiguredUplinkGrant*, the UE determines a RS resource index  from a value of *PUSCH-PathlossReferenceRS-Id* that is mapped to a SRI field value in a DCI format activating the PUSCH transmission. If the DCI format activating the PUSCH transmission does not include an SRI field, the UE determines a RS resource index  with a respective *PUSCH-PathlossReferenceRS-Id* value being equal to zero where the RS resource is either on serving cell or, if provided, on a serving cell indicated by a value of *pathlossReferenceLinking* |

***Possible Conclusion***

* ***The PL-RS for Type-2 CG-PUSCH is always based on the one indicated by SRI in activating DCI***

**Companies’ views and comments**

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| Company | View |
| vivo | Support as a conclusion. But we are expecting an optimized solution for this case in future. |
| OPPO | Support this conclusion. |
| LG | Ok with the proposed conclusion. |
| Ericsson | Support the conclusion – it is the natural interpretation of the spec. |
| Intel | Ok |
| Samsung | Support |
| ZTE | Support |
| CATT | Support. |
| Huawei, HiSilicon | Support |
| Spreadtrum | Support |
| Lenovo, MotM | Support |