**3GPP TSG- RAN WG1 Meeting #105-e R1-21xxxxx**

**e-Meeting, May 10th - 27th, 2021**

Agenda Item: 7.2.6

Source: Moderator (Apple Inc.)

Title: Summary of [105-e-NR-eMIMO-02] Email Discussion

Document for: Discussion/Decision

# Introduction

In this contribution, we provide a summary on 105-e-NR-eMIMO-02.

# MB.5 (E)

In R1-2105537, Huawei/HiSilicon propose a TP to avoid inconsistency between 38.331 and 38.214 with regard to time domain measurement restriction.

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| ***Reason for change:*** | The current specification has defined UE behavior for measurement restriction for L1-SINR. There is a conflict between the descriptions in TS 38.214 and 38.331. Specifically,  - In 38.214, the higher layer parameters *timeRestrictionForChannelMeasurements* and *timeRestrictionForInterferenceMeasurements* are considered as optional. Whether to apply measurement restriction for L1-SINR is determined based on whether the associated higher layer parameter is configured or not.  - In 38.331, the higher layer parameters *timeRestrictionForChannelMeasurements* and *timeRestrictionForInterferenceMeasurements* are mandatory to be present. The candidate values for the two parameters are ‘configured’ and ‘notConfigured’.  When *timeRestrictionForChannelMeasurements* or *timeRestrictionForInterferenceMeasurements* is configuredas “notConfigured”, if the UE determines whether to apply measurement restriction according to the description in 38.214, it may still be mist-interpreted as that the UE should apply measurement restriction, although the true intention of gNB is to disable measurement restriction. |
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| ***Summary of change:*** | Update the operating conditions for applying measurement restriction for L1-SINR in 38.214 to be aligned with signalling design in 38.331, i.e., from “is not configured with” to “the value of … is configured as ‘notConfigured’”, and from “is configured with” to “the value of … is configured as ‘configured’”. |
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| ***Consequences if not approved:*** | Inconsistency between 38.214 and 38.331. |

***Text Proposal for 38.214***

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| **5.2.1.4.4 L1-SINR Reporting**  < Unchanged parts are omitted >  When one or two resource settings are configured for L1-SINR measurement  - If the value of higher layer parameter *timeRestrictionForChannelMeasurements* in *CSI-ReportConfig* is configured as ‘notConfigured’, the UE shall derive the channel measurements for computing L1-SINR reported in uplink slot n based on only the SSB or NZP CSI-RS, no later than the CSI reference resource, (defined in TS 38.211[4]) associated with the CSI resource setting.  - If the value of higher layer parameter *timeRestrictionForChannelMeasurements* in *CSI-ReportConfig* is configured as ‘configured’, the UE shall derive the channel measurements for computing L1-SINR reported in uplink slot n based on only the most recent, no later than the CSI reference resource, occasion of SSB or NZP CSI-RS (defined in [4, TS 38.211]) associated with the CSI resource setting.  - If the value of higher layer parameter *timeRestrictionForInterferenceMeasurements* in *CSI-ReportConfig* is configured as ‘notConfigured’, the UE shall derive the interference measurements for computing L1-SINR reported in uplink slot n based on only the CSI-IM or NZP CSI-RS for interference measurement (defined in [4, TS 38.211]) or NZP CSI-RS for channel and interference measurement no later than the CSI reference resource associated with the CSI resource setting.  - If the value of higher layer parameter *timeRestrictionForInterferenceMeasurements* in *CSI-ReportConfig* is configured as ‘configured’, the UE shall derive the interference measurements for computing the L1-SINR reported in uplink slot n based on the most recent, no later than the CSI reference resource, occasion of CSI-IM or NZP CSI-RS for interference measurement (defined in [4, TS 38.211]) or NZP CSI-RS for channel and interference measurement associated with the CSI resource setting.  < Unchanged parts are omitted > |

**Companies’ view and comments**

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| Company | Comments |
| vivo | Fine with the alignment. |
| ZTE | Support |
| OPPO | Ok |
| Samsung | Support |
| DOCOMO | Ok |
| Spreadtrum | Fine |
| Nokia | Indeed, this is a good catch, this unfortunate change appears in other places also and we should make the changes consistent! Moreover, this needs to change in Rel15 also (L1-RSRP and CQI related), editor can provide changes there as well. We propose the following:  < Unchanged parts are omitted > 5.2.1.4.3 L1-RSRP Reporting < Unchanged parts are omitted >  If the higher layer parameter *timeRestrictionForChannelMeasurements* in *CSI-ReportConfig* is set to *‘notConfigured’*, the UE shall derive the channel measurements for computing L1-RSRP value reported in uplink slot *n* based on only the SS/PBCH or NZP CSI-RS, no later than the CSI reference resource, (defined in TS 38.211[4]) associated with the CSI resource setting.  If the higher layer parameter *timeRestrictionForChannelMeasurements* in *CSI-ReportConfig* is set to *‘configured’*, the UE shall derive the channel measurements for computing L1-RSRP reported in uplink slot *n* based on only the most recent, no later than the CSI reference resource, occasion of SS/PBCH or NZP CSI-RS (defined in [4, TS 38.211]) associated with the CSI resource setting.  < Unchanged parts are omitted > 5.2.1.4.4 L1-SINR Reporting < Unchanged parts are omitted >  When one or two resource settings are configured for L1-SINR measurement  - If the higher layer parameter *timeRestrictionForChannelMeasurements* in *CSI-ReportConfig* is set to *‘notConfigured’*, the UE shall derive the channel measurements for computing L1-SINR reported in uplink slot n based on only the SSB or NZP CSI-RS, no later than the CSI reference resource, (defined in TS 38.211[4]) associated with the CSI resource setting.  - If the higher layer parameter *timeRestrictionForChannelMeasurements* in *CSI-ReportConfig* is set to *‘configured’*, the UE shall derive the channel measurements for computing L1-SINR reported in uplink slot n based on only the most recent, no later than the CSI reference resource, occasion of SSB or NZP CSI-RS (defined in [4, TS 38.211]) associated with the CSI resource setting.  - If the higher layer parameter *timeRestrictionForInterferenceMeasurements* in *CSI-ReportConfig* is set to *‘notConfigured’*, the UE shall derive the interference measurements for computing L1-SINR reported in uplink slot n based on only the CSI-IM or NZP CSI-RS for interference measurement (defined in [4, TS 38.211]) or NZP CSI-RS for channel and interference measurement no later than the CSI reference resource associated with the CSI resource setting.  - If the higher layer parameter *timeRestrictionForInterferenceMeasurements* in *CSI-ReportConfig* is set to *‘configured’*, the UE shall derive the interference measurements for computing the L1-SINR reported in uplink slot n based on the most recent, no later than the CSI reference resource, occasion of CSI-IM or NZP CSI-RS for interference measurement (defined in [4, TS 38.211]) or NZP CSI-RS for channel and interference measurement associated with the CSI resource setting.  < Unchanged parts are omitted > 5.2.2.1 Channel quality indicator (CQI) The CQI indices and their interpretations are given in Table 5.2.2.1-2 or Table 5.2.2.1-4 for reporting CQI based on QPSK, 16QAM and 64QAM. The CQI indices and their interpretations are given in Table 5.2.2.1-3 for reporting CQI based on QPSK, 16QAM, 64QAM and 256QAM.  Based on an unrestricted observation interval in time unless specified otherwise in this Clause, and an unrestricted observation interval in frequency, the UE shall derive for each CQI value reported in uplink slot *n* the highest CQI index which satisfies the following condition:  - A single PDSCH transport block with a combination of modulation scheme, target code rate and transport block size corresponding to the CQI index, and occupying a group of downlink physical resource blocks termed the CSI reference resource, could be received with a transport block error probability not exceeding:  - 0.1, if the higher layer parameter *cqi-Table* in *CSI-ReportConfig* configures 'table1' (corresponding to Table 5.2.2.1-2), or 'table2' (corresponding to Table 5.2.2.1-3), or  - 0.00001, if the higher layer parameter *cqi-Table* in *CSI-ReportConfig* configures 'table3' (corresponding to Table 5.2.2.1-4).  If the higher layer parameter *timeRestrictionForChannelMeasurements* in *CSI-ReportConfig* is set to *‘notConfigured’*, the UE shall derive the channel measurements for computing CSI value reported in uplink slot *n* based on only the NZP CSI-RS, no later than the CSI reference resource, (defined in TS 38.211[4]) associated with the CSI resource setting.  If the higher layer parameter *timeRestrictionForChannelMeasurements* in*CSI-ReportConfig* is set to *‘configured’*, the UE shall derive the channel measurements for computing CSI reported in uplink slot *n* based on only the most recent, no later than the CSI reference resource, occasion of NZP CSI-RS (defined in [4, TS 38.211]) associated with the CSI resource setting.  If a UE is not configured with higher layer parameter *timeRestrictionForInterferenceMeasurements*, the UE shall derive the interference measurements for computing CSI value reported in uplink slot *n* based on only the CSI-IM and/or NZP CSI-RS for interference measurement no later than the CSI reference resource associated with the CSI resource setting.  < Unchanged parts are omitted > |
| Ericsson | Support.  Support to fix the RSRP and CQI issue in this thread, according to Nokia’s proposal. |
| Huawei, HiSilicon | Support |
| Qualcomm | Support. Where to discuss RSRP/CQI issue can be decided by two FLs |
| Intel | Support |
| LG | OK. Also fine with Nokia’s TP. |

# MB.4 (ND)

In R1-2104582, ZTE proposes to update CORESETPoolIndex after BFR.

***Justification***

The QCL assumption of all CORESETs on a beam failure SCell is determined according to *qnew* reported by the UE. Consequently, in such case, all CORESETs on the beam failure SCell(s) can only be transmitted by a single TRP, and it is straightforward that M-TRP transmission with two *CORESETPoolIndex* values does NOT work after BFR procedure is completed. Therefore, a fall back mechanism from M-TRP to S-TRP for SCell is required in Rel-16 based on the following analysis.

* After SCell-BFR is completed, there is no need for UE to keep tracking two *CORESETPoolIndex* values, and the UE power consumption can be saved significantly.
* Otherwise, if going with current spec, both features of SCell BFR and mDCI-mTRP can NOT be performed well in a given UE. In other words, it may reduce the motivation/possibility of both gNB and UE vendors to deploy these two useful features together.

To achieve this, a straightforward solution is to set *CORESETPoolIndex* of all CORESETs of the failed SCell(s) as 0 by default in the spec.

***Text Proposal for 38.213***

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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, and assumes the *CORESETPoolIndex*, if configured, of all CORESETs on the SCell(s) as 0.  **<Unchanged part is omitted>** |

***FL proposal***

As the discussion is to make a conclusion (ND issue), a conclusion is expected. From companies’ comments from the preparation phase, the following alternatives are provided. There are some comments that this is an optimization, and other comments that BFR+mTRP should be a Rel-17 feature. In addition, I added original proposal as Alt1, but I am not sure whether Alt1 is still valid since this is a ND issue.

**Possible conclusion**

* **Alt1: For mDCI based mTRP, UE automatically update *CORESETPoolIndex* to be 0 after 28 symbols after receiving beam failure recovery response** 
  + **Endorse the TP in R1-2104582**
* **Alt2: For mDCI based mTRP, UE does not automatically update *CORESETPoolIndex* after receiving beam failure recovery response** 
  + **No spec change is needed**
* **Alt3: Rel-16 does not support concurrent configuration of BFR and mDCI based mTRP in the same BWP**
* **Alt4: Other (Please provide details)**

**Companies’ view and comments**

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| Company | Comments |
| vivo | Alt3 seems the cleanest solution.  Alt1 might be too late to introduce.  We are also ok with Alt2 with network implementation to handle the issue. |
| ZTE | Alt-1 is preferred, considering that it is only an efficient scheme for configuring both BFR and mDCI based mTRP. |
| OPPO | Support Alt2.  We do not think spec change is needed and the system implementation can deal with it. |
| Samsung | Support Alt.2. No specification change is needed for this issue. |
| DOCOMO | We support Alt2.  We do not see any problem of Rel-16 spec. gNB implementation can avoid this issue. For example, gNB configures BFD-RS and NBI-RS associated with the 1st TRP. So that after BFR, UE can monitor/detect PDCCH with new beam from the 1st TRP. And gNB can re-configure the CORESET configurations. It does not matter whether UE can monitor a PDCCH from the CORESETs associated with the 2nd TRP (CORESETPoolIndex=1). |
| Spreadtrum | Support Alt.2. No specification change is needed for this issue, we believe gNB can handle it. |
| Nokia | Alt2. No spec change needed. |
| Ericsson | Alt 2. No spec change. Alt1 would require that the UE changes its RRC configuration which is not allowed. |
| Huawei, HiSilicon | Alt 2 |
| Qualcomm | Support Alt1. Otherwise, CORESETs on TRP #1 cannot be recovered. If all BFD RSs are configured for TRP #0, then BFR may be unnecessarily triggered even if TRP #1 is still working. So ideally BFD RSs should be configured for both TRPs. |
| Intel | Alt. 2 |
| LG | Alt2. This can be handled by gNB implementation. |

# MT.8

In R1-2104651, Qualcomm proposes to update the default PDSCH beam.

**Reason for change:** In current spec, there is no way for UE and gNB to communicate with default beam after BFR in the case of single-DCI based mTRP.

**Summary of change:** Resetting the default beam by resetting all TCI codepoints to the new identified beam.

**Consequences if not approved:** gNB and UE cannot communicate with default beam after BFR in the case of single-DCI based mTRP.

***Text Proposal for 38.213***

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| --Unchanged part omitted------------------------  For the PCell or the PSCell, after 28 symbols from a last symbol of a first PDCCH reception in a search space set provided by *recoverySearchSpaceId* where a UE detects a DCI format with CRC scrambled by C-RNTI or MCS-C-RNTI, the UE assumes same antenna port quasi-collocation parameters as the ones associated with index  for PDCCH monitoring in a CORESET with index 0, and if at least one TCI codepoint indicates two TCI states and UE is configured with *enableTwoDefaultTCIStates*, the UE assumes all TCI codepoints indicate same antenna port quasi-collocation parameters as the ones associated with index .  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  - If at least one TCI codepoint indicates two TCI states and UE is configured with *enableTwoDefaultTCIStates* on the SCell(s) indicated by the MAC CE, the UE assumes all TCI codepoints indicate same antenna port quasi-collocation parameters as the ones associated with the corresponding index(es) , if any. |

***FL proposal***

As the discussion is to make a conclusion (ND issue), the following possible conclusion is proposed based on the comments from preparation phase. Similar to MB.4, I am not sure whether Alt1 is still valid since it is an ND issue.

**Possible conclusion**

* **Alt1: For single-DCI based multi-TRP mode, UE resets the default PDSCH beam based on newly identified beam after 28 symbols after receiving beam failure recovery response**
  + **Endorse TP in R1-2104651**
* **Alt 2: For single-DCI based multi-TRP mode, UE does not automatically update default PDSCH beam after receiving beam failure recovery response**
  + **No spec change is needed**
* **Alt3: Other (Please provide details)**

**Companies’ view and comments**

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| Company | Comments |
| OPPO | Support Alt2  In our view, that is not a problem. The system can operate normally without any trouble  In PCell: the PDSCH scheduled by the CORESET-BFR follows the qnew.  In SCell, the system can schedule PDSCH with scheduling offset >= the threshold. Or the system can use PCell or other SCell to transmit beam update or switch MAC CE to update the TCI state of the failed SCell.  Furthermore, the PDSCH has HARQ re-transmission and one failed PDSCH transmission instance can always be picked up by following up re-transmission as long as the beam of PDCCH is reset, which is done per the current spec. That is also one reason why PDSCH beam is not part of beam failure recovery function. |
| Samsung | Support Alt.2. It seems that specification change is not needed. |
| DOCOMO | We support Alt 2.  This issue is not essential.  After BFR, gNB can send DCI format 1\_0 to schedule a PDSCH with a default beam to re-configure/update the beam configurations of PDCCH/PDSCH for UE. gNB does not need to send DCI format 1\_1/1\_2 for PDSCH scheduling, hence, the enhancement is not needed. |
| Spreadtrum | Support Alt.2. This issue is not essential. |
| Nokia | Alt.2 |
| Ericsson | Alt.1: in our view, this is the only reasonable solution, and we hope that UEs implement it like that in any case.  But this issue has been discussed for the sTRP case several times already. |
| Huawei, HiSilicon | Alt 2 |
| Qualcomm | Support Alt1. Otherwise, the default beam cannot work in case of sDCI mTRP. |
| Intel | Alt 1 |
| LG | Alt 2. There are implementation based solutions as commented by OPPO and DOCOMO to update TCI states. |
| ZTE | In technical, only TCI codepoint(s) with two states need to be updated rather than all of TCI codepoint(s). If so, we can support Alt-1. |