**3GPP TSG RAN WG1 #100b R1-2xxxxxx**

**e-Meeting, April 20th – 30th, 2020**

Agenda Item: 7.2.6.3

Source: Moderator (Apple)

Title: Draft TP on Email Thread [100b-e-NR-eMIMO-MB2-01]

Document for: Discussion/Decision

# Introduction

In this contribution, we provide draft TPs for email thread [100b-e-NR-eMIMO-MB2-01].

# Details for each TP

## Clarification on 2 port CMR

Reason for changes

In the last meeting [6], for L1-SINR, port and density restrictions are removed for NZP CMR if NZP IMR is configured, i.e., two resource settings are configured for L1-SINR. However, in TS 38.215, for CSI-SINR determination CSI reference signals transmitted on antenna port 3000 shall be used. Therefore, alignment is needed to allow all configured ports to be used for L1-SINR computation.

When 2 ports CSI-RS is configured as the CMR, the measured L1-SINR is based on the linear average power from the 2 ports.

Summary of changes

Remove restriction on port 3000 for L1-SINR in TS 38.215.

When 2 ports CSI-RS is configured as the CMR, the measured L1-SINR is based on the linear average power from the 2 ports.

Consequences if not approved

Only one port is used for NZP CMR for L1-SINR. Misalignment between TS 38.214 and TS 38.215.

When 2 ports CSI-RS is configured as the CMR, the measured L1-SINR is unclear.

### **TP 3.1-1 for 38.215**

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| < Start of text proposal on TS 38.215 v16.1.0 Section 5.1.6>  < Unchanged parts are omitted >  For CSI-SINR determination CSI reference signals transmitted on antenna port 3000 according to TS 38.211 [4] shall be used. If CSI-SINR is used for L1-SINR, CSI reference signals transmitted on all configured antenna ports can be used for CSI-SINR determination.  < Unchanged parts are omitted >  < End of text proposal on TS 38.215 v16.1.0 Section 5.1.6> |

### **TP 3.1-2 for 38.215**

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| 5.1.6 CSI signal-to-noise and interference ratio (CSI-SINR) CSI signal-to-noise and interference ratio (CSI-SINR), is defined as the linear average over the power contribution (in [W]) of the resource elements of the antenna port(s) carrying CSI reference signals divided by the linear average of the noise and interference power contribution (in [W]). If CSI-SINR is used for L1-SINR reporting with dedicated interference measurement resources, the interference and noise is measured over resource(s) indicated by higher layers as described in TS 38.214 [6]. Otherwise, the interference and noise are measured over the resource elements carrying CSI reference signals reference signals within the same frequency bandwidth. |

**Companies view and comments**

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| Company | Comments |
| CMCC | **Support** |
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## Clarification on group based L1-SINR report

Reason for changes

To implement the following agreement, some editorial changes on differential L1-SINR report should be clarified, and the clarification of bracket on UE behaviors for group based L1-SINR reprot should be clarified.

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| Agreement in RAN1#98  Support gNB to configure L1-SINR based beam report for both non-group based and group based beam reporting. |

Summary of changes

* CSI-RS and/or SSB resources reported in a single reporting instance of the group based reporting can be received simultaneously by the UE either with a single spatial domain receive filter, or with multiple simultaneous spatial domain receive filters.
* Differential L1-SINR is applied to the group based L1-SINR reporting.

Consequences if not approved

Report content and UE behaviours for group based L1-SINR report is unclear.

### **TP 3.2-1 for 38.214 section 5.2.1.4.2**

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| If the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'cri-SINR' or 'ssb-Index-SINR',  - if the UE is configured with the higher layer parameter *groupBasedBeamReporting* set to 'disabled', the UE shall report in a single report *nrofReportedRSForSINR* (higher layer configured) different CRI or SSBRI for each report setting.  - if the UE is configured with the higher layer parameter *groupBasedBeamReporting* set to 'enabled', the UE shall report in a single reporting instance two different CRI or SSBRI for each report setting, where CSI-RS and/or SSB resources can be received simultaneously by the UE either with a single spatial domain receive filter, or with multiple simultaneous spatial domain receive filters. |

### **TP 3.2-2 for 38.214 section 5.2.1.4.4**

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| For L1-SINR reporting, if the higher layer parameter nrofReportedRSForSINR in CSI-ReportConfig is configured to be one, the reported L1-SINR value is defined by a 7-bit value in the range [-23, 40] dB with 0.5 dB step size, and if the higher layer parameter nrofReportedRSForSINR is configured to be larger than one, or if the higher layer parameter *groupBasedBeamReporting* is configured as 'enabled', the UE shall use differential L1-SINR based reporting, where the largest measured value of L1-SINR is quantized to a 7-bit value in the range [-23, 40] dB with 0.5 dB step size, and the differential L1-SINR is quantized to a 4-bit value. The differential L1-SINR is computed with 1 dB step size with a reference to the largest measured L1-SINR value which is part of the same L1-SINR reporting instance. |

**Companies view and comments**

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| Company | Comments |
| CATT | For TP-3.2-1,   * The first change is fine. * Need of the second change is not clear. The description on UE receive panels doesn’t add any value to the specification as it does not add any restriction to UE behavior, nor provides any value to NW on how to interpret UE antenna architecture. “Received simultaneously”, although currently in the spec, does not add value to the spec either and is vague. A radio signal arriving at a receiver branch can certainly be always received (shall the UE chooses to), no matter how strong/weak the strength is. If the language is intended to put a threshold to the signal strength, then this should be made clear, but it would also result in more RAN1/RAN2/RAN4 spec work. At this moment it’s need is not clear to us. |
| CMCC | For TP 3.2-1, the change in first bullet is fine. The change in second bullet should be further clarified whether all of the CMR and IMR in the group can be received simultaneously by the UE. A modified TP is provided as follows:   |  | | --- | | - if the UE is configured with the higher layer parameter *groupBasedBeamReporting* set to 'enabled', the UE shall report in a single reporting instance two different CRI or SSBRI for each report setting, where CSI-RS and/or SSB resources for channel measurements can be received simultaneously by the UE either with a single spatial domain receive filter, or with multiple simultaneous spatial domain receive filters, and CSI-RS and/or SSB resources for interference measurements can be received simultaneously by the UE either with a single spatial domain receive filter, or with multiple simultaneous spatial domain receive filters. |   For TP 3.2-2: Support. |

## Editorial Correction of L1-SINR measurement and report

Reason for changes

For L1-RSRP the mapping of the CRI and SSBRI to the configured NZP CSI-RS or SSB resource IDs are performed according to the configuration order of the corresponding resources in the resource set. Such definition of the mapping, however, doesn’t exists for L1-SINR and should be clarified similar to L1-RSRP case.

In addition, the L1-SINR measurment should be with wideband granularity.

Further, there should be no QCL-typeD assumption of SSB.

Summary of changes

Definition of mapping of CRI and SSBRI to the configured NZP CSI-RS or SSBs for L1-SINR measuremernt. L1-SINR measurement is with wideband granularity.

Consequences if not approved

Mapping of CRI/SSBRI to the configured NZP CSI-RS or SSB for L1-SINR measurement is unclear. Whether L1-SINR measurement is wideband or subband is unclear.

### **TP 3.3-1 for 38.214**

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| 5.2.1.4.2 Report Quantity Configurations …  If the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'cri-RSRP', 'cri-RI-PMI-CQI ', 'cri-RI-i1', 'cri-RI-i1-CQI', 'cri-RI-CQI' or 'cri-RI-LI-PMI-CQI', or 'cri-SINR', and resources are configured in the corresponding resource set for channel measurement, then the UE shall derive the CSI parameters other than CRI conditioned on the reported CRI, where CRI *k* (*k* ≥ 0) corresponds to the configured (*k*+1)-th entry of associated *nzp-CSI-RSResource* in the corresponding *nzp-CSI-RS-ResourceSet* for channel measurement, and (*k*+1)-th entry of associated *csi-IM-Resource* in the corresponding *csi-IM-ResourceSet* (if configured) or (*k*+1)-th entry of associated *nzp-CSI-RSResource* in the corresponding *nzp-CSI-RS-ResourceSet* (if configured) for interference measurement. If CSI-RS resources are configured, each resource shall contain at most 16 CSI-RS ports. If CSI-RS resources are configured, each resource shall contain at most 8 CSI-RS ports.  If the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'ssb-Index-RSRP', the UE shall report SSBRI, where SSBRI *k* (*k* ≥ 0) corresponds to the configured (*k*+1)-th entry of the associated *csi-SSB-ResourceList* in the corresponding *CSI-SSB-ResourceSet.*  If the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'ssb-Index-SINR', the UE shall derive L1-SINR conditioned on the reported SSBRI, where SSBRI *k* (*k* ≥ 0) corresponds to the configured (*k*+1)-th entry of the associated *csi-SSB-ResourceList* in the corresponding *CSI-SSB-ResourceSet* for channel measurement, and (*k*+1)-th entry of associated *csi-IM-Resource* in the corresponding *csi-IM-ResourceSet* (if configured) or (*k*+1)-th entry of associated *nzp-CSI-RSResource* in the corresponding *nzp-CSI-RS-ResourceSet* (if configured) for interference measurement.  If the UE is configured with a *CSI-ReportConfig* with the higher layer parameter *reportQuantity* set to 'cri-RI-PMI-CQI', ' cri-RI-i1', 'cri-RI-i1-CQI', 'cri-RI-CQI' or 'cri-RI-LI-PMI-CQI', then the UE is not expected to be configured with more than 8 CSI-RS resources in a CSI-RS resource set contained within a resource setting that is linked to the *CSI-ReportConfig*.  If the UE is configured with a *CSI-ReportConfig* with higher layer parameter *reportQuantity* set to 'cri-RSRP' or 'none' and the *CSI-ReportConfig* is linked to a resource setting configured with the higher layer parameter *resourceType* set to 'aperiodic', then the UE is not expected to be configured with more than 16 CSI-RS resources in a CSI-RS resource set contained within the resource setting.  … |

### **TP 3.3-2 for 38.214**

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| 5.2.1.4 Reporting configurations A CSI Reporting Setting is said to have a wideband frequency-granularity if  - *reportQuantity* is set to 'cri-RI-PMI-CQI', or 'cri-RI-LI-PMI-CQI', *cqi-FormatIndicator* is set to 'widebandCQI' and *pmi-FormatIndicator* is set to 'widebandPMI', or  - *reportQuantity* is set to 'cri-RI-i1' or  - *reportQuantity* is set to 'cri-RI-CQI' or 'cri-RI-i1-CQI' and *cqi-FormatIndicator* is set to 'widebandCQI', or  - *reportQuantity* is set to 'cri-RSRP' or 'ssb-Index-RSRP' or 'cri-SINR', or 'ssb-Index-SINR' |

**Companies view and comments**

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| Company | Comments |
| CATT | **Support.** |
| CMCC | **Support** |

## Editorial Correction on resource setting

Reason for changes

According to TS 38.214, the interference measurements based on NZP CSI-RS are used for both CSI and L1‑SINR reporting. However, the conditions of NZP CSI-RS configurations are different. More specifically, when NZP CSI-RS is used for CSI, UE does not expect to be configured with more than one NZP CSI-RS resource in the associated resource set within the resource setting for channel measurement. In contrast, according to Rel-16 agreement for L1-SINR, more than one NZP CSI-RS resource can be used for channel measurements when NZP CSI-RS is configured as interference measurement resource.

It is, therefore, necessarily to limit the existing restriction to CSI measurements except for L1-SINR. In addition, the constraint on the number of NZP CSI-RS ports across all NZP CSI-RS resource for interference measurements should be also revisited to allow large values.

Further, L1-SINR should also support periodic, semi-persistent, and aperiodic report.

In addition, in 5.2.1.2 of TS 38.214, texts were added with regards to resource setting for L1-SINR based on agreements in Rel-16 including QCL-D assumption for L1-SINR report. As the QCL-D assumption for IMR for L1-SINR is different from the QCL-D assumption for other CSI reports specified in Rel-15, the texts from Rel-15 specification need to be modified to exclude the case of L1-SINR report to avoid any confusion.

Summary of changes

Specify the restriction of no more than 1 NZP IMR is only applicable for CSI measurement, and the restriciton of no more than 18 ports is for CSI measurement.

L1-SINR should also support periodic, semi-persistent, and aperiodic report.

Clarification of QCL-TypeD assumption for IMR.

Consequences if not approved

The restriction of no more than 1 NZP IMR and no more than 18 ports is for CSI measurement would be applicable for L1-SINR.

It is unclear whether L1-SINR should also support periodic, semi-persistent, and aperiodic report.

QCL-TypeD assumption for IMR is unclear.

### **TP 3.4-1 for 38.214**

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| 5.2.1.4.1 Resource Setting configuration  < Unchanged parts are omitted >  Except for L1-SINR, ~~If~~ if interference measurement is performed on NZP CSI-RS, a UE does not expect to be configured with more than one NZP CSI-RS resource in the associated resource set within the resource setting for channel measurement. Except for L1-SINR, ~~The~~ the UE configured with the higher layer parameter *nzp-CSI-RS-ResourcesForInterference* may expect no more than 18 NZP CSI-RS ports configured in a NZP CSI-RS resource set.  < Unchanged parts are omitted > |

### **TP 3.4-2 for 38.214**

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| TS38.214: 5.2.1.4.1 Resource Setting configuration  -----Start TP-----  For aperiodic CSI, each trigger state configured using the higher layer parameter *CSI-AperiodicTriggerState* is associated with one or multiple *CSI-ReportConfig* where each *CSI-ReportConfig* is linked to periodic, or semi-persistent, or aperiodic resource setting(s):  - When one Resource Setting is configured, the Resource Setting (given by higher layer parameter resourcesForChannelMeasurement) is for channel measurement for L1-RSRP or for channel and interference measurement for L1-SINR computation.   * When two Resource Settings are configured, the first one Resource Setting (given by higher layer parameter *resourcesForChannelMeasurement*) is for channel measurement and the second one (given by either higher layer parameter *csi-IM-ResourcesForInterference* or higher layer parameter *nzp-CSI-RS-ResourcesForInterference*) is for interference measurement performed on CSI-IM or on NZP CSI-RS. * When three Resource Settings are configured, the first Resource Setting (higher layer parameter *resourcesForChannelMeasurement*) is for channel measurement, the second one (given by higher layer parameter *csi-IM-ResourcesForInterference*) is for CSI-IM based interference measurement and the third one (given by higher layer parameter *nzp-CSI-RS-ResourcesForInterference*) is for NZP CSI-RS based interference measurement.   For semi-persistent or periodic CSI, each *CSI-ReportConfig* is linked to periodic or semi-persistent Resource Setting(s):  - When one Resource Setting (given by higher layer parameter *resourcesForChannelMeasurement*) is configured, the Resource Setting is for channel measurement for L1-RSRP or for channel and interference measurement for L1-SINR computation.   * When two Resource Settings are configured, the first Resource Setting (given by higher layer parameter *resourcesForChannelMeasurement*) is for channel measurement and the second Resource Setting (given by higher layer parameter *csi-IM-ResourcesForInterference or higher layer parameter nzp-CSI-RS-ResourceForInterference*) is used for interference measurement performed on CSI-IM or on NZP CSI-RS.   -----End TP------ |

### **TP 3.4-3 for 38.214**

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| 5.2.1.2 Resource settings  Each CSI Resource Setting *CSI-ResourceConfig* contains a configuration of a list of S≥1 CSI Resource Sets (given by higher layer parameter *csi-RS-ResourceSetList*), where the list is comprised of references to either or both of NZP CSI-RS resource set(s) and SS/PBCH block set(s) or the list is comprised of references to CSI-IM resource set(s). Each CSI Resource Setting is located in the DL BWP identified by the higher layer parameter *BWP-id*, and all CSI Resource Settings linked to a CSI Report Setting have the same DL BWP.  The time domain behavior of the CSI-RS resources within a CSI Resource Setting are indicated by the higher layer parameter *resourceType* and can be set to aperiodic, periodic, or semi-persistent. For periodic and semi-persistent CSI Resource Settings, the number of CSI-RS Resource Sets configured is limited to S=1. For periodic and semi-persistent CSI Resource Settings, the configured periodicity and slot offset is given in the numerology of its associated DL BWP, as given by *BWP-id.* When a UE is configured with multiple *CSI-ResourceConfigs* consisting the same NZP CSI-RS resource ID, the same time domain behavior shall be configured for the *CSI-ResourceConfigs*. When a UE is configured with multiple *CSI-ResourceConfigs* consisting the same CSI-IM resource ID, the same time-domain behavior shall be configured for the *CSI-ResourceConfigs*. All CSI Resource Settings linked to a CSI Report Setting shall have the same time domain behavior.  The following are configured via higher layer signaling for one or more CSI Resource Settings for channel and interference measurement:  - CSI-IM resource for interference measurement as described in Clause 5.2.2.4.  - NZP CSI-RS resource for interference measurement as described in Clause 5.2.2.3.1.  - NZP CSI-RS resource for channel measurement as described in Clause 5.2.2.3.1.  The UE may assume that the NZP CSI-RS resource(s) for channel measurement and the CSI-IM resource(s) for interference measurement configured for one CSI reporting are resource-wise QCLed with respect to 'QCL-TypeD'. When NZP CSI-RS resource(s) is used for interference measurement, the UE may assume that the NZP CSI-RS resource for channel measurement and the CSI- IM resource or NZP CSI-RS resource(s) for interference measurement configured for one CSI reporting are QCLed with respect to 'QCL-TypeD' except when it is for L1-SINR report. |

### **TP 3.4-4 for 38.214 section 5.2.1.2**

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| For L1-SINR measurement:  - When one Resource Setting is configured, the Resource Setting (given by higher layer parameter *resourcesForChannelMeasurement*) is for channel and interference measurement for L1-SINR computation. UE may assume that same 1 port NZP CSI-RS resource(s) with density 3 REs/RB is used for both channel and interference measurements.  - When two Resource Settings are configured, the first one Resource Setting (given by higher layer parameter *resourcesForChannelMeasurement*) is for channel measurement on SSB or NZP CSI-RS and the second one (given by either higher layer parameter *csi-IM-ResourcesForInterference* or higher layer parameter *nzp-CSI-RS-ResourcesForInterference*) is for interference measurement performed on CSI-IM or on 1 port NZP CSI-RS with density 3 REs/RB, where each SSB or NZP CSI-RS resource for channel measurement is associated with one CSI-IM resource or one NZP CSI-RS resource for interference measurement by the ordering of the SSB or NZP CSI-RS resource for channel measurement and CSI-IM resource or NZP CSI-RS resource for interference measurement in the corresponding resource sets. The number of SSB(s) or CSI-RS resources for channel measurement equals to the number of CSI-IM resources or the number of NZP CSI-RS resource for interference measurement.  - UE may apply the assumption that the CSI-IM resource or NZP CSI-RS resource for interference measurement is quasi co-located with the associated SSB, if any, configured for one CSI reporting with respect to 'QCL-TypeD'  - UE may apply 'QCL-TypeD' configured to the NZP CSI-RS resource for channel measurement, if any, to measure the associated CSI- IM resource or associated NZP CSI-RS resource for interference measurement configured for one CSI reporting  - UE may expect that the NZP CSI-RS resource set for channel measurement and the NZP-CSI-RS resource set for interference measurement, if any, are configured with the higher layer parameter *repetition*. |

**Companies view and comments**

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| Company | Comments |
| CATT | Fine with TP 3.4-1, 3.4-2  TP 3.4-3 is not immediately clear to us. Clarification is appreciated.  TP-3.4-4, the “if any” restriction for SSB does not seem to be necessary. |
| CMCC | Support |

## Editorial Correction on maximum number of resources for L1-SINR measurement

Reason for changes

According to the agreement, it should be clarified that the maximum number of CSI-RS resource sets configured for a UE is 16, and the maximum number of resources over all resource settings for L1-SINR computation is 128 when CMR and IMR are both configured

Summary of changes

Clarified that the maximum number of CSI-RS resource sets configured for a UE is 16, and the maximum number of resources over all resource settings for L1-SINR computation is 128 when CMR and IMR are both configured.

Consequences if not approved

Maximum number of CSI-RS resource sets configured for a UE and the maximum number of resources over all resource settings for L1-SINR computation are unclear when CMR and IMR are both configured.

### **TP 3.5-1 for 38.214**

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| TS38.214: 5.2.1.4.4 L1-SINR Reporting  -----Start TP-----  For L1-SINR computation, for channel measurement the UE may be configured with NZP CSI-RS resources and/or SS/PBCH Block resources, for interference measurement the UE may be configured with NZP CSI-RS or CSI-IM resources.  - for channel measurement, the UE may be configured with CSI-RS resource setting with up to 16 resource sets, with a total of up to 64 CSI-RS resources or up to 64 SS/PBCH Block resources.  - for interference measurement, the number of CSI-IM resources or the number of NZP CSI-RS resources equals to the number of SSB(s) or CSI-RS resources for channel measurement.  -----End TP----- |

### **TP 3.5-2 for 38.214**

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| 5.2.1.4.1 Resource Setting Configuration  […]  A UE is not expected to be configured with more than one CSI-RS resource in resource set for channel measurement for a *CSI-ReportConfig* with the higher layer parameter *codebookType* set to either 'typeII', 'typeII-PortSelection', ‘typeII-r16’ or to ‘typeII-PortSelection-r16’. A UE is not expected to be configured with more than 64 NZP CSI-RS resources in resource setting for channel measurement for a CSI-ReportConfig with the higher layer parameter *reportQuantity* set to 'none', 'cri-RI-CQI', 'cri-RSRP', ~~or~~ 'ssb-Index-RSRP' or ‘cri-SINR’. If interference measurement is performed on CSI-IM, each CSI-RS resource for channel measurement is resource-wise associated with a CSI-IM resource by the ordering of the CSI-RS resource and CSI-IM resource in the corresponding resource sets. The number of CSI-RS resources for channel measurement equals to the number of CSI-IM resources.  […] |

**Companies view and comments**

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| Company | Comments |
| CATT | **Support** |
| CMCC | **Support** |