**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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## 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#98Support 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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## 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 $K\_{s}>1 $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 $K\_{s}=2 $CSI-RS resources are configured, each resource shall contain at most 16 CSI-RS ports. If $2<K\_{s}\leq 8 $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 configurationsA 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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## 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 settingsEach 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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## 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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