**3GPP TSG RAN WG1 #122 R1-2505535**

**Bengaluru, India, Aug 25th – 29th, 2025**

**Agenda item:** 8.2.2

**Source:** Moderator (Samsung)

**Title:** Moderator Summary#1 on Rel-19 CSI enhancements: Round 1

**Document for:** Discussion and Decision

## Introduction

The scope given in the Rel-19 NR MIMO Phase 5 WID pertaining to CSI enhancement is as follows (2d added in [1]):

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| 1. Specify CSI support for up to 128 CSI-RS ports, targeting FR1
	1. Type-I codebook refinement supporting up to a total of 128 CSI-RS ports across all resources, assuming legacy CSI-RS resources (with up to 32 CSI-RS ports per resource), based on extension of legacy codebooks
	2. Type-II codebook refinement supporting up to a total of 128 CSI-RS ports across all resources, assuming legacy CSI-RS resources (with up to 32 CSI-RS ports per resource), based on extension of legacy codebooks, **without modifying any codebook parameter other than** introducing additional values for the number of ports codebook parameter(s)
	3. Extension of CRI(s)-based CSI reporting (CQI/PMI/RI calculated per CRI for ≥1 CRIs) for hybrid beamforming supporting up to a total of 128 CSI-RS ports across all resources, with up to 32 CSI-RS ports per resource, without new codebook design
	4. SRS port grouping and its association to the two codewords for the 6/8Rx low complexity receiver supporting more than 4 layers, with legacy codebook
		* No enhancement on codeword-to-layer mapping, DL resource allocation, CSI feedback, and DCI format
		* Note: Whether to support 6Rx with more than 4 layers is to be decided in RAN4 Rel-19 RF enhancements WI
2. Specify UE reporting enhancement for CJT deployments under non-ideal synchronization and backhaul, targeting FR1, both FDD and TDD
3. Inter-TRP time misalignment and frequency/phase offset measurement and reporting, assuming legacy CSI-RS design, with stand-alone aperiodic reporting on PUSCH
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## Summary of companies’ proposals and views

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| 1.5 | **Proposal 1.E**: Adopt the following changes to TS38.214 V19.0.0 Clause 6.2.1.3 on priority rules for UE sounding procedure as follows:**6.2.1.3 UE sounding procedure between component carriers**< Unchanged part omitted >- the UE shall drop PUSCH transmission carrying aperiodic CSI comprising only CQI/PMI/L1-RSRP/L1-SINR/TDCP/cjtc-Dd/cjtc-F/cjtc-Dd-F/cjtc-P on a carrier of a serving cell in set whenever the transmission and aperiodic SRS transmission (including any interruption due to uplink or downlink RF retuning time [11, TS 38.133]) as defined by higher layer parameters *switchingTimeUL* and *switchingTimeDL* of *SRS-SwitchingTimeNR)* on the carrier of the serving cell happen to overlap in the same symbol.< Unchanged part omitted >**FL assessment**: This proposal is technically sound since Rel-19 introduces new reportQuantities (mostly not from MIMO), including 'cli-SRS-RSRP', 'cli-RSSI', 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', 'p-ssb-index-RSRP-r19', 'rs-pai-r19', 'csi-pai-r19', 'cjtc-Dd', 'cjtc-F', 'cjtc-Dd-F' or 'cjtc-P'.**The TP can be found in Section 3.4** | **Support/fine:** OPPO, NTT DOCOMO, Google, Spreadtrum, Fujitsu, vivo, ETRI, Ericsson (discuss), Lenovo, Apple, ZTE/Sanechips (discuss), CATT, Xiaomi (discuss), NEC, Samsung (ok), Huawei/HiSi, **Not support:**  |
| **Reason for change**: The newly agreed CSI reporting quantities in Rel-19 MIMO CSI has not been reflected in the current description of priority rules in TS38.214 |
| **Summary of the change**: Added the new CSI reporting quantities for CJT calibration reporting  |
| **Consequences if not approved**: Incomplete description in TS38.214 |
| **6.2.1.3 UE sounding procedure between component carriers**< Unchanged part omitted >- the UE shall drop PUSCH transmission carrying aperiodic CSI comprising only CQI/PMI/L1-RSRP/L1-SINR/TDCP/cjtc-Dd/cjtc-F/cjtc-Dd-F/cjtc-P on a carrier of a serving cell in set whenever the transmission and aperiodic SRS transmission (including any interruption due to uplink or downlink RF retuning time [11, TS 38.133]) as defined by higher layer parameters *switchingTimeUL* and *switchingTimeDL* of *SRS-SwitchingTimeNR)* on the carrier of the serving cell happen to overlap in the same symbol.< Unchanged part omitted > |

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| 1.1 | **[116bis] Agreement**For the Rel-19 Type-I and Type-II codebook refinement for 48, 64, and 128 CSI-RS ports, regarding the mapping from CSI-RS resource index/port index per resource and port index to CSI/PMI calculation, support NW to configure UE with one of the following mapping methods via higher-layer (RRC) signaling, * *Mapping method 1*: Sequential ordering/indexing within (1st resource, 1st polarization), then (2nd resource, 1st polarization), …, then (Kth resource, 1st polarization), then (1st resource, 2nd polarization), then (2nd resource, 2nd polarization), …, then (Kth resource, 2nd polarization)
* *Mapping method 2*: Sequential ordering/indexing within (where K\*n2 = N2):

**[117] Agreement**For the Rel-19 Type-I and Type-II codebook refinement for 48, 64, and 128 CSI-RS ports, regarding port mapping, * Following legacy principle, “sequential ordering/indexing within” a group of Q indices {i0, i1, …, iQ-1} is a linearly increasing sequence such that iq < iq+1 (where q=0, 1, …, Q-2 is the port index within a CSI-RS resource, and iq or iq+1 {0, 1,…, KQ-1}) is the port index for the codebook, across the K>1 CSI-RS resources).
* After resource aggregation, P (=48, 64, or 128) ports are numbered in accordance to Table 7.4.1.5.3-1 from TS 38.211

**[121] Agreement**For the Rel-19 Type-I SP and Type-II codebook refinement for *P*=48, 64, and 128 CSI-RS ports with K>1 aggregated NZP aperiodic CSI-RS resources for CMR, to implement the previous agreements on the mapping from CSI-RS resource index/port index per resource and port index to CSI/PMI calculation* In TS38.211, extend the enumeration of antenna port *p=*3000+*p*’ with *p*’=0 …*P–*1
* In TS38.214, remove the term ‘port index for CSI/PMI calculation’

**Proposal 1.A**: For the Rel-19 Type-I SP and Type-II codebook refinement, refine the following agreement in RAN1#121 as follows:**Agreements**For the Rel-19 Type-I SP and Type-II codebook refinement for *P*=48, 64, and 128 CSI-RS ports with K>1 aggregated NZP ~~aperiodic~~ CSI-RS resources for CMR, to implement the previous agreements on the mapping from CSI-RS resource index/port index per resource and port index to CSI/PMI calculation* In TS38.211, extend the enumeration of antenna port *p=*3000+*p*’ with *p*’=0 …*P–*1
* In TS38.214, remove the term ‘port index for CSI/PMI calculation’

Consequently, based on the endorsed version of TS38.214 V19.0.0, the current description for aperiodic CSI-RS resources should also be applied to periodic and semi-persistent CSI-RS resources.**FL assessment**: The above proposal attempts to harmonize the texts in 211 and 214 for port mapping. While the text in 211 is fine, the text in 214 exhibits discrepancy for P and SP CSI-RS as it assumes a different port indexing scheme from the one specified in 211. This should be fixed. Note that the previous agreement in RAN1#121 was limited only to AP due to a trivial yet unfortunate “*obvious typo*” from the FL.Example TPs can be found in * Huawei [1], where 2 TPs are proposed: one for port mapping per se, the other for SRS port grouping in relation to port mapping
* ZTE [3], TP-3
* OPPO [8], TP-2
* Qualcomm [15], TP-1 and TP-2
* NTT DOCOMO [16], TP

**A harmonized TP can be found in Section 3.1 + 3.2** | **Support/fine:** Huawei, HiSi, ZTE/Sanechips, Xiaomi, Samsung, OPPO, NEC, Ericsson, Qualcomm, NTT DOCOMO, Google, Spreadtrum, Fujitsu, ETRI, Lenovo, Apple, CATT, **Not support:**  |
| **Reason for change**: The agreement in RAN1#121 on port indexing included the typo “aperiodic”. * While the typo is not implemented in TS38.211 (rightly so), it is implemented in TS38.214. In TS38.214, a functionally identical port indexing mechanism is used for periodic, semi-persistent, and aperiodic but formulated in two different manners. In doing so, the current formulation in TS38.214 exhibits discrepancy for P and SP CSI-RS as it assumes a different port indexing scheme from the one specified in TS38.211

**[121] Agreement**For the Rel-19 Type-I SP and Type-II codebook refinement for *P*=48, 64, and 128 CSI-RS ports with K>1 aggregated NZP aperiodic CSI-RS resources for CMR, to implement the previous agreements on the mapping from CSI-RS resource index/port index per resource and port index to CSI/PMI calculation* In TS38.211, extend the enumeration of antenna port *p=*3000+*p*’ with *p*’=0 …*P–*1
* In TS38.214, remove the term ‘port index for CSI/PMI calculation’

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| **Summary of the change**: Harmonized the description for P/SP with AP, and thereby removing the discrepancy for P/SP CSI-RS |
| **Consequences if not approved**: Erroneous description in TS38.214 |
| 5.2.1.4.2 Report quantity configurations<omitted text>- the higher layer bitmap parameter *portSubsetIndicator-r19*, of length 48, 64 or 128 bits, which contains the bit sequence , where is the MSB and is the LSB, bit corresponds to the port index, after CSI-RS resource aggregation, in order of increasing port index, as described in Clause 7.4.1.5.3 of [4, TS 38.211]. A bit value 0 in *portSubsetIndicator-r19* indicates that the corresponding antenna port is disabled for the sub-configuration, whereas bit value 1 indicates that the antenna port is enabled and belongs to the antenna port subset for the sub-configuration. For the derivation of PMI, port indices corresponding to all bits with value of 1 in *portSubsetIndicator-r19* are mapped to consecutive port indices in increasing order of the bit position in *portSubsetIndicator-r19*. The number of enabled antenna ports can be 48, 64 or 128 for a sub-configuration configured with *codebookType* set to 'typeI-SinglePanel-r19' or 2, 4, 8, 12, 16, 24 or 32 for a sub-configuration configured with *codebookType* set to 'typeI-SinglePanel', according to UE capability.<omitted text>5.2.2.2.1a Refined Type I Single-Panel CodebookFor 48, 64 and 128 antenna ports, obtained by aggregating CSI-RS resources for channel measurement, and the UE configured with higher layer parameter *codebookType* set to 'typeI-SinglePanel-r19'- The values of and are configured with the higher layer parameter *n1-n2-typeI-r19*. The supported configurations of , for a given number of CSI-RS ports, are given in Table 5.2.2.2.1a-1, for which . The number of CSI-RS ports, , is .**Table 5.2.2.2.1a-1: Supported configurations of**

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| **Number of CSI-RS antenna ports,**  |  |
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| 48 | (8,3) |
| (6,4) |
| 64 | (16,2) |
| (8,4) |
| 128 | (16,4) |
| (8,8) |

- The port index, , is described in Clause 7.4.1.5.3 of [4, TS 38.211].<omitted text>5.2.2.2.5a Refined eType II CodebookFor 48, 64 and 128 antenna ports, obtained by aggregating CSI-RS resources for channel measurement, and the UE configured with higher layer parameter *codebookType* set to 'eTypeII-r19'- The values of and are configured with the higher layer parameter *n1-n2-typeII-r19*. The supported configurations of , for a given number of CSI-RS ports, are given in Table 5.2.2.2.1a-1, for which . The number of CSI-RS ports, , is .- The port index, , is defined in Clause 7.4.1.5.3 of [4, TS 38.211].<omitted text>5.2.2.2.9a Refined FeType II Port Selection CodebookFor 48 and 64 antenna ports, obtained by aggregating CSI-RS resources for channel measurement, and the UE configured with higher layer parameter *codebookType* set to 'typeII-FePortSelection-r19'- The number of CSI-RS ports is , where is the number of CSI-RS resources in the CSI-RS resource set for channel measurement and the value of is configured by higher layer parameter *nrofPorts*- The port index, , is defined in Clause 7.4.1.5.3 of [4, TS 38.211].<omitted text>5.2.2.2.11a Refined eType II Codebook for predicted PMIFor 48, 64 and 128 antenna ports, obtained by aggregating CSI-RS resources for channel measurement, and the UE configured with higher layer parameter *codebookType* set to 'typeII-Doppler-r19'- The values of and are configured with the higher layer parameter *n1-n2-typeII-r19*. The supported configurations of , for a given number of CSI-RS ports, are given in Table 5.2.2.2.1a-1, for which . The number of CSI-RS ports, , is .- The the port index, , is defined in Clause 7.4.1.5.3 of [4, TS 38.211].<omitted text>5.2.2.5.1 UE assumptions for CQI/PMI/RI calculation<omitted text>- The PDSCH transmission scheme where the UE may assume that PDSCH transmission would be performed with up to 8 transmission layers as defined in Clause 7.3.1.4 of [4, TS 38.211]. For CQI calculation, the UE should assume that PDSCH signals on antenna ports in the set [1000,…, 1000+ν-1] for ν layers would result in signals equivalent to corresponding symbols transmitted on antenna ports [3000,…, 3000+*PCSI-RS* -1], as given by  Where is a vector of PDSCH symbols from the layer mapping defined in Clause 7.3.1.4 of [4, TS 38.211], is the number of CSI-RS ports. If only one CSI-RS port is configured, *W(i)* is 1. If the higher layer parameter *reportQuantity* in *CSI-ReportConfig* for which the CQI is reported is set to either 'cri-RI-PMI-CQI' or 'cri-RI-LI-PMI-CQI', *W(i)* is the precoding matrix corresponding to the reported PMI applicable to *x(i)*. If the higher layer parameter *reportQuantity* in *CSI-ReportConfig* for which the CQI is reported is set to 'cri-RI-CQI', *W(i)* is the precoding matrix corresponding to the procedure described in Clause 5.2.1.4.2. If the higher layer parameter *reportQuantity* in *CSI-ReportConfig* for which the CQI is reported is set to 'cri-RI-i1-CQI', *W(i)* is the precoding matrix corresponding to the reported i1 according to the procedure described in Clause 5.2.1.4.2. The corresponding PDSCH signals transmitted on antenna ports [3000,…,3000 +  *PCSI-RS*  - 1] would have a ratio of EPRE to CSI-RS EPRE equal to the ratio given in Clause 5.2.2.3.1.- If a UE is configured with *codebookType* set to 'typeI-SinglePanel-r19' and with the higher layer parameter *typeI-softScalingRank1-2-r19*, for , and , if supported by UE capability, the UE can assume that the PDSCH signal for each layer mapped to a vector of group would have the same ratio of EPRE to CSI-RS EPRE for all CSI-RS resources, equal to times the *powerControlOffset* (in linear scale) of the respective CSI-RS resource, where and are described in Clause 5.2.2.2.1a; otherwise, the UE can assume that the PDSCH signals for layers would have the same ratio of EPRE to CSI-RS EPRE for all CSI-RS resources, equal to the *powerControlOffset* of the respective CSI-RS resource. |
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| **Reason for change**: The agreement in RAN1#121 on port indexing included the typo “aperiodic”. * While the typo is not implemented in TS38.211 (rightly so), it is implemented in TS38.214. In TS38.214, a functionally identical port indexing mechanism is used for periodic, semi-persistent, and aperiodic but formulated in two different manners. In doing so, the current formulation in TS38.214 exhibits discrepancy for P and SP CSI-RS as it assumes a different port indexing scheme from the one specified in TS38.211

**[121] Agreement**For the Rel-19 Type-I SP and Type-II codebook refinement for *P*=48, 64, and 128 CSI-RS ports with K>1 aggregated NZP aperiodic CSI-RS resources for CMR, to implement the previous agreements on the mapping from CSI-RS resource index/port index per resource and port index to CSI/PMI calculation* In TS38.211, extend the enumeration of antenna port *p=*3000+*p*’ with *p*’=0 …*P–*1
* In TS38.214, remove the term ‘port index for CSI/PMI calculation’

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| **Summary of the change**: Harmonized the description for P/SP with AP, and thereby removing the discrepancy for P/SP CSI-RS |
| **Consequences if not approved**: Erroneous description in TS38.214 |
| 5.2.2.5.1 UE assumptions for CQI/PMI/RI calculation<omitted text>For a UE configured with a *CSI-ReportConfig* that contains a list of sub-configurations provided by *csi-ReportSubConfigToAddModList*,- if a sub-configuration indicates a CSI-RS antenna port subset using the higher layer bitmap parameter *portSubsetIndicator* or *portSubsetIndicator-r19*, as described in clause 5.2.1.4.2, for CQI calculation, antenna ports corresponding to all bits with value of 1 in *portSubsetIndicator* are mapped to consecutive antenna ports starting at CSI-RS antenna port 3000 in increasing order of the bit position in *portSubsetIndicator*. The UE should assume that PDSCH signals on antenna ports in the set [1000,…, 1000+ν-1] for ν layers would result in signals equivalent to corresponding symbols transmitted on antenna ports [3000, …, 3000+P-1] *T*, as given bywhere *P* corresponds to the number of bits with value 1 in the bitmap *portSubsetIndicator* and *T* , and are as previously described in this Clause, and the corresponding PDSCH EPRE to CSI-RS EPRE is as previously defined in this Clause if the sub-configuration does not indicate a power offset *powerOffset*.* ~~If a sub-configuration indicates a CSI-RS antenna port subset using the higher layer bitmap parameter~~ *~~portSubsetIndicator-r19~~*~~, for CQI calculation, port indices, , corresponding to all bits with value of 1 in~~ *~~portSubsetIndicator-r19~~* ~~in increasing order of the bit position in~~ *~~portSubsetIndicator-r19~~*~~, are mapped to antenna ports ,or to antenna ports if the CSI-RS resources are aperiodic, with index , of the respective CSI-RS resource , with , for , as described in Clause 5.2.1.4.2, where~~ ~~corresponds to the number of bits with value 1 in the bitmap~~ *~~portSubsetIndicator-r19~~*~~, and is the total number of ports obtained by aggregating CSI-RS resources for channel measurement. The UE should assume that PDSCH signals on antenna ports in the set [1000,…, 1000+ν-1] for ν layers would result in signals equivalent to corresponding symbols transmitted on antenna ports of the respective CSI-RS resource , as given by~~

~~or~~~~where~~ *~~T~~* ~~and~~ ~~are as previously described in this Clause, and the corresponding PDSCH EPRE to CSI-RS EPRE is as previously defined in this Clause depending on the configured~~ *~~codebookType~~* ~~for the sub-configuration, if the sub-configuration does not indicate a power offset~~ *~~powerOffset~~*~~.~~<omitted text> |

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| 1.3 | **Proposal 1.C**: For the Rel-19 Type-I SP codebook refinement for 48, 64, and 128 CSI-RS ports mode-B, support following TP to accurately referring spatial domain basis vector selection. 5.2.2.2.1a Refined Type I Single-Panel Codebook<Unchanged part omitted>The index is given bywhere for and for . The mapping of and to and for is obtained as in Clause 5.2.2.2.3 by replacing with and replacing with , where the values of are given in Table 5.2.2.2.5-4 and Table 5.2.2.2.1a-5, and and for one to one mapping to and for with ,.The index , for and is given byand is mapped to . The mapping of index , for and , to , with , is given in Table 5.2.2.2.1a-6. The quantities and for *typeI-codebookMode-r19* = 'modeB' are the same as defined above for 'modeA'.<Unchanged part omitted>**FL assessment**: This TP seems to be correct and clearer than the current text. Whether this is needed or not can be discussed. **The TP can be found in Section 3.3** | **Support/fine:** NEC, Google, Samsung, OPPO, NTT DOCOMO, Spreadtrum, Fujitsu, vivo, ETRI, Ericsson, Lenovo, Apple, ZTE/Sanechips, CATT, Xiaomi, Qualcomm, **Not support (obvious):** Nokia**,** |
| **Reason for change**: The current description for Type-I Scheme-B basis selection can benefit from clearer description |
| **Summary of the change**: Refine the current description in TS38.214 in clause 5.2.2.2.1a |
| **Consequences if not approved**: Potential lack of clarity in the description of UE behaviour in TS38.214 |
| 5.2.2.2.1a Refined Type I Single-Panel Codebook<Unchanged part omitted>The index is given bywhere for and for . The mapping of and to and for is obtained as in Clause 5.2.2.2.3 by replacing with and replacing with , where the values of are given in Table 5.2.2.2.5-4 and Table 5.2.2.2.1a-5, and and for one to one mapping to and for with ,.The index , for and is given byand is mapped to . The mapping of index , for and , to , with , is given in Table 5.2.2.2.1a-6. The quantities and for *typeI-codebookMode-r19* = 'modeB' are the same as defined above for 'modeA'.<Unchanged part omitted> |

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| 3.1 | **Proposal 3.A**: For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured, regarding CQI/PMI/RI calculation, the PDSCH is assumed to be transmitted according toWhere are the selected CSI-RS resource, k is the subcarrier index, is the reference subcarrier, is the subcarrier spacing and is within the interval in which the delay offset, is reported by the UE. **FL assessment**: This proposal is technically sound and correct. Note that the digitally compensated DO is functionally equivalent to Rel-18 Type-II CJT mode-1 which also uses a similar text.**The TP can be found in Section 3.6** | **Support/fine:** Huawei/HiSi, ZTE/Sanechips, Google, Samsung, OPPO, Spreadtrum, Fujitsu, vivo, ETRI, Ericsson, Lenovo, Apple, ZTE/Sanechips, CATT, Xiaomi, NEC, NTT DOCOMO, Qualcomm, **Not support (already clear without equation):** Nokia, |
| **Reason for change**: It was agreed that CJTC Dd report can be linked with Rel-18 Type-II CJT, which implies that the CQI/PMI calculation for Rel-18 Type-II CJT can be configured to assume a previously reported CJTC Dd report. Analogous to Rel-19 Type-II CJT mode-1, this can be reflected in the CQI/PMI calculation equation. However, the current description in TS38.214 already captures the necessary behaviour albeit without equation. |
| **Summary of the change**: Added the equation for CQI/PMI calculation when CJTC Dd report is linked with Rel-18 Type-II CJT |
| **Consequences if not approved**: Possible lack of clarity in UE behaviour when CJTC Dd report is linked with Rel-18 Type-II CJT |
| 5.2.2.5.1b UE assumptions for CQI/PMI/RI calculation for CJT If the higher layer parameter *reportQuantity* in *CSI-ReportConfig* for which the CQI is reported is set to 'cri-RI-PMI-CQI', the higher layer parameter *codebookType* is set to 'typeII-CJT-r18' or ' typeII-CJT-PortSelection-r18', and the corresponding CSI-RS Resource Set for channel measurement is configured with CSI-RS resources, for CQI calculation- a UE should assume PDSCH signals on antenna ports in the set for layers would result in signals equivalent to corresponding symbols transmitted on antenna ports of each of the *N*0 selected CSI-RS resources, as given by where is the precoding matrix corresponding to the procedure described in Clause 5.2.2.2.8 and 5.2.2.2.9 for *codebookType* set to 'typeII-CJT-r18' and ' typeII-CJT-PortSelection-r18', respectively, and are the indices of the *N*0 selected CSI-RS resources in increasing order, such that . A UE should assume that the signals , , fully overlap in time and frequency.- if the CSI reports with *reportQuantity* set to 'cri-RI-PMI-CQI' and *codebookType* set to 'typeII-CJT-r18' is linked to a CSI report with *reportQuantity* set to 'cjtc-Dd' by the higher layer parameter *linkedCJTCReport*, and the two CSI reports are jointly triggered, or separately triggered and the compensation is enabled by the higher layer parameter *delayOffsetCompensation,* a UE should assume PDSCH signals on antenna ports in the set for layers would result in signals equivalent to corresponding symbols transmitted on antenna ports of each of the *N*0 selected CSI-RS resources, as given by  where is the precoding matrix corresponding to the procedure described in Clause 5.2.2.2.8 and 5.2.2.2.9 for *codebookType* set to 'typeII-CJT-r18', and are the indices of the *N*0 selected CSI-RS resources in increasing order, such that , is the subcarrier index and is the reference subcarrier index, is the subcarrier spacing and is within the interval in which the delay offset, is reported by the UE. A UE should assume that the signals , , fully overlap in time and frequency. |

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| 1.7 | **[118bis] Agreement**For a UE configured with a total of PSRS=6 or 8 ports across ≥1 SRS resources for antenna switching intended for xT6R or xT8R, respectively, support the following fixed SRS port grouping where (with the PSRS ports indexed in an ascending order according to SRS resource ID and port number within each SRS resource): * SRS port group 0, corresponding to CW0, comprises the even PSRS/2 out of PSRS ports; and
* SRS port group 1, corresponding to CW1, comprises the odd PSRS/2 out of PSRS ports

The above feature is applicable only for reportQuantity = ‘cri-RI-CQI’No other spec enhancement is introduced on new CW-to-layer mapping, DL resource allocation, CSI feedback, and DCI format Note: The above grouping assumption is to align NW and UE on the association between SRS ports and reported CQIs for the two CWs when reportQuantity = ‘cri-RI-CQI’.Note: different SRS ports are associated with different UE antenna ports.Note: if one single CW is scheduled, both SRS port groups can correspond to the same CW, i.e. no enhancement is needed for the single-CW caseNote: This feature is a separate UE capability and, for UEs supporting this capability, configured via RRC (FFS details on the extend of RRC configuration)Note: Whether to support 6Rx with more than 4 layers is to be decided in RAN4 Rel-19 RF enhancements WIFFS (by RAN1#118bis): Whether there is impact on mapping between CWs to CSI-RS ports For SRS antenna switching with multiple aperiodic SRS resource sets, PSRS ports indexed in an ascending order according to SRS resource set ID and SRS resource ID in a set and port number within each SRS resource**Proposal 1.G**: For a UE configured with a total of PSRS=6 or 8 ports across ≥1 SRS resources for antenna switching intended for xT6R or xT8R, respectively, when SRS port grouping is configured, * For P/SP SRS, the 6/8R ports consists of ports within an SRS resource set
* For AP SRS, the 6/8R ports consists of ports across multiple sets.

**FL assessment**: This proposal attempts to revise the description in TS38.214 for SRS port grouping based on the legacy behaviour, i.e. the ports from different SRS resources correspond to a same set for P/SP and different sets for AP. The proposal seems valid. **The TP can be found in Section 3.5** | **Support/fine:** Huawei/HiSi, NTT DOCOMO, vivo, ETRI, ZTE/Sanechips, CATT, Xiaomi, NEC, Qualcomm, Samsung (ok) **Not support** (no ambiguity with the current text)**:** Google, Spreadtrum, Xiaomi, Nokia,  |
| **Reason for change**: In RAN1 #118bis meeting [1], SRS port grouping has been agreed for periodic, semi-persistent and aperiodic SRS resource sets. The SRS ports indexing for P/SP SRS resource set and AP SRS resource set are different following the agreement. For P/SP SRS, the 6/8R ports consists of ports within a set, while for AP SRS, the 6/8R ports can consist of ports across multiple sets.While the current description in TS38.214 seems sufficient, the proposed TP can improve the clarity.  |
| **Summary of the change**: Separated description in TS38.214 for aperiodic from periodic and semi-persistent SRS |
| **Consequences if not approved**: Potential lack of clarity in description in TS38.214 |
| < Start of the text proposal >5.2.2.5.1 UE assumptions for CQI/PMI/RI calculation*--- unchanged text omitted ---*- For a UE configured with one or more SRS resource sets with higher layer parameter *usage* set to 'antennaSwitching' and higher layer parameter *resourceType* set to 'periodic' or 'semi-persistent', with a total of or 8 ports across the resources in a set intended for xT6R or xT8R, respectively, if the higher layer parameter *reportQuantity* in *CSI-ReportConfig* for which the CQI is reported is set to 'cri-RI-CQI' and the UE is configured with the higher layer parameter *SRSPortGrouping-r19*, the UE can assume that SRS port group 0 corresponds to codeword 0 and comprises the even ports, and that SRS port group 1 corresponds to codeword 1 and comprises the odd ports out of the total ports. The SRS ports are indexed in an ascending order according to SRS resource ID and port number within each SRS resource.- For a UE configured with one or more SRS resource sets with higher layer parameter *usage* set to 'antennaSwitching' and higher layer parameter *resourceType* set to 'aperiodic', with a total of or 8 ports across the resources across the resource set(s) intended for xT6R or xT8R, respectively, if the higher layer parameter *reportQuantity* in *CSI-ReportConfig* for which the CQI is reported is set to 'cri-RI-CQI' and the UE is configured with the higher layer parameter *SRSPortGrouping-r19*, the UE can assume that SRS port group 0 corresponds to codeword 0 and comprises the even ports, and that SRS port group 1 corresponds to codeword 1 and comprises the odd ports out of the total ports. The SRS ports are indexed in an ascending order according to SRS resource set ID, SRS resource ID and port number within each SRS resource.*--- unchanged text omitted ---*< End of the text proposal > |

**Please read**:

* As we are now in the maintenance phase, only *potentially* essential issues/proposals will be discussed. Essential means without the changes the specs are ambiguous, inconsistent, and/or broken.
* Proposals related to editorial changes (e.g. minor typos) and past agreements *perhaps* not properly or sufficiently captured should be addressed by the editors. Please contact the editors directly. Examples:
	+ ZTE’s R1-2505268 TP-1, TP-4
	+ CATT’s R1-2505321 TPs 2.1, 2.2, 3.1
	+ Vivo’s R1-2505371 TP-2
	+ Xiaomi’s R1-2505428 Proposals 2, 3
	+ LG’s R1-2505817 Proposal 1
	+ Nokia’s R1-2506161 Proposals 1 and 2
	+ Ericsson’s R1-2506167 Proposal 2
* Proposals related to RRC parameters that do not need significant discussion in 8.2.2 can be directly commented to the MIMO RRC moderator (Darcy Tsai) during the RAN1#122 email discussion. Examples:
	+ Samsung’s R1-2505534 Proposal 2
* Proposals related to UE capability will be handled in UE feature session. Examples:
	+ ZTE’s R1-2505268 Proposal 1
* I will provide the corresponding **official TPs only** for proposals that seem promising and are clearly essential (based on companies’ views gathered in round-1) *no later than prior to round-1 (Monday) online session.*

### Issue 1 (WID objective 2a and 2b): Type-I and Type-II codebook refinement for up to 128 CSI-RS ports

Table 1A Summary: issue 1

|  |  |  |
| --- | --- | --- |
| **#** | **Issue/proposal** | **Companies’ views** |
| **New proposals** |
| 1.1 | **[116bis] Agreement**For the Rel-19 Type-I and Type-II codebook refinement for 48, 64, and 128 CSI-RS ports, regarding the mapping from CSI-RS resource index/port index per resource and port index to CSI/PMI calculation, support NW to configure UE with one of the following mapping methods via higher-layer (RRC) signaling, * *Mapping method 1*: Sequential ordering/indexing within (1st resource, 1st polarization), then (2nd resource, 1st polarization), …, then (Kth resource, 1st polarization), then (1st resource, 2nd polarization), then (2nd resource, 2nd polarization), …, then (Kth resource, 2nd polarization)
* *Mapping method 2*: Sequential ordering/indexing within (where K\*n2 = N2):

**[117] Agreement**For the Rel-19 Type-I and Type-II codebook refinement for 48, 64, and 128 CSI-RS ports, regarding port mapping, * Following legacy principle, “sequential ordering/indexing within” a group of Q indices {i0, i1, …, iQ-1} is a linearly increasing sequence such that iq < iq+1 (where q=0, 1, …, Q-2 is the port index within a CSI-RS resource, and iq or iq+1 {0, 1,…, KQ-1}) is the port index for the codebook, across the K>1 CSI-RS resources).
* After resource aggregation, P (=48, 64, or 128) ports are numbered in accordance to Table 7.4.1.5.3-1 from TS 38.211

**[121] Agreement**For the Rel-19 Type-I SP and Type-II codebook refinement for *P*=48, 64, and 128 CSI-RS ports with K>1 aggregated NZP aperiodic CSI-RS resources for CMR, to implement the previous agreements on the mapping from CSI-RS resource index/port index per resource and port index to CSI/PMI calculation* In TS38.211, extend the enumeration of antenna port *p=*3000+*p*’ with *p*’=0 …*P–*1
* In TS38.214, remove the term ‘port index for CSI/PMI calculation’

**Proposal 1.A**: For the Rel-19 Type-I SP and Type-II codebook refinement, refine the following agreement in RAN1#121 as follows:**Agreements**For the Rel-19 Type-I SP and Type-II codebook refinement for *P*=48, 64, and 128 CSI-RS ports with K>1 aggregated NZP ~~aperiodic~~ CSI-RS resources for CMR, to implement the previous agreements on the mapping from CSI-RS resource index/port index per resource and port index to CSI/PMI calculation* In TS38.211, extend the enumeration of antenna port *p=*3000+*p*’ with *p*’=0 …*P–*1
* In TS38.214, remove the term ‘port index for CSI/PMI calculation’

Consequently, based on the endorsed version of TS38.214 V19.0.0, the current description for aperiodic CSI-RS resources should also be applied to periodic and semi-persistent CSI-RS resources.**FL assessment**: The above proposal attempts to harmonize the texts in 211 and 214 for port mapping. While the text in 211 is fine, the text in 214 exhibits discrepancy for P and SP CSI-RS as it assumes a different port indexing scheme from the one specified in 211. This should be fixed. Note that the previous agreement in RAN1#121 was limited only to AP due to a trivial yet unfortunate “*obvious typo*” (from JD’s wording in [15]) from the FL.Example TPs can be found in * Huawei [1], where 2 TPs are proposed: one for port mapping per se, the other for SRS port grouping in relation to port mapping
* ZTE [3], TP-3
* OPPO [8], TP-2
* Qualcomm [15], TP-1 and TP-2
* NTT DOCOMO [16], TP

**A harmonized TP can be found in Section 3.1 + 3.2** | **Support/fine:** Huawei, HiSi, ZTE/Sanechips, Xiaomi, Samsung, OPPO, NEC, Ericsson, Qualcomm, NTT DOCOMO, Google, Spreadtrum, Fujitsu, ETRI, Lenovo, Apple, CATT, **Not support:**  |
| 1.2 | **[120bis] Conclusion**For the Rel-19 Type-I SP codebook refinement for 48, 64, and 128 CSI-RS ports, when the Rel-18 SD NES Type-I is configured for the Rel-19 Type-I SP codebook, the *powerOffset* parameter **can be configured** in all the respective subConfiguration IEs* The supported values for *powerOffset* follow the legacy specification

**Proposal 1.B**: For the Rel-19 Type-I SP codebook refinement for 48, 64, and 128 CSI-RS ports, when the Rel-18 SD NES Type-I is configured for the Rel-19 Type-I SP codebook with the *powerOffset* parameter configured in all the respective subConfiguration IEs, the soft scaling (if configured) is calculated based on *powerControlOffset* (in linear scale) of the respective CSI-RS resource and *powerOffset* (in linear scale) in the respective sub-configuration**FL assessment**: For this proposal to be valid, a UE must be configured with Rel-19 Type-I SP, SD+PD NES, and soft scaling. * But the use of soft scaling together with SD+PD NES has not yet been agreed, at least explicitly.
* Even if it were not precluded, this would seem to fall into optimization rather than an essential change.

More discussion on the combination is needed.  | **Support/fine:** Google, Fujitsu (open), Lenovo, ZTE/Sanechips,**Not support:** Samsung, OPPO, NTT DOCOMO (discuss combo first), Spreadtrum, vivo, ETRI, Ericsson, Apple, CATT, Xiaomi (discuss combo first), Qualcomm, Nokia,  |
| 1.3 | **Proposal 1.C**: For the Rel-19 Type-I SP codebook refinement for 48, 64, and 128 CSI-RS ports mode-B, support following TP to accurately referring spatial domain basis vector selection. 5.2.2.2.1a Refined Type I Single-Panel Codebook<Unchanged part omitted>The index is given bywhere for and for . The mapping of and to and for is obtained as in Clause 5.2.2.2.3 by replacing with and replacing with , where the values of are given in Table 5.2.2.2.5-4 and Table 5.2.2.2.1a-5, and and for one to one mapping to and for with ,.The index , for and is given byand is mapped to . The mapping of index , for and , to , with , is given in Table 5.2.2.2.1a-6. The quantities and for *typeI-codebookMode-r19* = 'modeB' are the same as defined above for 'modeA'.<Unchanged part omitted>**FL assessment**: This TP seems to be correct and clearer than the current text. Whether this is needed or not can be discussed. **The TP can be found in Section 3.3** | **Support/fine:** NEC, Google, Samsung, OPPO, NTT DOCOMO, Spreadtrum, Fujitsu, vivo, ETRI, Ericsson, Lenovo, Apple, ZTE/Sanechips, CATT, Xiaomi, Qualcomm, **Not support (obvious):** Nokia**,** |
| 1.4 | **Proposal 1.D**: For Rel-19 Type-II codebook refinement for 48, 64, and 128 CSI-RS ports based on the Rel-18 Type-II Doppler codebook, a UE shall assume that CSI-RS ports mapped to the same port index across the K aperiodic CSI-RS resources, , as described in Clause 7.4.1.5.3 of [4, TS 38.211], share the same antenna port.**FL assessment**: This proposal has been discussed since RAN1#121. The proposal is reformulated based on vivo’s latest Tdoc [5]The proposal is technically sound. It was argued by vivo that for “KDOPP = {4, 8, 12} CSI-RS resource groups are introduced for Type-II Doppler CSI. This means that within a CMR group, there may be multiple CSI-RS ports with the same CSI-RS port index mapped to different antenna ports.” | **Support/fine:** vivo, Apple, CATT, Xiaomi, NEC, **Not support** (NW implementation)**:** Google, Samsung, OPPO, NTT DOCOMO, Spreadtrum, Fujitsu, ETRI, Ericsson, Lenovo, ZTE/Sanechips,  |
| 1.5 | **Proposal 1.E**: Adopt the following changes to TS38.214 V19.0.0 Clause 6.2.1.3 on priority rules for UE sounding procedure as follows:**6.2.1.3 UE sounding procedure between component carriers**< Unchanged part omitted >- the UE shall drop PUSCH transmission carrying aperiodic CSI comprising only CQI/PMI/L1-RSRP/L1-SINR/TDCP/cjtc-Dd/cjtc-F/cjtc-Dd-F/cjtc-P on a carrier of a serving cell in set whenever the transmission and aperiodic SRS transmission (including any interruption due to uplink or downlink RF retuning time [11, TS 38.133]) as defined by higher layer parameters *switchingTimeUL* and *switchingTimeDL* of *SRS-SwitchingTimeNR)* on the carrier of the serving cell happen to overlap in the same symbol.< Unchanged part omitted >**FL assessment**: This proposal is technically sound since Rel-19 introduces new reportQuantities (mostly not from MIMO), including 'cli-SRS-RSRP', 'cli-RSSI', 'p-cri-r19', 'p-cri-RSRP-r19', 'p-ssb-index-r19', 'p-ssb-index-RSRP-r19', 'rs-pai-r19', 'csi-pai-r19', 'cjtc-Dd', 'cjtc-F', 'cjtc-Dd-F' or 'cjtc-P'.**The TP can be found in Section 3.4** | **Support/fine:** OPPO, NTT DOCOMO, Google, Spreadtrum, Fujitsu, vivo, ETRI, Ericsson (discuss), Lenovo, Apple, ZTE/Sanechips (discuss), CATT, Xiaomi (discuss), NEC, Samsung (ok), Huawei/HiSi, **Not support:**  |
| 1.6 | **[117] Agreement**For the Rel-19 Type-II codebook refinement for 48, 64, and 128 CSI-RS ports, on CBSR, * -bit group-based CBSR
* the following (X1, X2) values are supported:

|  |  |  |
| --- | --- | --- |
| **P** | **(N1, N2)** | **(X1, X2)** |
| 48 | (8,3) | (1,1), (2,1), (4,1) |
| (6,4) | (1,1), (2,1), (2,2),  |
| 64 | (16,2) | (1,1), (2,1), (2,2), (4,1), (4,2) |
| (8,4) | (1,1), (2,1), (2,2), (4,1), (4,2) |
| 128 | (16,4) | (1,1), (2,1), (2,2), (4,1), (4,2) |
| (8,8) | (1,1), (2,1), (2,2), (4,1), (4,2) |

**Proposal 1.F**: For the Rel-19 Type-II codebook refinement for 48, 64, and 128 CSI-RS ports, on CBSR, clarify that the -bit group-based bitmap is identical for all the groups**FL assessment**: This proposal is technically sound. Although the proposal is aligned with the understanding of the FL (and should be to other 😊), it doesn’t hurt to clarify to avoid ambiguity, | **Support/fine:** Fraunhofer IIS/HHI, Samsung, Spreadtrum, Fujitsu, vivo, Ericsson, Lenovo, Apple, CATT, Xiaomi, NEC, **Not support:** NTT DOCOMO, Google, ETRI, ZTE/Sanechips, Huawei/HiSi,  |
| 1.7 | **[118bis] Agreement**For a UE configured with a total of PSRS=6 or 8 ports across ≥1 SRS resources for antenna switching intended for xT6R or xT8R, respectively, support the following fixed SRS port grouping where (with the PSRS ports indexed in an ascending order according to SRS resource ID and port number within each SRS resource): * SRS port group 0, corresponding to CW0, comprises the even PSRS/2 out of PSRS ports; and
* SRS port group 1, corresponding to CW1, comprises the odd PSRS/2 out of PSRS ports

The above feature is applicable only for reportQuantity = ‘cri-RI-CQI’No other spec enhancement is introduced on new CW-to-layer mapping, DL resource allocation, CSI feedback, and DCI format Note: The above grouping assumption is to align NW and UE on the association between SRS ports and reported CQIs for the two CWs when reportQuantity = ‘cri-RI-CQI’.Note: different SRS ports are associated with different UE antenna ports.Note: if one single CW is scheduled, both SRS port groups can correspond to the same CW, i.e. no enhancement is needed for the single-CW caseNote: This feature is a separate UE capability and, for UEs supporting this capability, configured via RRC (FFS details on the extend of RRC configuration)Note: Whether to support 6Rx with more than 4 layers is to be decided in RAN4 Rel-19 RF enhancements WIFFS (by RAN1#118bis): Whether there is impact on mapping between CWs to CSI-RS ports For SRS antenna switching with multiple aperiodic SRS resource sets, PSRS ports indexed in an ascending order according to SRS resource set ID and SRS resource ID in a set and port number within each SRS resource**Proposal 1.G**: For a UE configured with a total of PSRS=6 or 8 ports across ≥1 SRS resources for antenna switching intended for xT6R or xT8R, respectively, when SRS port grouping is configured, * For P/SP SRS, the 6/8R ports consists of ports within an SRS resource set
* For AP SRS, the 6/8R ports consists of ports across multiple sets.

**FL assessment**: This proposal attempts to revise the description in TS38.214 for SRS port grouping based on the legacy behaviour, i.e. the ports from different SRS resources correspond to a same set for P/SP and different sets for AP. The proposal seems valid. **The TP can be found in Section 3.5** | **Support/fine:** Huawei/HiSi, NTT DOCOMO, vivo, ETRI, ZTE/Sanechips, CATT, Xiaomi, NEC, Qualcomm, Samsung (ok) **Not support** (no ambiguity with the current text)**:** Google, Spreadtrum, Xiaomi, Nokia,  |
| **Proposals from previous more recent meeting(s) and/or round(s)** |
|  |  |  |
|  |  |  |

Table 1B SLS results: issue 1

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Table 1C Additional inputs: issue 1

|  |  |
| --- | --- |
| **Company** | **Input** |
| Mod V0 | **Please share your inputs on each of the issues and, if applicable, proposals in TABLE 1A.** |
| Google | Proposal 1.A: OKProposal 1.B: Support. Proposal 1.C: SupportProposal 1.D: We failed to see the ambiguity. Proposal 1.E: The change would hurt other agenda items. Rel-19 AI/ML and SBFD introduced new metrics to be reported. MIMO should focus on the metric introduced by R19 MIMO. We understand the motivation but the formulation should be changed to focus on the metric introduced by R19 MIMO. Moreover, the change might be NBC.  |
| Samsung | Proposal 1.ASupport.Proposal 1.BWe have never discussed on a feature configuring R19 eType-I SP, SD+PD NES, and soft scaling in the normative phase. Since R19 CSI is in maintenance phase and the proposal is not an essential issue (but an optimization), it would be better to deprioritize the proposal/discussion.Proposal 1.CWe are fine with the modification since it corrects the current texts. Proposal 1.DWe think the assumption is an obvious configuration that NW only needs to follow and the case of configuring a same CSI-RS port mapped to different antenna ports across groups could be regarded as an erroneous case. Proposal 1.EIt seems we need to first discuss the priority rule for the new report quantities and an agreement for this is needed before we propose the text proposal, although it is unclear to us whether this is an essential issue.Proposal 1.FFine with it, and it is aligned with our understanding. |
| OPPO | Proposal 1.ASupport. Proposal 1.BWe can first discuss whether R19 eType-I CB with soft scaling can be configured together with Rel-19 SD NES Type-I. Proposal 1.CSupportProposal 1.DWe didn’t have this for Rel-18 Doppler codebook. Then we can’t understand why it is needed for Rel-19Proposal 1.EWe think the CR is needed. 1) Firstly, we don’t see any NBC issue for this CR. Instead, it is forward compatible to new CSI types in future release (e.g. Rel-20). 2) We can first discuss the priority rule, but at least for CJT calibration reports, we think they can have the same priority as CQI/PMI/RSRP/SINR (lower than SRI/RI/SSBRI). 3) Another way is to only add the CJT calibration reports after TDCP as below. We could be fine with this way, though it is not a good solution considering too many new CSI types in Rel-19.< Unchanged part omitted >- the UE shall drop PUSCH transmission carrying aperiodic CSI comprising only CQI/PMI/L1-RSRP/L1-SINR/TDCP/cjtc-Dd/cjtc-F/cjtc-Dd-F/cjtc-P on a carrier of a serving cell in set whenever the transmission and aperiodic SRS transmission (including any interruption due to uplink or downlink RF retuning time [11, TS 38.133]) as defined by higher layer parameters *switchingTimeUL* and *switchingTimeDL* of *SRS-SwitchingTimeNR)* on the carrier of the serving cell happen to overlap in the same symbol.< Unchanged part omitted > |
| Mod V5 | **Added proposal 1.F****Added TP for proposal 1.A and 1.F in Section 3** |
| NTT DOCOMO | Proposal 1.ASupport. Proposal 1.BNot support. We also think whether such combination configuration can be configured should be discussed first. Proposal 1.CSupport.Proposal 1.DOK to have it or leave it to NW implementation.Proposal 1.EWe see some new report quantities are introduced and thus this issue needs to be discussed. Another TP from OPPO in above reply seems a good candidate.Proposal 1.FWe failed to see the necessary.Proposal 1.GSupport. BTW, the TP in Section 3.2 is for Proposal 1.G, not Proposal 1.F (typo in the title of Section 3.2). |
| Google | Proposal 1.E: Thanks OPPO for the clarification. OK with OPPO’s new TP below to focus on the metric introduced in R19 MIMO.< Unchanged part omitted >- the UE shall drop PUSCH transmission carrying aperiodic CSI comprising only CQI/PMI/L1-RSRP/L1-SINR/TDCP/cjtc-Dd/cjtc-F/cjtc-Dd-F/cjtc-P on a carrier of a serving cell in set whenever the transmission and aperiodic SRS transmission (including any interruption due to uplink or downlink RF retuning time [11, TS 38.133]) as defined by higher layer parameters *switchingTimeUL* and *switchingTimeDL* of *SRS-SwitchingTimeNR)* on the carrier of the serving cell happen to overlap in the same symbol.< Unchanged part omitted >Proposal 1.F: There seems to be no ambiguity without the change. Proposal 1.G: We failed to see the necessity for the TP. There seems to be no ambiguity in current spec. Current spec has already covered the case of single set SRS and multi-set SRS. |
| Spreadtrum | Proposal 1.A: SupportProposal 1.B: Agree with FL assessment, this proposal is an optimization and not essential. Proposal 1.C: Support.Proposal 1.D: We think this is a valid UE assumption. However, we agree with OPPO that such description may not be needed. Proposal 1.E: We are fine with the new TP from OPPO’s comment. For now we just add the new report quantities introduced by Rel.19 MIMO.Proposal 1.F: Support.Proposal 1.G: Not sure whether the TP is needed. The current spec describes the 6 or 8 ports in resource basis not matter the SRS resources are configured in one or more SRS resources sets. We don’t see any ambiguity. |
| Fujitsu | Proposal 1.A: SupportProposal 1.B: We are open to discuss this issue. Proposal 1.C: Support.Proposal 1.D: We think this is not needed. Proposal 1.E: Support the new TP.Proposal 1.F: Support. |
| vivo | Proposal 1.B: Not support. The proposal is an optimization.Proposal 1.C: OKProposal 1.D: Support.Replying OPPO’s comments: In a legacy aperiodic CMR configuration for Rel-18 Type-II Doppler codebook, the UE shall assume that the antenna ports with the same port index of the K aperiodic CSI-RS resources are the same. However, for 'typeII-Doppler-r19', a similar clarification seems to have been missed.

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| --- |
| <omitted text>A UE configured with a CodebookConfig with the higher layer parameter vectorLengthDD, a CSI-ReportConfig with the higher layer parameter reportQuantity set to 'cri-RI-PMI-CQI', or a CSI-ReportConfig with the higher layer parameter [RRC\_name-r19] and codebookType set to 'typeII-Doppler-r18', is expected to be configured with K∈{4,8,12} aperiodic CSI-RS resources or with a single periodic or semi-persistent CSI-RS resource in the resource set for channel measurement. For an aperiodic CSI-RS resource set for channel measurement, the K CSI-RS resources are triggered by the same triggering instance and the separation between two consecutive CSI-RS resources is m∈{1,2} slots, which is configured by higher layer parameter aperiodicResourceOffset in the CodebookConfig. The K aperiodic CSI-RS resources are transmitted following the order of the CSI-RS resource IDs configured in the CSI-RS resource set. The UE shall assume that the antenna port with the same port index of the K aperiodic CSI-RS resources is the same. If interference measurement is performed on CSI-IM, only one resource is configured in the corresponding csi-IM-ResourceSet. If interference measurement is performed on NZP CSI-RS, only one resource is configured in the corresponding NZP-CSI-RS-ResourceSet for interference measurement.<omitted text> |

Proposal 1.E: OK with OPPO’s new TP.< Unchanged part omitted >- the UE shall drop PUSCH transmission carrying aperiodic CSI comprising only CQI/PMI/L1-RSRP/L1-SINR/TDCP/cjtc-Dd/cjtc-F/cjtc-Dd-F/cjtc-P on a carrier of a serving cell in set whenever the transmission and aperiodic SRS transmission (including any interruption due to uplink or downlink RF retuning time [11, TS 38.133]) as defined by higher layer parameters *switchingTimeUL* and *switchingTimeDL* of *SRS-SwitchingTimeNR)* on the carrier of the serving cell happen to overlap in the same symbol.< Unchanged part omitted >Proposal 1.F: OK.Proposal 1.G: OK |
| ETRI | Proposal 1.A: Support.Proposal 1.B: We have similar view as OPPO and DCM.Proposal 1.C: Support.Proposal 1.D: Leave it as NW implementation.Proposal 1.E: We are fine with OPPO's new TP.Proposal 1.F: We don't see any ambiguity in the current spec.Proposal 1.G: OK. |
| Ericsson | **Proposal 1.B**We agree that this falls under the optimization category and is not an essential correction to be addressed during maintenance.**Proposal 1.C:**Ok**Proposal 1.D:**Can be left to network implementation**Proposal 1.E:**This issue needs to be discussed further given the new report quantities introduced in other (non-MIMO) work items.**Proposal 1.F:**Ok. |
| Lenovo | Proposal 1.A: Support. Proposal 1.B: Support since we think it is beneficial for explicit supporting SD+PD NES.Proposal 1.C: We fine with the modification.Proposal 1.D: Agree this is an obvious configuration by NW.Proposal 1.E: We understand the motivation for change and details can be further discussed, such as change based on only the report quantity from Rel.19 MIMO.Proposal 1.F: We are fine with it for clarification.  |
| Apple | **Proposal 1.A**We are okay **Proposal 1.B**Prefer not to discuss this, i.e., soft scaling cannot be used together with SD+PD NES**Proposal 1.C:**We are okay **Proposal 1.D:**We are okay to clarify such assumption at the UE side**Proposal 1.E:**The new TP from OPPO, i.e., only adding CJT calibration report introduced in Rel-19 MIMO, is better. We do not need to do maintenance for the other agenda, e.g., SBFD, AI/ML, etc. **Proposal 1.F:**We are okay  |
| ZTE | **Proposal 1.A:**Support. **Proposal 1.B:**Do NOT support. We agree with FL that this proposal seems an optimization, thus should NOT be discussed in the maintenance phase. If some clarification is needed, we prefer NOT to support joint configuration of soft scaling factor and SD+PD NES. **Proposal 1.C:**Fine with the TP. **Proposal 1.D:**Do NOT support. We think the error case precluded by the proposal should naturally be avoided by NW implementation. So, it does need to be specified.**Proposal 1.E:**We share similar view with Ericsson that, some further discussion may be needed because some new quantities are introduced by non-MIMO items.**Proposal 1.F:**Do NOT support. We never agree to change the two-level structure of CBSR for Type-II codebook. So, to our understanding, the two-level CBSR should be reused for Type-II codebook, and the group-based CBSR should be introduced for the second level.**Proposal 1.F:**Fine with the proposal and the TP. |
| CATT | **Proposal 1.A**Support**Proposal 1.B**We don't prefer to open discussion on soft scaling combined with SD+PD NES**Proposal 1.C:**OK**Proposal 1.D:**We are OK.In current 214, in resource setting configuration for Rel-18 Doppler CB it indeed states that “the UE shall assume that the antenna port with the same port index of the aperiodic CSI-RS resources is the same.” Such description is not presented in the paragraph for Rel-19 Doppler CB. Although it can be guaranteed with NW implementation, it is ok to clarify the UE assumption.**Proposal 1.E:**We are OK with OPPO’s new TP,i.e., “comprising only CQI/PMI/L1-RSRP/L1-SINR/TDCP/cjtc-Dd/cjtc-F/cjtc-Dd-F/cjtc-P”**Proposal 1.F:**Support**Proposal 1.G:**We are fine either way. In our understanding the current spec and HW’s proposal are aligned and HW’s proposal is clearer. |
| Xiaomi | **Proposal 1.B**:We need to firstly discuss whether soft scalling and Rel-19 SD NES Type I should be configured simultaneously. **Proposal 1.C**:Support**Proposal 1.D**:Fine or leave it to NW implementation**Proposal 1.E**:Prefer to further discuss the priority of these reporting quantity.**Proposal 1.F/ Proposal 1.G**:Support |
| NEC | **Proposal 1.A:** Support the proposal and TP in Proposal 1.A.**Proposal 1.D:** Fine with either have it or leave if for NW implementation.**Proposal 1.E:** Support. The description needs to be updated with newly introduced CSI quantities, seems no NBC issue.**Proposal 1.F:** Fine.**Proposal 1.G:** Fine. |
| Qualcomm | **Proposal 1.A**: Support in general.For the TP in Section 3.1, we think that the following part in Clause 5.2.2.5.1 of 214 on NES should also be addressed:

|  |
| --- |
| ------------------------------------------Start of Text Proposal ----------------------------------< Unchanged text omitted >- For a UE configured with a *CSI-ReportConfig* that contains a list of sub-configurations provided by *csi-ReportSubConfigToAddModList*,- if a sub-configuration indicates a CSI-RS antenna port subset using the higher layer bitmap parameter *portSubsetIndicator* or *portSubsetIndicator-r19*, as described in clause 5.2.1.4.2, for CQI calculation, antenna ports corresponding to all bits with value of 1 in *portSubsetIndicator* are mapped to consecutive antenna ports starting at CSI-RS antenna port 3000 in increasing order of the bit position in *portSubsetIndicator*. The UE should assume that PDSCH signals on antenna ports in the set [1000,…, 1000+ν-1] for ν layers would result in signals equivalent to corresponding symbols transmitted on antenna ports [3000, …, 3000+P-1] *T*, as given bywhere *P* corresponds to the number of bits with value 1 in the bitmap *portSubsetIndicator* and *T* , and are as previously described in this Clause, and the corresponding PDSCH EPRE to CSI-RS EPRE is as previously defined in this Clause if the sub-configuration does not indicate a power offset *powerOffset*.~~- If a sub-configuration indicates a CSI-RS antenna port subset using the higher layer bitmap parameter~~ *~~portSubsetIndicator-r19~~*~~, for CQI calculation, port indices, , corresponding to all bits with value of 1 in~~ *~~portSubsetIndicator-r19~~* ~~in increasing order of the bit position in~~ *~~portSubsetIndicator-r19~~*~~, are mapped to antenna ports ,or to antenna ports if the CSI-RS resources are aperiodic, with index , of the respective CSI-RS resource , with , for , as described in Clause 5.2.1.4.2, where~~ ~~corresponds to the number of bits with value 1 in the bitmap~~ *~~portSubsetIndicator-r19~~*~~, and is the total number of ports obtained by aggregating CSI-RS resources for channel measurement. The UE should assume that PDSCH signals on antenna ports in the set [1000,…, 1000+ν-1] for ν layers would result in signals equivalent to corresponding symbols transmitted on antenna ports of the respective CSI-RS resource , as given by~~~~or~~~~where~~ *~~T~~* ~~and~~ ~~are as previously described in this Clause, and the corresponding PDSCH EPRE to CSI-RS EPRE is as previously defined in this Clause depending on the configured~~ *~~codebookType~~* ~~for the sub-configuration, if the sub-configuration does not indicate a power offset~~ *~~powerOffset~~*~~.~~< Unchanged text omitted >--------------------------------------- End of Text Proposal ------------------------------------ |

[Mod: Added in section 3.2]**Proposal 1.B**: We agree with some companies that soft CBSR for NES was not agreed, thus not prefer to add it at the maintenance stage.**Proposal 1.C**: OK**Proposal 1.G**: OK |
| Huawei, HiSilicon | **Proposal 1.A:** support.**Proposal 1.E:** To avoid any potential problem with other CSI reports, adding new report quantities seems to be better.**Proposal 1.F:** we still prefer the CBSR should be based on legacy CBSR scheme, i.e., the two-level CBSR of Rel-16 type-II codebook.**Proposal 1.G:** Support the proposal and the TP. The problem in the current specification is that the SRS indexing across multiple SRS resources always happens no matter P/SP or AP SRS. However, following previous agreement, this only happens for AP SRS. While for P/SP, the SRS indexing should be within one SRS resource.For SRS antenna switching with multiple aperiodic SRS resource sets, PSRS ports indexed in an ascending order according to SRS resource set ID and SRS resource ID in a set and port number within each SRS resource |
| Nokia | **Proposal 1.B:** agree with FL assessment and other companies’ comments that the combination of soft scaling and NES Type-I has not been agreed and we don’t think this is an essential feature to introduce now**Proposal 1.C**: I feel this is not essential as the interpretation of the text should be obvious**Proposal 1.G**: We don’t see the need for this proposal, the description is already capturing the two cases. The proposed TP creates unnecessary duplication of the text |
| Mod V25 | **Added more TPs in section 3.*** **Proposal 1.A in section 3.1 (main), 3.2 (from JD)**
* **Proposal 1.C in section 3.3**
* **Proposal 1.E in section 3.4**
* **Proposal 1.G in section 3.5**

**For proposal 1.E, use the new version from OPPO – a proposed TP in 8.2.2 can only address what MIMO has agreed. For other quantities, other agenda items can propose their own TPs (and later the editor can consolidate and revise if needed)** |
| Mod V26/27 | **No revision** |
| NEC | **Proposal 1.C**: @ Nokia, thank you. It’s not only for clear description. But as the selection of SD basis in clause 5.2.2.2.3 is defined for , which is starting from 0, as:

|  |
| --- |
| 5.2.2.2.3 Type II Codebook <Irrelevant part omitted>Then the elements of  and  are found from using the algorithm: for  Find the largest  in Table 5.2.2.2.3-1 such that       When  and  are known,  is found using: where the indices  are assigned such that  increases as  increases, where  is given in Table 5.2.2.2.3-1.<Irrelevant part omitted> |

While it’s defined for as , if we simply refer the selection, the formula is not accurate (e.g. the initial value  doesn’t exist for . So we proposed this TP.  |
| Mod V28 | **No revision.****@Nokia: please check NEC’s response**  |

### Issue 2 (WID objective 2c): CRI-based CSI for hybrid beamforming (HBF)

Table 2A Summary: issue 2

|  |  |  |
| --- | --- | --- |
| **#** | **Issue** | **Companies’ views** |
| **New proposals** |
| 2.1 | Proposal 2.A: For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports,* If higher layer parameter *mrSelectedResources* is not configured for the CSI report, support to associate the NZP CSI-RS resource for interference measurement with the NZP CSI-RS resource for channel measurement with smallest CRI;
* Else, support to associate the NZP CSI-RS resource for interference measurement with the first configured NZP CSI-RS resource for channel measurement among the non-reported MR CRIs.

FL assessment: For the KS NZP CSI-RS resources for CM, only 1 NZP CSI-RS resource for IM can be configured (regardless whether MR is configured or not). The proposal introduces an association rule where the single NZP CSI-RS resource for IM corresponds to the “first” NZP CSI-RS resource for CM. It is unclear if this association is needed since NZP CSI-RS resource for IM is typically used for interference emulation.   | **Support/fine:** Huawei/HiSi, Google (ok), NTT DOCOMO, Not support: Samsung, OPPO, Spreadtrum, Fujitsu, vivo, ETRI, Ericsson, Lenovo, Apple, ZTE/Sanechips, CATT (may need clarification), Xiaomi (already agreed to reuse legacy), Qualcomm,  |
| **Proposals from previous more recent meeting(s) and/or round(s)** |
|  |  |  |
|  |  |  |

Table 2B SLS results: issue 2

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Table 2C Additional inputs: issue 2

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| --- | --- |
| **Company** | **Input** |
| Mod V0 | **Please share your inputs on each of the issues and, if applicable, proposals in TABLE 1A** |
| Google | Proposal 2.A: We understand the technical benefit, but it seems to be an optimization. If majority is fine, we are also fine with the proposal. |
| Samsung | Proposal 2.ASeems not essential and not aligned with our understanding: the 1 NZP-CSI-RS resource for IM is used to emulate an intra-cell interference that is common for all Ks NZP CSI-RS resources for CM. Otherwise, we should’ve defined Ks NZP-CSI RS for IM. |
| OPPO | Proposal 2.AWe have similar understanding as Samsung. |
| Huawei, HiSilicon | **Proposal 2.A:** Support.As widely accepted by the group, gNB may transmit different CMRs by different analog beams under HBF architecture, and **the pairing situation of different analog beams can be distinct**. To accurately emulate the intra-cell interference suffered by a UE when it’s scheduled by different analog beams, Ks NZP CSI-RS resources for IM are needed in principle. While given the fait accompli that only 1 NZP CSI-RS resource for IM can be configured, what we can do is to make the best of it as proposed, so that:* The ambiguity between gNB transmission ehavior and UE CSI calculation assumption can be eliminated;
* The only IMR can be maximized to provide accurate CSI for a high-priority beam (when *mrSelectedResources* is configured)
 |
| Mod V5 | **No revision** |
| NTT DOCOMO | Support. We think it is beneficial to associate the NZP-IMR with a CMR, as the NZP-IMR could be specific interference for an analog beam. |
| Spreadtrum | Proposal 2.AWe have similar view as Samsung. Since CRI-based CSI is targeting FR1, the intra-cell interference measured by UE can be commonly applied to all Ks CMRs. |
| Fujitsu | Based on the current agreements, our understanding also is that this single NZP CSI-RS for IM can be associated with all NZP CSI-RSs for CMR. |
| Vivo | Proposal 2.A: This proposal seems to be an optimization. We also have same understanding as Samsung. |
| ETRI | Proposal 2.A: We have similar view as Samsung. |
| Ericsson | Proposal 2.A: Given that we have only 1 NZP CSI-RS for IM for the Ks NZP CSI-RS resources for CM, we are not sure if this association rule is essential.  |
| Lenovo | Proposal 2.A: it seems this is for optimization and thus not so essential. |
| Apple | **Proposal 2.A**Little confused here. What about the IMR assumption for the other CMRs? |
| ZTE | **Proposal 2.A:**NOT support. We share same understanding with Samsung. The only one IMR should be applicable for all CMRs. |
| CATT  | **Proposal 2.A**We think that at least the 3 following aspects should be clarified:* The interference assumption for each CMR

In our understanding, the single NZP CSI-RS for IM is associated with all NZP CSI-RSs for CMR. Therefore, each of the NZP-CSI-RS for channel measurement will assume the intra-cell interference represented by the single associated IMR.* The QCL for the single NZP CSI-RS for IM

In the spec 214, it states that “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 ‘typeD’ ”. For multi-CRI HBF, since the single NZP CSI-RS for IM is associated with all NZP CSI-RSs for CMR, but different NZP CSI-RSs for CMR can have different beams, the QCL for the single NZP CSI-RS for IM should be clarified. We think this is the intention of HW’s proposal.* The aperiodic triggering offset of single NZP CSI-RS for IM

In the spec 214, it states that “a UE is not expected to be configured with a different aperiodic triggering offset of the NZP CSI-RS for interference measurement from the associated NZP CSI-RS for channel measurement”. For multi-CRI HBF, since the single NZP CSI-RS for IM is associated with all NZP CSI-RSs for CMR, the aperiodic triggering offset of the single NZP CSI-RS for IM should be clarified, i.e., is there resource-level slot offset, if yes, which slot offset among the associated NZP CSI-RSs for CMR should be adopted?  |
| ETRI | **Proposal 2.A**@CATT: For the second bullet, we consider that the objective of WID is confined to FR1, and therefore the issue may not be applicable. Regarding the third bullet, we are open to discussing the aperiodic triggering offset of NZP CSI-RS for IM. |
| Xiaomi | According to the agreement on IMR configuration, reuse the legacy IMR rule for the Rel-15 CRI-based reporting for NZP CSI-RS resource for interference measurement for Rel-19 CRI-based CSI reporting. In current spec, such association is not supported for Rel-15 CRI-based reporting. The necessary of introducing such association need to further justify.  |
| Qualcomm | After checking, we agree with Xiaomi.We think we made a mistake during Rel-19.In legacy Rel-15, NZP CSI-RS for IM actually can’t be supported for CRI-based report.In RAN1#16bis (2024-04), the following agreement said to follow legacy Rel-15:

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| --- |
| **Agreement**For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports, * When M>1, the M PMIs are independently calculated and indicated
* with the Rel-16 eType-II codebook and KS={1,2,3,4}, support M=2 with a maximum of 16 ports per resource, R=1 only, and a maximum UCI payload of 1706 bits.
	+ The value of M={1, 2} is NW-configured via higher-layer (RRC) signalling
	+ The maximum value of M is subject to UE capability
* on the configured KS>1 NZP CSI-RS resources, reuse the legacy IMR rule for the Rel-15 CRI-based reporting for NZP CSI-RS resource for interference measurement, i.e. only 1 NZP CSI-RS resource for interference measurement can be configured
 |

However, we now see it is not aligned with Rel-15:We’d like to check companies’ views regarding how to proceed.In our view, regardless whether we correct the mistake or not, at least we should not further optimize it.[Mod: The above doesn’t indicate any mistake. As Xiaomi pointed out, Rel-15 allows up to 1 NZP CSI-RS resource for IM. This is what we agreed on. Xiaomi also pointed out that legacy doesn’t specify any association between the configured NZP CSI-RS resource for IM with any of the CMR(s).Based on the legacy behaviour, there is no need to SPECIFY the association between the NZP CSI-RS resource for IM (if configured) and any of the Ks CMR(s)]. |
| Nokia | Proposal 2.A: Not support. This seems an optimisation for a special case. The one NZP-IMR, if used, is associated to all the CMRs |
| Mod V25/26/27 | **No revision. @Qualcomm, please check my response**  |

### Issue 3 (WID objective 3): CJT calibration reporting for non-ideal synchronization and backhaul

Table 3A Summary: issue 3

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| --- | --- | --- |
| **#** | **Issue** | **Companies’ views** |
| **New proposals** |
| 3.1 | **Proposal 3.A**: For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured, regarding CQI/PMI/RI calculation, the PDSCH is assumed to be transmitted according toWhere are the selected CSI-RS resource, k is the subcarrier index, is the reference subcarrier, is the subcarrier spacing and is within the interval in which the delay offset, is reported by the UE. **FL assessment**: This proposal is technically sound and correct. Note that the digitally compensated DO is functionally equivalent to Rel-18 Type-II CJT mode-1 which also uses a similar text.**The TP can be found in Section 3.6** | **Support/fine:** Huawei/HiSi, ZTE/Sanechips, Google, Samsung, OPPO, Spreadtrum, Fujitsu, vivo, ETRI, Ericsson, Lenovo, Apple, ZTE/Sanechips, CATT, Xiaomi, NEC, NTT DOCOMO, Qualcomm, **Not support (already clear without equation):** Nokia, |
|  |  |  |
| **Proposals from previous more recent meeting(s) and/or round(s)** |
|  | **--** |  |

Table 3B LLS/SLS results: issue 3

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Table 3C Additional inputs: issue 3

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| --- | --- |
| **Company** | **Input** |
| Mod V0 | **Please share your inputs on each of the issues and, if applicable, proposals in TABLE 3A** |
| Google | Proposal 3.A: We understand the motivation, but the sentence “ is the DO” could be misleading. Does it mean the “measured DO” or “quantized DO”? Further, what is the value if the DO is reported as ‘out-of-range’?[Mod: It is the quantized DO reported by the UE. Agree with OPPO that it cannot be ‘out of range’] |
| Samsung | Proposal 3.AIt seems the proposal is needed since we have defined the CJT CSI report linking with CJTC-Dd report. We are supportive with the direction of the proposal. |
| OPPO | Proposal 3.AAgree with the motivation. We can further clarify that is the measured delay offset which cannot be ‘out-of-range’. |
| Mod V5 | **Revision per inputs from Google and OPPO** |
| Google | Proposal 3.AThanks FL for the update. The formulation that “It is assumed that is not ‘out of range’” may sound like UE is not allowed to report ‘out of range’. We suggest the following change:* It is assumed to be 0 if ~~that~~ is ~~not~~ ‘out of range’

[Mod: I removed the sub-bullet based on the discussion below. This was indeed discussed for several meetings already as Spreadtrum pointed out ☹] |
| Spreadtrum | Proposal 3.AWe are fine with the main bullet. Regarding the sub-bullet, it has been discussed for several meetings, and there’s no agreement regarding the additional UE procedure when the reported DO value is ‘out of range’. In our views, we support either the latest version suggested by Google, or just leave it to UE implementation by removing the sub-bullet. |
| Fujitsu | In the previous meeting, it was assumed that the num of TRS sets always are equal to the num of CSI-RSs for Rel-18 CJT Type II. Thus, in our understanding, the TRPs with “out of range” will not be selected/ reported by UE for Rel-18 Type II reporting. And for this formula of CQI assumption, the dimension of this vector should be the number of selected TRPs not the number of configured TRPs. Thus, we think the sub bullet might be not needed. |
| Vivo | Proposal 3.A: We are fine with the FL’s update.  |
| ETRI | Proposal 3.A: Support. But we suggest the following change for clarification as the delay offset reported is defined as an interval but is a scalar:  is within the interval in which the delay offset, , falls into ~~delay offset reported by the UE~~. |
| Ericsson | Support |
| Lenovo | Proposal 3.AWe think the proposal is needed and are fine with it in principle. For inconsistence and clarification, we suggest to make slight updating as following:**Proposal 3.A**: For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured, regarding CQI/PMI/RI calculation, the PDSCH is assumed to be transmitted according toWhere are the selected CSI-RS resources, k is the subcarrier index, is the reference subcarrier, is the subcarrier spacing and is the DO.  |
| Apple | **Proposal 3.A**We are okay with the updated TP |
| ZTE | **Proposal 3.A**Support. Fine with the updated TP. |
| CATT | **Proposal 3.A:**support |
| Xiaomi | **Proposal 3.A**Prefer to adopt the changes proposed by Lenovo based on the updated version by FL. |
| NEC | **Proposal 3.A:**We are OK with the proposal. And regarding the for the calculation, it should be a value known to both UE and NW for alignment. Also as pointed out by ETRI, the reported delay offset is an interval while for calculation it should be a detailed value. We suggest to use the lower boundary of the interval i.e. for the calculation.[Mod: “Lower boundary” or “mid value” was proposed by several companies during the normative phase and discussed for several meetings and not agreeable ☹ So I won’t bring this up. What ETRI suggested seems to be the best we can do] In addition, we also prefer the additional note from Google that: It is assumed to be 0 if ~~that~~ is ~~not~~ ‘out of range’ |
| NTT DOCOMO | **Proposal 3.A:**Support |
| Qualcomm | **Proposal 3.A**: We are in general OK with the proposalSome minors:1. The selected index, seems better to be (rather than ), to be aligned with existing spec2. Same editorial suggestion as Lenovo. |
| Nokia | **Proposal 3.A.** Not support. The specs seem already clear on the UE behaviour when it comes to delay offset compensation for jointly or separately triggered Dd and CJT reports  |
| Mod V25 | **Revised proposal 3.A per inputs (Google, ETRI, Lenovo, NEC, Qualcomm). TP will be in section 3.6.****@Google, NEC: please check my response re your proposal ☹** |
| Mod V27 | **Removed the phase from nref since the DO is assumed to be 0. Added TP in section 3.6** |
| NEC | Thanks FL’s effort. We are fine with the revised proposal.[Mod: Thanks for your understanding!] |
| Mod V28 | **No revision** |

## Text proposals

### Proposal 1.A

|  |
| --- |
| **Reason for change**: The agreement in RAN1#121 on port indexing included the typo “aperiodic”. * While the typo is not implemented in TS38.211 (rightly so), it is implemented in TS38.214. In TS38.214, a functionally identical port indexing mechanism is used for periodic, semi-persistent, and aperiodic but formulated in two different manners. In doing so, the current formulation in TS38.214 exhibits discrepancy for P and SP CSI-RS as it assumes a different port indexing scheme from the one specified in TS38.211

**[121] Agreement**For the Rel-19 Type-I SP and Type-II codebook refinement for *P*=48, 64, and 128 CSI-RS ports with K>1 aggregated NZP aperiodic CSI-RS resources for CMR, to implement the previous agreements on the mapping from CSI-RS resource index/port index per resource and port index to CSI/PMI calculation* In TS38.211, extend the enumeration of antenna port *p=*3000+*p*’ with *p*’=0 …*P–*1
* In TS38.214, remove the term ‘port index for CSI/PMI calculation’

  |
| **Summary of the change**: Harmonized the description for P/SP with AP, and thereby removing the discrepancy for P/SP CSI-RS |
| **Consequences if not approved**: Erroneous description in TS38.214 |
| 5.2.1.4.2 Report quantity configurations<omitted text>- the higher layer bitmap parameter *portSubsetIndicator-r19*, of length 48, 64 or 128 bits, which contains the bit sequence , where is the MSB and is the LSB, bit corresponds to the port index, after CSI-RS resource aggregation, in order of increasing port index, as described in Clause 7.4.1.5.3 of [4, TS 38.211]. A bit value 0 in *portSubsetIndicator-r19* indicates that the corresponding antenna port is disabled for the sub-configuration, whereas bit value 1 indicates that the antenna port is enabled and belongs to the antenna port subset for the sub-configuration. For the derivation of PMI, port indices corresponding to all bits with value of 1 in *portSubsetIndicator-r19* are mapped to consecutive port indices in increasing order of the bit position in *portSubsetIndicator-r19*. The number of enabled antenna ports can be 48, 64 or 128 for a sub-configuration configured with *codebookType* set to 'typeI-SinglePanel-r19' or 2, 4, 8, 12, 16, 24 or 32 for a sub-configuration configured with *codebookType* set to 'typeI-SinglePanel', according to UE capability.<omitted text>5.2.2.2.1a Refined Type I Single-Panel CodebookFor 48, 64 and 128 antenna ports, obtained by aggregating CSI-RS resources for channel measurement, and the UE configured with higher layer parameter *codebookType* set to 'typeI-SinglePanel-r19'- The values of and are configured with the higher layer parameter *n1-n2-typeI-r19*. The supported configurations of , for a given number of CSI-RS ports, are given in Table 5.2.2.2.1a-1, for which . The number of CSI-RS ports, , is .**Table 5.2.2.2.1a-1: Supported configurations of**

|  |  |
| --- | --- |
| **Number of CSI-RS antenna ports,**  |  |
|
| 48 | (8,3) |
| (6,4) |
| 64 | (16,2) |
| (8,4) |
| 128 | (16,4) |
| (8,8) |

- The port index, , is described in Clause 7.4.1.5.3 of [4, TS 38.211].<omitted text>5.2.2.2.5a Refined eType II CodebookFor 48, 64 and 128 antenna ports, obtained by aggregating CSI-RS resources for channel measurement, and the UE configured with higher layer parameter *codebookType* set to 'eTypeII-r19'- The values of and are configured with the higher layer parameter *n1-n2-typeII-r19*. The supported configurations of , for a given number of CSI-RS ports, are given in Table 5.2.2.2.1a-1, for which . The number of CSI-RS ports, , is .- The port index, , is defined in Clause 7.4.1.5.3 of [4, TS 38.211].<omitted text>5.2.2.2.9a Refined FeType II Port Selection CodebookFor 48 and 64 antenna ports, obtained by aggregating CSI-RS resources for channel measurement, and the UE configured with higher layer parameter *codebookType* set to 'typeII-FePortSelection-r19'- The number of CSI-RS ports is , where is the number of CSI-RS resources in the CSI-RS resource set for channel measurement and the value of is configured by higher layer parameter *nrofPorts*- The port index, , is defined in Clause 7.4.1.5.3 of [4, TS 38.211].<omitted text>5.2.2.2.11a Refined eType II Codebook for predicted PMIFor 48, 64 and 128 antenna ports, obtained by aggregating CSI-RS resources for channel measurement, and the UE configured with higher layer parameter *codebookType* set to 'typeII-Doppler-r19'- The values of and are configured with the higher layer parameter *n1-n2-typeII-r19*. The supported configurations of , for a given number of CSI-RS ports, are given in Table 5.2.2.2.1a-1, for which . The number of CSI-RS ports, , is .- The the port index, , is defined in Clause 7.4.1.5.3 of [4, TS 38.211].<omitted text>5.2.2.5.1 UE assumptions for CQI/PMI/RI calculation<omitted text>- The PDSCH transmission scheme where the UE may assume that PDSCH transmission would be performed with up to 8 transmission layers as defined in Clause 7.3.1.4 of [4, TS 38.211]. For CQI calculation, the UE should assume that PDSCH signals on antenna ports in the set [1000,…, 1000+ν-1] for ν layers would result in signals equivalent to corresponding symbols transmitted on antenna ports [3000,…, 3000+*PCSI-RS* -1], as given by  Where is a vector of PDSCH symbols from the layer mapping defined in Clause 7.3.1.4 of [4, TS 38.211], is the number of CSI-RS ports. If only one CSI-RS port is configured, *W(i)* is 1. If the higher layer parameter *reportQuantity* in *CSI-ReportConfig* for which the CQI is reported is set to either 'cri-RI-PMI-CQI' or 'cri-RI-LI-PMI-CQI', *W(i)* is the precoding matrix corresponding to the reported PMI applicable to *x(i)*. If the higher layer parameter *reportQuantity* in *CSI-ReportConfig* for which the CQI is reported is set to 'cri-RI-CQI', *W(i)* is the precoding matrix corresponding to the procedure described in Clause 5.2.1.4.2. If the higher layer parameter *reportQuantity* in *CSI-ReportConfig* for which the CQI is reported is set to 'cri-RI-i1-CQI', *W(i)* is the precoding matrix corresponding to the reported i1 according to the procedure described in Clause 5.2.1.4.2. The corresponding PDSCH signals transmitted on antenna ports [3000,…,3000 +  *PCSI-RS*  - 1] would have a ratio of EPRE to CSI-RS EPRE equal to the ratio given in Clause 5.2.2.3.1.- If a UE is configured with *codebookType* set to 'typeI-SinglePanel-r19' and with the higher layer parameter *typeI-softScalingRank1-2-r19*, for , and , if supported by UE capability, the UE can assume that the PDSCH signal for each layer mapped to a vector of group would have the same ratio of EPRE to CSI-RS EPRE for all CSI-RS resources, equal to times the *powerControlOffset* (in linear scale) of the respective CSI-RS resource, where and are described in Clause 5.2.2.2.1a; otherwise, the UE can assume that the PDSCH signals for layers would have the same ratio of EPRE to CSI-RS EPRE for all CSI-RS resources, equal to the *powerControlOffset* of the respective CSI-RS resource. |

### Proposal 1.A.2

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| **Reason for change**: The agreement in RAN1#121 on port indexing included the typo “aperiodic”. * While the typo is not implemented in TS38.211 (rightly so), it is implemented in TS38.214. In TS38.214, a functionally identical port indexing mechanism is used for periodic, semi-persistent, and aperiodic but formulated in two different manners. In doing so, the current formulation in TS38.214 exhibits discrepancy for P and SP CSI-RS as it assumes a different port indexing scheme from the one specified in TS38.211

**[121] Agreement**For the Rel-19 Type-I SP and Type-II codebook refinement for *P*=48, 64, and 128 CSI-RS ports with K>1 aggregated NZP aperiodic CSI-RS resources for CMR, to implement the previous agreements on the mapping from CSI-RS resource index/port index per resource and port index to CSI/PMI calculation* In TS38.211, extend the enumeration of antenna port *p=*3000+*p*’ with *p*’=0 …*P–*1
* In TS38.214, remove the term ‘port index for CSI/PMI calculation’

  |
| **Summary of the change**: Harmonized the description for P/SP with AP, and thereby removing the discrepancy for P/SP CSI-RS |
| **Consequences if not approved**: Erroneous description in TS38.214 |
| 5.2.2.5.1 UE assumptions for CQI/PMI/RI calculation<omitted text>For a UE configured with a *CSI-ReportConfig* that contains a list of sub-configurations provided by *csi-ReportSubConfigToAddModList*,- if a sub-configuration indicates a CSI-RS antenna port subset using the higher layer bitmap parameter *portSubsetIndicator* or *portSubsetIndicator-r19*, as described in clause 5.2.1.4.2, for CQI calculation, antenna ports corresponding to all bits with value of 1 in *portSubsetIndicator* are mapped to consecutive antenna ports starting at CSI-RS antenna port 3000 in increasing order of the bit position in *portSubsetIndicator*. The UE should assume that PDSCH signals on antenna ports in the set [1000,…, 1000+ν-1] for ν layers would result in signals equivalent to corresponding symbols transmitted on antenna ports [3000, …, 3000+P-1] *T*, as given bywhere *P* corresponds to the number of bits with value 1 in the bitmap *portSubsetIndicator* and *T* , and are as previously described in this Clause, and the corresponding PDSCH EPRE to CSI-RS EPRE is as previously defined in this Clause if the sub-configuration does not indicate a power offset *powerOffset*.* ~~If a sub-configuration indicates a CSI-RS antenna port subset using the higher layer bitmap parameter~~ *~~portSubsetIndicator-r19~~*~~, for CQI calculation, port indices, , corresponding to all bits with value of 1 in~~ *~~portSubsetIndicator-r19~~* ~~in increasing order of the bit position in~~ *~~portSubsetIndicator-r19~~*~~, are mapped to antenna ports ,or to antenna ports if the CSI-RS resources are aperiodic, with index , of the respective CSI-RS resource , with , for , as described in Clause 5.2.1.4.2, where~~ ~~corresponds to the number of bits with value 1 in the bitmap~~ *~~portSubsetIndicator-r19~~*~~, and is the total number of ports obtained by aggregating CSI-RS resources for channel measurement. The UE should assume that PDSCH signals on antenna ports in the set [1000,…, 1000+ν-1] for ν layers would result in signals equivalent to corresponding symbols transmitted on antenna ports of the respective CSI-RS resource , as given by~~

~~or~~~~where~~ *~~T~~* ~~and~~ ~~are as previously described in this Clause, and the corresponding PDSCH EPRE to CSI-RS EPRE is as previously defined in this Clause depending on the configured~~ *~~codebookType~~* ~~for the sub-configuration, if the sub-configuration does not indicate a power offset~~ *~~powerOffset~~*~~.~~<omitted text> |

### Proposal 1.C

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| **Reason for change**: The current description for Type-I Scheme-B basis selection can benefit from clearer description |
| **Summary of the change**: Refine the current description in TS38.214 in clause 5.2.2.2.1a |
| **Consequences if not approved**: Potential lack of clarity in the description of UE behaviour in TS38.214 |
| 5.2.2.2.1a Refined Type I Single-Panel Codebook<Unchanged part omitted>The index is given bywhere for and for . The mapping of and to and for is obtained as in Clause 5.2.2.2.3 by replacing with and replacing with , where the values of are given in Table 5.2.2.2.5-4 and Table 5.2.2.2.1a-5, and and for one to one mapping to and for with ,.The index , for and is given byand is mapped to . The mapping of index , for and , to , with , is given in Table 5.2.2.2.1a-6. The quantities and for *typeI-codebookMode-r19* = 'modeB' are the same as defined above for 'modeA'.<Unchanged part omitted> |

### Proposal 1.E

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| **Reason for change**: The newly agreed CSI reporting quantities in Rel-19 MIMO CSI has not been reflected in the current description of priority rules in TS38.214 |
| **Summary of the change**: Added the new CSI reporting quantities for CJT calibration reporting  |
| **Consequences if not approved**: Incomplete description in TS38.214 |
| **6.2.1.3 UE sounding procedure between component carriers**< Unchanged part omitted >- the UE shall drop PUSCH transmission carrying aperiodic CSI comprising only CQI/PMI/L1-RSRP/L1-SINR/TDCP/cjtc-Dd/cjtc-F/cjtc-Dd-F/cjtc-P on a carrier of a serving cell in set whenever the transmission and aperiodic SRS transmission (including any interruption due to uplink or downlink RF retuning time [11, TS 38.133]) as defined by higher layer parameters *switchingTimeUL* and *switchingTimeDL* of *SRS-SwitchingTimeNR)* on the carrier of the serving cell happen to overlap in the same symbol.< Unchanged part omitted > |

### Proposal 1.G

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| **Reason for change**: In RAN1 #118bis meeting [1], SRS port grouping has been agreed for periodic, semi-persistent and aperiodic SRS resource sets. The SRS ports indexing for P/SP SRS resource set and AP SRS resource set are different following the agreement. For P/SP SRS, the 6/8R ports consists of ports within a set, while for AP SRS, the 6/8R ports can consist of ports across multiple sets.While the current description in TS38.214 seems sufficient, the proposed TP can improve the clarity.  |
| **Summary of the change**: Separated description in TS38.214 for aperiodic from periodic and semi-persistent SRS |
| **Consequences if not approved**: Potential lack of clarity in description in TS38.214 |
| < Start of the text proposal >5.2.2.5.1 UE assumptions for CQI/PMI/RI calculation*--- unchanged text omitted ---*- For a UE configured with one or more SRS resource sets with higher layer parameter *usage* set to 'antennaSwitching' and higher layer parameter *resourceType* set to 'periodic' or 'semi-persistent', with a total of or 8 ports across the resources in a set intended for xT6R or xT8R, respectively, if the higher layer parameter *reportQuantity* in *CSI-ReportConfig* for which the CQI is reported is set to 'cri-RI-CQI' and the UE is configured with the higher layer parameter *SRSPortGrouping-r19*, the UE can assume that SRS port group 0 corresponds to codeword 0 and comprises the even ports, and that SRS port group 1 corresponds to codeword 1 and comprises the odd ports out of the total ports. The SRS ports are indexed in an ascending order according to SRS resource ID and port number within each SRS resource.- For a UE configured with one or more SRS resource sets with higher layer parameter *usage* set to 'antennaSwitching' and higher layer parameter *resourceType* set to 'aperiodic', with a total of or 8 ports across the resources across the resource set(s) intended for xT6R or xT8R, respectively, if the higher layer parameter *reportQuantity* in *CSI-ReportConfig* for which the CQI is reported is set to 'cri-RI-CQI' and the UE is configured with the higher layer parameter *SRSPortGrouping-r19*, the UE can assume that SRS port group 0 corresponds to codeword 0 and comprises the even ports, and that SRS port group 1 corresponds to codeword 1 and comprises the odd ports out of the total ports. The SRS ports are indexed in an ascending order according to SRS resource set ID, SRS resource ID and port number within each SRS resource.*--- unchanged text omitted ---*< End of the text proposal > |

### Proposal 3.A

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| **Reason for change**: It was agreed that CJTC Dd report can be linked with Rel-18 Type-II CJT, which implies that the CQI/PMI calculation for Rel-18 Type-II CJT can be configured to assume a previously reported CJTC Dd report. Analogous to Rel-19 Type-II CJT mode-1, this can be reflected in the CQI/PMI calculation equation. However, the current description in TS38.214 already captures the necessary behaviour albeit without equation. |
| **Summary of the change**: Added the equation for CQI/PMI calculation when CJTC Dd report is linked with Rel-18 Type-II CJT |
| **Consequences if not approved**: Possible lack of clarity in UE behaviour when CJTC Dd report is linked with Rel-18 Type-II CJT |
| 5.2.2.5.1b UE assumptions for CQI/PMI/RI calculation for CJT If the higher layer parameter *reportQuantity* in *CSI-ReportConfig* for which the CQI is reported is set to 'cri-RI-PMI-CQI', the higher layer parameter *codebookType* is set to 'typeII-CJT-r18' or ' typeII-CJT-PortSelection-r18', and the corresponding CSI-RS Resource Set for channel measurement is configured with CSI-RS resources, for CQI calculation- a UE should assume PDSCH signals on antenna ports in the set for layers would result in signals equivalent to corresponding symbols transmitted on antenna ports of each of the *N*0 selected CSI-RS resources, as given by where is the precoding matrix corresponding to the procedure described in Clause 5.2.2.2.8 and 5.2.2.2.9 for *codebookType* set to 'typeII-CJT-r18' and ' typeII-CJT-PortSelection-r18', respectively, and are the indices of the *N*0 selected CSI-RS resources in increasing order, such that . A UE should assume that the signals , , fully overlap in time and frequency.- if the CSI reports with *reportQuantity* set to 'cri-RI-PMI-CQI' and *codebookType* set to 'typeII-CJT-r18' is linked to a CSI report with *reportQuantity* set to 'cjtc-Dd' by the higher layer parameter *linkedCJTCReport*, and the two CSI reports are jointly triggered, or separately triggered and the compensation is enabled by the higher layer parameter *delayOffsetCompensation,* a UE should assume PDSCH signals on antenna ports in the set for layers would result in signals equivalent to corresponding symbols transmitted on antenna ports of each of the *N*0 selected CSI-RS resources, as given by  where is the precoding matrix corresponding to the procedure described in Clause 5.2.2.2.8 and 5.2.2.2.9 for *codebookType* set to 'typeII-CJT-r18', and are the indices of the *N*0 selected CSI-RS resources in increasing order, such that , is the subcarrier index and is the reference subcarrier index, is the subcarrier spacing and is within the interval in which the delay offset, is reported by the UE. A UE should assume that the signals , , fully overlap in time and frequency. |

# References

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| --- | --- | --- | --- |
| 1 | R1-2505206 | Maintenance of 128 CSI-RS ports and UE reporting enhancement | Huawei, HiSilicon |
| 2 | R1-2505255 | CSI Enhancement for NR MIMO | Google |
| 3 | R1-2505268 | Maintenance on CSI enhancements | ZTE Corporation, Sanechips |
| 4 | R1-2505321 | Maintenance on Rel-19 CSI enhancements | CATT |
| 5 | R1-2505371 | Maintenance on Rel-19 CSI enhancements | vivo |
| 6 | R1-2505428 | Maintenance on Rel-19 CSI enhancement | Xiaomi |
| 7 | R1-2505534 | Remaining issues on Rel-19 CSI enhancements | Samsung |
| 8 | R1-2505736 | CSI enhancements for Rel-19 MIMO | OPPO |
| 9 | R1-2505809 | Maintenance on CSI enhancements | Lenovo |
| 10 | R1-2505817 | Maintenance on CSI enhancements | LG Electronics |
| 11 | R1-2505938 | Remaining issues on CSI enhancements | NEC |
| 12 | R1-2506042 | Maintenance on Rel. 19 MIMO CSI enhancements | Fraunhofer IIS, Fraunhofer HHI |
| 13 | R1-2506161 | Maintenance of CSI enhancement for NR MIMO Phase 5 | Nokia |
| 14 | R1-2506167 | Maintenance on CSI enhancements for large antenna arrays and CJT | Ericsson |
| 15 | R1-2506176 | Maintenance on Rel-19 CSI for >32 ports and UE-assisted CJT | Qualcomm Incorporated |
| 16 | R1-2506273 | Maintainance on CSI enhancements | NTT DOCOMO, INC. |
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