**3GPP TSG RAN WG1 #119 R1-2409588**

**Orlando, US, November 18th – 22nd, 2024**

**Agenda item:** 9.2.2

**Source:** Moderator (Samsung)

**Title:** Moderator Summary on Rel-19 CSI enhancements

**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 |

## Summary of companies’ proposals and views

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| 3.1.1 | **[118bis] Agreement**  For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured with two separate triggers, to indicate *whether or not* the UE should perform delay offset (DO) compensation based on the latest linked CJTC Dd report when calculating the Rel-18 Type-II CJT CSI, introduce a 1-bit indicator per CSI trigger state:   * … * FFS (RAN1#119): Whether the 1-bit indicator applies to all the NTRP CSI-RS resources, or 1-bit indicator per CSI-RS resource * …   **Proposal 3.A.1**: For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured with two separate triggers, to indicate *whether or not* the UE should perform delay offset (DO) compensation based on the latest linked CJTC Dd report when calculating the Rel-18 Type-II CJT CSI, the 1-bit indicator per CSI trigger state applies to all the NTRP configured CSI-RS resources.  **FL assessment**: This was discussed OFFLINE [1]. | **Support/fine**: Ericsson, New H3C, Huawei/HiSi, Samsung, vivo, ZTE, Apple, Lenovo/MotM, NTT DOCOMO, NTT CORP, OPPO, Qualcomm, CATT, Intel, TCL, Xiaomi, Spreadtrum, UNISOC, Fujitsu, NEC, KDDI, MediaTek, Sony, Google, IDC, Sharp, Nokia/NSB, CMCC, HONOR, NICT, China Telecom, New H3C,  **Not support**: |
| 3.2.1 | **[118bis] Agreement**  For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured with a joint trigger:   * Reuse the CPU occupation and active resource counting for the Rel-18 eType-II CJT * FFS (RAN1#119): Re timeline, decide whether to reuse or further relax the timeline for the Rel-18 eType-II CJT   **Proposal 3.B.1**: For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured with a joint trigger, the timeline (Z/Z’) is determined as Z/Z’ associated with the Rel-18 eType-II CJT, plus Drelax   * The value of Drelax is a UE capability, taken from {0, drelax}   + FFS: The value of drelax (>0), including whether it depends on SCS * For linking CJTC Dd and Rel-18 eType-II CJT CSI, joint triggering is a separate UE feature group from separate triggering   **FL assessment**: This was discussed OFFLINE [1]. | **Support/fine**: Samsung, vivo, New H3C, Ericsson, Huawei/HiSi, Apple, NTT DOCOMO, NTT CORP, OPPO, Qualcomm, Intel, TCL, Xiaomi, Spreadtrum, UNISOC, Fujitsu, NEC, KDDI, MediaTek, Sony, Sharp, CMCC, ZTE, CATT, Nokia/NSB, NICT, Google (ok), China Telecom, New H3C,  **Not support**: |
| 3.3 | **[118bis] Agreement**  For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured, support linking the CMRs in the two CSI Report Settings so that UE knows which CMRs in the two report settings correspond to the same TRP.   * Based on a fixed correspondence between the set of TRS resource set IDs in sequential order and the set of CSI-RS resource IDs in sequential order of configuration in their respective Resource Setting   FFS: linking, when the number of resources configured for CJT CSI is < number of resource sets configured for CJT Dd, in case of separate triggers  **Conclusion 3.C:** 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 linking the CMRs in the two CSI Report Settings, for separate triggering, the UE expects that the number of CSI-RS resources associated with the Rel-18 eType-II CJT CSI is always the same as the number of TRS resource sets associated with the Rel-19 CJTC Dd report  **Question 3.C:** 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 linking the CMRs in the two CSI Report Settings, please share your views, if any, on   * Whether or not, for separate trigger, the UE can assume that the number of CSI-RS resources associated with the Rel-18 eType-II CJT CSI is always the *same* as the number of TRS resource sets associated with the Rel-19 CJTC Dd report   + If not, whether an additional mapping between the CMRs is needed or not   **Yes** **(always same, baseline)**: Apple, CATT, Lenovo/MotM, Samsung, OPPO, Google, Qualcomm, NTT DOCOMO, NTT CORP, Xiaomi, NEC, ZTE, IDC, Spreadtrum, Sharp, Intel, Rakuten, Sony, Apple, Huawei/HiSi, KDDI,  **Not always (need justification)**: Fujitsu, MediaTek, Nokia/NSB,  **FL assessment**: This FFS can be discussed. If there is no resolution, the baseline is that there is no additional mapping needed and hence the number of CSI-RS resources associated with the Rel-18 eType-II CJT CSI is always the same as the number of TRS resource sets associated with the Rel-19 CJTC Dd report. | |
| 2.4 | **Proposal 2.D**: For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports, if the UCI associated with each of the M CRIs comprises two parts and is multiplexed on PUCCH, the UE determines the PUCCH resource, the number of PRBs for the PUCCH resource, assuming that the CSI associated with each of the M reported CRIs corresponds to rank 1  **FL assessment**: The proposal (addressing the use of two-part UCI on PUCCH) can benefit from more discussion. It is unclear whether rank-1 is the best assumption for resource determination since it represents the lowest overhead. | **Support/fine**: Samsung, Google, Qualcomm, NTT DOCOMO, NTT CORP, MediaTek, Xiaomi, CMCC, Lenovo/MotM, Nokia/NSB, NEC, OPPO, Fujitsu, ZTE, CATT, IDC, Spreadtrum, vivo, Sharp, KDDI, Intel, Ericsson, Apple, Huawei/HiSi (open), TCL, New H3C,  **Not support**: |
| 2.2 | **Proposal 2.B**: For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports, regarding UCI reported in CSI part-1, if resource-specific RI restriction is configured, zero padding bits are introduced in CSI part 1 for each of the (MMR) reported CRIs:   * For a k-th CRI from the (MMR) reported CRIs (where k=1, 2, …, (MMR)), zero padding bits are inserted after RI field for the k-th CRI, where:   + - , where is the size of RI field corresponding to the i-th CRI, and is the set of CRIs corresponding to the (KsMR) resources     - is the size of RI field corresponding to the k-th CRI   **FL assessment**: The proposal is needed to ensure that the payload for CSI part 1 stays the same for a given RRC configuration. Resource-specific RI restriction (not supported in legacy) implies that the variation of RI bit-width can vary depending on which CRI(s) are selected. So padding bits are needed (following the legacy method of ensuring constant payload). | **Support/fine**: Samsung, Google, NTT DOCOMO, NTT CORP, Qualcomm, MediaTek, Xiaomi, CMCC, NEC, Fujitsu, Tejas, ZTE, CATT, IDC, Spreadtrum, OPPO (ok), Sharp, KDDI, Intel, Rakuten, Ericsson, Apple, Huawei/HiSi (open), TCL, New H3C,  **Not support**: Nokia/NSB (leave to editor), vivo (bitwidth for each RI= max(RI)), |
| 2.3 | **Proposal 2.C**: For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports, regarding one-part CSI wideband reporting, if resource-specific RI restriction is configured, the zero padding bits for each of the M reported CRI are determined as follows:   * For a k-th CRI from the M reported CRIs, , where:   + , where *Q* is the set of CRIs corresponding to Ks resources and is the maximum payload size of associated CSI fields for a j-th CRI, and , where is the set of rank values that are allowed to be reported for the j-th CRI;   + , where is the reported rank for k-th CRI;   + Note: is the size of RI field corresponding to k-th CRI.   + Note: The definition of the operator B(∙) is as legacy (as defined in 38.212).   + Note: the is in the same place as legacy padding bits.   **FL assessment**: The proposal is needed analogous to CSI part 1. | **Support/fine**: Samsung, Google, Qualcomm, NTT DOCOMO, NTT CORP, MediaTek, Xiaomi, CMCC, NEC, Fujitsu, Tejas, ZTE, CATT, IDC, Spreadtrum, OPPO (ok), Sharp, KDDI, Intel, Rakuten, Ericsson, Apple, Huawei/HiSi (open), TCL, New H3C,  **Not support**: Nokia/NSB (leave to editor), vivo bitwidth for each RI= max(RI), |
| 1.5 | **Proposal 1.E**: For the Rel-19 Type-I SP codebook refinement for P=48, 64, 128 CSI-RS ports, when the UE reports or multiplexes the CSI on PUCCH, the PUCCH resource, the number of PRBs for the PUCCH resource, and/or the number of Part 2 CSI reports are determined based on the RI value that results in the largest UCI payload.   * [For Scheme-B, the RI value that results in the largest UCI payload is determined as min(4, maximum configured rank per CSI reporting configuration)] * [For Scheme-A, the RI value that results in the largest UCI payload is determined as maximum configured rank per CSI reporting configuration]   **FL assessment**: This proposal seems needed for PUCCH resource determination. | **Support/fine**: Huawei/HiSi, vivo, NTT DOCOMO, NTT CORP, Qualcomm, Samsung, MediaTek, Xiaomi, CMCC, Lenovo/MotM, Nokia/NSB, NEC, Fujitsu, Tejas, ZTE, IDC, Spreadtrum, vivo, Sharp, KDDI, Intel, Rakuten, Ericsson, Apple, TCL, New H3C,  **Not support**: Google, |
| 3.1.2 | **[118bis] Agreement**  For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured with two separate triggers, to indicate *whether or not* the UE should perform delay offset (DO) compensation based on the latest linked CJTC Dd report when calculating the Rel-18 Type-II CJT CSI, introduce a 1-bit indicator per CSI trigger state:   * … * FFS (RAN1#119): How this applies to a single CSI trigger state associated with >1 CSI reports   **Proposal 3.A.2**: For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured with two separate triggers, to indicate *whether or not* the UE should perform delay offset (DO) compensation based on the latest linked CJTC Dd report when calculating the Rel-18 Type-II CJT CSI, when a single CSI trigger state associated with >1 Rel-18 Type-II CJT CSI reports, the 1-bit indicator per CSI trigger state applies to all the Rel-18 Type-II CJT CSI reports linked with a CJTC Dd report.  **FL assessment**: This was discussed OFFLINE [1].  **From moderator perspective, including the 1-bit indicator in the CSI-AssociatedReportConfigInfo seemingly reverts the previous agreement (even if this parameter is inside the trigger state IE). In addition, it allows additional flexibility of having different values for the 1-bit indicator across different Rel-18 Type-II CJT CSI reports linked with the CJTC Dd report.** | **Support:** Ericsson, New H3C, Huawei/HiSi, Samsung, vivo (ok), Apple, Lenovo/MotM, NTT DOCOMO, Qualcomm, CATT, Intel, TCL, Xiaomi, Spreadtrum, UNISOC, Fujitsu, NEC, KDDI, MediaTek, Sony, OPPO, IDC, Sharp, IDC, CMCC, Nokia/NSB, NICT, China Telecom, New H3C,  **Not support (1-bit indicator in CSI-AssociatedReportConfigInfo, so it becomes NW implementation):** Google,Nokia/NSB,ZTE, |
| 1.1 | **[117] Agreement**  For the Rel-19 Type-I codebook refinement for 48, 64, and 128 CSI-RS ports, for RI=v=1, support the following:   * for each group of SD basis vectors, a 3-bit scaling factor can be NW-configured via higher-layer (RRC) signalling, where the scaling factors are defined as scalings on the power control offset configured for the associated CSI-RS resources   + The values of and for this feature are separately configured from those for CBSR   + Separate configuration (RRC signalling) from CBSR   + The candidate values of and are the same as those agreed for CBSR * The codepoints of each of the group-specific 3-bit scaling factors are mapped to values of   …  **[118bis] Agreement**  For the Rel-19 Type-I SP codebook refinement for 48, 64, and 128 CSI-RS ports, regarding the support for the 3-bit scaling factor(s) for RI=*v* >1, support only for RI=*v*=2 without per-SD-basis-vector/layer power adjustment/boosting   * FFS: Details on per-layer scaling factor applied to each of the selected SD basis vectors, extending the agreed scaling factor for RI= *v* =1 (in RAN1#117)   This feature is a separate UE capability from soft scaling for RI=*v*=1. Introduce new RRC parameter to enable the feature.  …  For the Rel-19 Type-I SP codebook refinement for 48, 64, and 128 CSI-RS ports, regarding per-layer scaling factor applied to each of the selected SD basis vectors associated with RI=*v* {2} for the 3-bit scaling factor(s), decide, by RAN1#119, from the following alternatives:   * Alt1: * Alt2: * Alt3: * Alt4: * Alt5: * Alt6: * Alt7:   + if two different vectors for , for the vector with smaller scaling factor , and for the other vector configured with larger scaling factor ;   + otherwise ( or one same vector for ), for the vector   Where ri denotes the number of layers associated with the i-th SD basis vector.  The same scheme applies to both Mode-A and Mode-B.  Note: as agreed in RAN1#117.  Normalization of precoder should be taken into account in the final specification design.  **Proposal 1.A.1:** For the Rel-19 Type-I SP codebook refinement for 48, 64, and 128 CSI-RS ports, regarding per-layer scaling factor applied to each of the selected SD basis vectors associated with RI=*v=*2 for the 3-bit scaling factor(s):   * The scaling formula is where is a multiplicative factor independent of *i*   + Reuse legacy precoder normalization (per discretion of the spec editor)   + FFS (RAN1#119): Whether min( , 1) operation is needed   + FFS (RAN1#119): Whether other than 1 (baseline) is needed (e.g. or ) * Regarding the configuration of the value (3-bit indicator per SD basis vector group), decide, by RAN1#119, between the following:   + Alt1. RI=1 and RI=2 are separately configured (RI-specific)   + Alt2. A same configuration is used for RI=1 and RI=2 (RI-common)   **FL assessment**: This was discussed OFFLINE [1]. **Two sets of simulation results are available, i.e. from Ericsson and Nokia, justifying proposal 1.A.1 against “AltB” (** where ri denotes the number of layers associated with the i-th SD basis vector**).**  Note that (without any additional multiplicative factor or min operation, or any other formula) should be the baseline since it is analogous to the scaling formula for RI=v=1 (i.e. without any additional agreement on scaling formula for RI=v=2, it is understood that a similar formula to the agreed formula for RI=v=1 is reused).  Si value configuration   * **Alt1. RI-specific**: vivo, New H3C, Samsung (ok), NEC, OPPO, Lenovo/MotM, Ericsson (ok), Google, CMCC, * **Alt2. RI-common**: ZTE, Huawei/HiSi, Samsung, Ericsson, Apple, Xiaomi, Qualcomm, NTT DOCOMO, NTT CORP, Intel, MediaTek, Tejas, Sharp, Nokia/NSB, Fraunhofer IIS/HHI, IDC, KDDI, Rakuten,    value:   * 1 (baseline): Ericsson, Intel, Rakuten, Samsung, vivo, * 1 when b0=b1, else : Qualcomm, Xiaomi, * : Huawei/HiSi | **Support/fine:** Ericsson, vivo, NewH3C, Samsung,(ok), ZTE (ok), CATT,NTT DOCOMO, NTT CORP,Intel, TCL, Fujitsu, NEC, MediaTek, Tejas, OPPO (ok), Sharp, CMCC, Lenovo/MotM (with RI-specific), Qualcomm (at least when b0=b1), China Telecom, Nokia/NSB, Fraunhofer IIS/HHI, KDDI, Rakuten, Apple, Huawei/HiSi, New H3C,  **Not support ():** Xiaomi (with v scaling), IDC, Goggle, |
| 1.3 | **Conclusion 1.C**: For the Rel-19 Type-I SP codebook refinement for P=48, 64, 128 CSI-RS ports, when a UE is configured with sub-band SP-CSI for Scheme-B, the UE is not expected to be configured to report the CSI on PUCCH format 4  **FL assessment**: The current spec “A UE is not expected to report CSI with a total number of UCI bits and CRC bits larger than 115 bits when configured with PUCCH format 4” which, as pointed out by several companies, seems to be sufficient to preclude the above configuration.  **Proposal 1.C**: For the Rel-19 Type-I SP codebook refinement for P=48, 64, 128 CSI-RS ports, when sub-band SP-CSI for Scheme-B is configured to be reported on PUCCH format 4:   * a UE is not expected to be configured with the smaller sub-band size between the two configurable sub-band sizes for a given BWP; and * the UCI for the co-phase selection is restricted from 2-bit (QPSK) to 1-bit (BPSK)   **Support/fine:** Samsung, Qualcomm, MediaTek, Xiaomi (open), Fraunhofer IIS/HHHI (open), IDC, KDDI (open),  **Not support:** Google, NTT DOCOMO (exclude PF4), NTT CORP, CMCC, Lenovo/MotM (exclude PF4), OPPO (exclude PF4), ZTE (exclude PF4), Spreadtrum, Sharp (exclude PF4), Nokia/NSB (exclude PF4, current spec), vivo (exclude PF4, current spec), Intel (exclude PF4, current spec), Ericsson (exclude PF4, current spec), Apple (exclude PF4, current spec), Huawei/HiSi (exclude PF4, current spec), New H3C, | |
| 2.5 | **Proposal 2.E**: For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports, regarding packing order and priority levels of *NRep* CSI reports with *M* CRIs, the UCI packing order and the consecutive priority levels (higher to lower) are as follows:   * The UCI for the *M* CRIs of the first CSI report * The UCI for the *M* CRIs of the second CSI report * *…* * The UCI for the *M* CRIs of the *NRep*-th CSI report   Note: The UCI packing order and the associated priority level for the UCI for the M CRIs in each report follows the previous agreements.  **FL assessment**: The proposal addresses the priority and packing order when NRep>1 reports. This proposal seems needed for completion. | **Support/fine**: Tejas, [Google], Qualcomm, Samsung, NTT DOCOMO, NTT CORP, MediaTek, Xiaomi, CMCC, Fujitsu, CATT, IDC, Spreadtrum, OPPO (ok), vivo, Sharp, KDDI, Ericsson, Apple, TCL, New H3C,  **Not support**: Lenovo/MotM, Nokia/NSB, Intel (RI\*SE sorting), Huawei/HiSi, |
| 3.2.3 | **Proposal 3.B.3**: For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured with a joint triggering carried on a same PUSCH (hence on a same slot), the UCI associated with the CJTC Dd is placed in the part of UCI as TS 38212 Table 6.3.1.1.2-13; the CSI part 1 of Rel-18 eType-II CJT CSI is placed in the part of UCI as TS 38.212 Table 6.3.1.1.2-13 and the CSI part 2 of Rel-18 eType-II CJT CSI is placed in the part of UCI as TS 38.212 Table 6.3.1.1.2-14   * The previously agreed UCI design and mapping order for CJTC Dd report are reused * The legacy UCI design, UCI mapping order, and UCI omission for the Rel-18 eType-II CJT CSI are reused   **FL assessment**: This proposal is needed since joint triggering introduces a new PUSCH reporting format within 1 slot. | **Support/fine**: CMCC, Samsung (ok), Qualcomm (ok), NTT DOCOMO (ok), NTT CORP, Xiaomi, TCL,  **Not support**: Fujitsu, Huawei/HiSi, [OPPO], |
| 2.1 | **[116bis] Agreement**  For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports, on the configured KS>1 NZP CSI-RS resources, reuse the legacy CMR and IMR rules for the Rel-15 CRI-based reporting. This includes:   * All the KS NZP CSI-RS resources are associated with a same CSI-RS resource set * …   **Proposal 2.A**: For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports, regarding aperiodic CSI-RS resource configuration, an RRC-configured resource-level slot offset (relative to the resource-set-level slot offset, using the same design as Rel-19 Type-I/II codebook refinement for 48, 64, and 128 ports) is supported for aperiodic CSI-RS resource set   * FFS: The number of bits for indicating the resource-level slot offset (relative to the resource-set-level slot offset) for KS resources, including the value(s) of the slot offset * FFS: Whether, in addition, configuring an *available* slot offset for each CSI-RS resource within the aperiodic CSI-RS resource set   + Note: “*Available* slot offset” is analogous to the Rel-17 SRS triggering offset enhancement   **FL assessment**: The proposal is unclear. It was agreed that all the KS resources are associated with a same resource set. In this case, all the restrictions apply including the permitted resource-level slot offset | **Support/fine**: Huawei/HiSi, ZTE, Qualcomm, China Telecom, Samsung, NTT DOCOMO, NTT CORP, MediaTek, CMCC, NEC, Tejas, CATT, IDC, vivo, Sharp, Intel, Rakuten, Ericsson, Apple, Huawei/HiSi, TCL,  **Not support**: Google (configure 1 vs 2 slots), Xiaomi, Lenovo/MotM, OPPO, Fujitsu, Spreadtrum, New H3C, |
| 1.2 | **Proposal 1.B**: For the Rel-19 Type-I SP codebook refinement for 48, 64, and 128 CSI-RS ports, extend the agreed Scheme-A and Scheme-B to 16, 24, and 32 CSI-RS ports, for all applicable RI values with K=1 only, and without any further modification/enhancement of the sub-features pertinent to the Rel-19 Type-I SP design (including, e.g. the Rel-19 Type-I SP CBSR, soft scaling).   * For the Rel-19 Type-I SP codebook, the support for 16, 24, and 32ports are 3 separate UE capabilities from the support for the previously agreed number of ports (48, 64, 128 ports) * The Rel-18 SD NES schemes applicable to Rel-15 Type-I SP codebooks are also applicable to the extension of the Rel-19 Type-I SP codebook to 16, 24, and 32 ports * FFS: whether to adopt the extended orthogonal set for the 2nd SD basis for Scheme-A, RI=2-4 and 16, 24, and 32 CSI-RS ports   **FL assessment**: This was discussed OFFLINE [1]. | **Support/fine (A+B):** ZTE, IDC, Samsung, Xiaomi, Nokia/NSB, NEC, Fujitsu, NTT DOCOMO, NTT CORP, Spreadtrum, UNISOC, CMCC, MediaTek, Ericsson, Apple, Google, IDC, Tejas, Sharp, Orange, Lenovo/MotM (ok, low priority), China Telecom, KDDI, Intel (ok), New H3C,  **Fine only Scheme-A RI=3-4 (2nd):** Huawei/HiSi  **Support/fine B only, concern A:** CATT, Fraunhofer IIS/HHI, Rakuten,  **Not support:** OPPO,HONOR, TCL, vivo, Xiaomi, Huawei/HiSi, |

***Ground rules in sharing your inputs:***

* **Please do NOT input anything in Tables 1A, 2A, and 3A**
  + **Including company names - appreciate your trying to save me some work, but …**
  + **For some reason, most likely due to poor MS Word inter-platform/version compatibility support (if any), the formatting of the FL proposals will change (for the worse) if you do so. This has happened several times in Athens and Changsha ☹**
* **Please input your comments ONLY in Tables 1C, 2C, and 3C, thanks! 😊**

### 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

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| **#** | **Issue/proposal** | **Companies’ views** |
| 1.1 | **[117] Agreement**  For the Rel-19 Type-I codebook refinement for 48, 64, and 128 CSI-RS ports, for RI=v=1, support the following:   * for each group of SD basis vectors, a 3-bit scaling factor can be NW-configured via higher-layer (RRC) signalling, where the scaling factors are defined as scalings on the power control offset configured for the associated CSI-RS resources   + The values of and for this feature are separately configured from those for CBSR   + Separate configuration (RRC signalling) from CBSR   + The candidate values of and are the same as those agreed for CBSR * The codepoints of each of the group-specific 3-bit scaling factors are mapped to values of   …  **[118bis] Agreement**  For the Rel-19 Type-I SP codebook refinement for 48, 64, and 128 CSI-RS ports, regarding the support for the 3-bit scaling factor(s) for RI=*v* >1, support only for RI=*v*=2 without per-SD-basis-vector/layer power adjustment/boosting   * FFS: Details on per-layer scaling factor applied to each of the selected SD basis vectors, extending the agreed scaling factor for RI= *v* =1 (in RAN1#117)   This feature is a separate UE capability from soft scaling for RI=*v*=1. Introduce new RRC parameter to enable the feature.  …  For the Rel-19 Type-I SP codebook refinement for 48, 64, and 128 CSI-RS ports, regarding per-layer scaling factor applied to each of the selected SD basis vectors associated with RI=*v* {2} for the 3-bit scaling factor(s), decide, by RAN1#119, from the following alternatives:   * Alt1: * Alt2: * Alt3: * Alt4: * Alt5: * Alt6: * Alt7:   + if two different vectors for , for the vector with smaller scaling factor , and for the other vector configured with larger scaling factor ;   + otherwise ( or one same vector for ), for the vector   Where ri denotes the number of layers associated with the i-th SD basis vector.  The same scheme applies to both Mode-A and Mode-B.  Note: as agreed in RAN1#117.  Normalization of precoder should be taken into account in the final specification design.  **Proposal 1.A.1:** For the Rel-19 Type-I SP codebook refinement for 48, 64, and 128 CSI-RS ports, regarding per-layer scaling factor applied to each of the selected SD basis vectors associated with RI=*v=*2 for the 3-bit scaling factor(s):   * The scaling formula is where is a multiplicative factor independent of *i*   + Reuse legacy precoder normalization (per discretion of the spec editor)   + FFS (RAN1#119): Whether min( , 1) operation is needed   + FFS (RAN1#119): Whether other than 1 (baseline) is needed (e.g. or ) * Regarding the configuration of the value (3-bit indicator per SD basis vector group), decide, by RAN1#119, between the following:   + Alt1. RI=1 and RI=2 are separately configured (RI-specific)   + Alt2. A same configuration is used for RI=1 and RI=2 (RI-common)   **FL assessment**: This was discussed OFFLINE [1]. **Two sets of simulation results are available, i.e. from Ericsson and Nokia, justifying proposal 1.A.1 against “AltB” (** where ri denotes the number of layers associated with the i-th SD basis vector**).**  Note that (without any additional multiplicative factor or min operation, or any other formula) should be the baseline since it is analogous to the scaling formula for RI=v=1 (i.e. without any additional agreement on scaling formula for RI=v=2, it is understood that a similar formula to the agreed formula for RI=v=1 is reused).  Si value configuration   * **Alt1. RI-specific**: vivo, New H3C, Samsung (ok), NEC, OPPO, Lenovo/MotM, Ericsson (ok), Google, CMCC, * **Alt2. RI-common**: ZTE, Huawei/HiSi, Samsung, Ericsson, Apple, Xiaomi, Qualcomm, NTT DOCOMO, NTT CORP, Intel, MediaTek, Tejas, Sharp, Nokia/NSB, Fraunhofer IIS/HHI, IDC, KDDI, Rakuten,    value:   * 1 (baseline): Ericsson, Intel, Rakuten, Samsung, vivo, * 1 when b0=b1, else : Qualcomm, Xiaomi, * : Huawei/HiSi | **Support/fine:** Ericsson, vivo, NewH3C, Samsung,(ok), ZTE (ok), CATT,NTT DOCOMO, NTT CORP,Intel, TCL, Fujitsu, NEC, MediaTek, Tejas, OPPO (ok), Sharp, CMCC, Lenovo/MotM (with RI-specific), Qualcomm (at least when b0=b1), China Telecom, Nokia/NSB, Fraunhofer IIS/HHI, KDDI, Rakuten, Apple, Huawei/HiSi, New H3C,  **Not support ():** Xiaomi (with v scaling), IDC, Goggle, |
| 1.2 | **Proposal 1.B**: For the Rel-19 Type-I SP codebook refinement for 48, 64, and 128 CSI-RS ports, extend the agreed Scheme-A and Scheme-B to 16, 24, and 32 CSI-RS ports, for all applicable RI values with K=1 only, and without any further modification/enhancement of the sub-features pertinent to the Rel-19 Type-I SP design (including, e.g. the Rel-19 Type-I SP CBSR, soft scaling).   * For the Rel-19 Type-I SP codebook, the support for 16, 24, and 32ports are 3 separate UE capabilities from the support for the previously agreed number of ports (48, 64, 128 ports) * The Rel-18 SD NES schemes applicable to Rel-15 Type-I SP codebooks are also applicable to the extension of the Rel-19 Type-I SP codebook to 16, 24, and 32 ports * FFS: whether to adopt the extended orthogonal set for the 2nd SD basis for Scheme-A, RI=2-4 and 16, 24, and 32 CSI-RS ports   **FL assessment**: This was discussed OFFLINE [1]. | **Support/fine (A+B):** ZTE, IDC, Samsung, Xiaomi, Nokia/NSB, NEC, Fujitsu, NTT DOCOMO, NTT CORP, Spreadtrum, UNISOC, CMCC, MediaTek, Ericsson, Apple, Google, IDC, Tejas, Sharp, Orange, Lenovo/MotM (ok, low priority), China Telecom, KDDI, Intel (ok), New H3C,  **Fine only Scheme-A RI=3-4 (2nd):** Huawei/HiSi  **Support/fine B only, concern A:** CATT, Fraunhofer IIS/HHI, Rakuten,  **Not support:** OPPO,HONOR, TCL, vivo, Xiaomi, Huawei/HiSi, |
| 1.3 | **Conclusion 1.C**: For the Rel-19 Type-I SP codebook refinement for P=48, 64, 128 CSI-RS ports, when a UE is configured with sub-band SP-CSI for Scheme-B, the UE is not expected to be configured to report the CSI on PUCCH format 4  **FL assessment**: The current spec “A UE is not expected to report CSI with a total number of UCI bits and CRC bits larger than 115 bits when configured with PUCCH format 4” which, as pointed out by several companies, seems to be sufficient to preclude the above configuration.  **Proposal 1.C**: For the Rel-19 Type-I SP codebook refinement for P=48, 64, 128 CSI-RS ports, when sub-band SP-CSI for Scheme-B is configured to be reported on PUCCH format 4:   * a UE is not expected to be configured with the smaller sub-band size between the two configurable sub-band sizes for a given BWP; and * the UCI for the co-phase selection is restricted from 2-bit (QPSK) to 1-bit (BPSK)   **Support/fine:** Samsung, Qualcomm, MediaTek, Xiaomi (open), Fraunhofer IIS/HHHI (open), IDC, KDDI (open),  **Not support:** Google, NTT DOCOMO (exclude PF4), NTT CORP, CMCC, Lenovo/MotM (exclude PF4), OPPO (exclude PF4), ZTE (exclude PF4), Spreadtrum, Sharp (exclude PF4), Nokia/NSB (exclude PF4, current spec), vivo (exclude PF4, current spec), Intel (exclude PF4, current spec), Ericsson (exclude PF4, current spec), Apple (exclude PF4, current spec), Huawei/HiSi (exclude PF4, current spec), New H3C, | |
| 1.4. | **Proposal 1.D**: For the Rel-19 Type-I SP codebook refinement for P=48, 64, 128 CSI-RS ports, regarding Scheme-B, when the UE is configured to report wideband CSI on PUCCH:   * For PUCCH format 2, one-part CSI is used * For PUCCH formats 3 and 4, two-part CSI is used where SD basis selection is reported in CSI-part2   + CSI fields in CSI-part1 and part2 follows the legacy sub-band CSI   **FL assessment**: This proposal is scheme-B optimization for WB PUCCH reporting. Whether a two-part CSI is needed or not can be discussed, e.g. whether the difference in payload across RIs is enough to justify the use of two-part CSI on PUCCH F3/4 especially for WB.   * From moderator perspective, **the difference in payload across RIs will be much larger when Nrep>1 is configured to be reported on the same PUCCH**.   + **[JD/Qualcomm] Nrep>1 on PUCCH is practical for CA, since only one (or optionally, two) cell can have PUCCH to convey all DL CCs’ CSI reports.** * To minimize spec impact, PF2 is still kept 1-part (since 2-part isn’t supported for PF2 in legacy). * Therefore, this proposal is technically sound | **Support/fine:** Qualcomm,Xiaomi (open), Fraunhofer IIS/HHHI (open), Samsung (ok), Tejas (open), vivo (open), Sharp, NTT DOCOMO, NTT CORP, Apple (open), TCL,  **Not support:** Google, CMCC, Lenovo/MotM, OPPO, Fujitsu, ZTE, CATT, Spreadtrum, Intel, Huawei/HiSi, New H3C, |
| 1.5 | **Proposal 1.E**: For the Rel-19 Type-I SP codebook refinement for P=48, 64, 128 CSI-RS ports, when the UE reports or multiplexes the CSI on PUCCH, the PUCCH resource, the number of PRBs for the PUCCH resource, and/or the number of Part 2 CSI reports are determined based on the RI value that results in the largest UCI payload.   * [For Scheme-B, the RI value that results in the largest UCI payload is determined as min(4, maximum configured rank per CSI reporting configuration)] * [For Scheme-A, the RI value that results in the largest UCI payload is determined as maximum configured rank per CSI reporting configuration]   **FL assessment**: This proposal seems needed for PUCCH resource determination. | **Support/fine**: Huawei/HiSi, vivo, NTT DOCOMO, NTT CORP, Qualcomm, Samsung, MediaTek, Xiaomi, CMCC, Lenovo/MotM, Nokia/NSB, NEC, Fujitsu, Tejas, ZTE, IDC, Spreadtrum, vivo, Sharp, KDDI, Intel, Rakuten, Ericsson, Apple, TCL, New H3C,  **Not support**: Google, |
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Table 1B SLS results: issue 1

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| **Company** | **SLS results** | | |
| **Issue #** | **Metric** | **Observation** |
| ZTE | 1.2 | 5%/95%/avg UPT gain | Performance comparison between Rel-19 Type-I codebook (Scheme-A) and Rel-15 Type-I codebook for RI=3-4  *It is shown in the figure of SLS results above that Rel-19 Type-I codebook (Scheme-A) for rank-3/4 offers a significant UPT gain (i.e., ~21.2% for cell-edge UE, ~3.8% for near-field UE, ~8.1% in average) over Rel-15 SP Type-I codebook for PCSI-RS = 32.* |
| Samsung | 1.2 | Avg UPT gain vs overhead | *It is shown in the figures of SLS results above that Both schemes A and B yield avg UPT gain over the Rel-15 T1 for at least configurations of 32 and 16 ports. Especially, scheme B yields significant UPT gains 8% and 4.5% over both Scheme A and Rel-15 T1 in the legacy number of CSI-RS ports 32 and 16 ports, respectively.* |
| Vivo | 1.2 | Cell mean SE | Cell mean SE comparison for different CB schemes  *It is shown in the figure of SLS results above that when rank adaptation up to rank 2 is enabled, Rel-19 Type-I Scheme B yields 1~2% Cell-mean SE gain over Rel-15 Type-I for 8T4R, 16T4R, and 32T4R.* |
| Nokia/NSB | 1.2 | Mean UPT gain vs overhead | Mean throughput gain vs mean overhead comparison between Rel-15 Type-I, Scheme-A and Scheme-B for maximum rank 8, with 16 (4x2) and 32 (8x2) ports.  *It is observed from the SLS results above that:* *for 16 ports, Scheme-A shows about 5.6% mean throughput gain over Rel-15 Type-I with about 5 bits increase in mean overhead. Scheme-B shows about 11.5% mean throughput gain over Rel-15 Type-I with about 58 bits increase in mean overhead.* *For 32 ports, Scheme-A shows about 6% mean throughput gain over Rel-15 Type-I with about 10 bits increase in mean overhead. Scheme-B shows about 13% mean throughput gain over Rel-15 Type-I with about 59 bits increase in mean overhead.* |
| Nokia/NSB | 1.1 | Mean UPT gain, 5% UPT gain |  |
| Ericsson | 1.1 | Mean UPT gain, 5% UPT gain | Comparison of alternatives A and B for 3-bit scaling factor applied to RI=v=2  *It is observed from the SLS results above that Alt A outperforms Alt B (i.e., Alt B incurs 9% and 26% loss for 50% and 70% RU, respectively).* |
| 1.2 | Mean UPT gain, 5% UPT gain | Comparison between Rel-15 and Rel-19 Type I codebooks for 32 ports for ranks 1-4  *It is observed from the SLS results above that Rel-19 Type I Scheme A (no array splitting) shows around 3% (4%) gain at 50% RU and around 7% (8%) gain at 70% RU when compared to the Rel-15 baseline for mean user throughput (cell edge throughput). Rel-19 Type I Scheme B shows around 7% (12%) gain at 50% RU and around 16% (24%) gain at 70% RU when compared to the Rel-15 baseline for mean user throughput (cell edge throughput).* ***​*** |
| CATT | 1.2 | Mean UPT | Average throughput performance comparison between Rel-15 Type I SP codebook and extension of scheme A and B with 32 ports, up to 4 layers. Ok to extend scheme B to <=32 ports but have concerns for scheme A. we suggest to remove scheme A from the proposal. |
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Table 1C Additional inputs: issue 1

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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 1.A.1: It seems the first issue is whether the power scaling factor is RI common or RI specific. According to the agreement in last RAN1 meeting, to enable the power scaling or not is RI specific. It seems more reasonable to have RI specific power scaling factors.  Proposal 1.C: We do not see the necessity. If there is not sufficient room for CSI report, UE will drop it as what is specified currently. This implies gNB should provide reasonable configuration.  [Mod: UCI omission is designed for emergency purposes when UL RA is not sufficient. For Scheme-B, without any additional restriction, UCI omission will happen all the time when PUCCH format 4 is used.]  Proposal 1.D: Is it correct understanding that this is what is defined in legacy (one part for short PUCCH, two part for long PUCCH)?  [Mod: This is not fully according to the legacy. Not all large PUCCH formats will use two parts. Wideband is always one-part for legacy]  Proposal 1.E: It seems we determine the PUCCH resource from the configured PUCCH resource list based on the UCI payload size instead of the PRBs of the PUCCH resource? It seems that number of PRBs is still configured by RRC.  [Mod: No, proposal 1.E is actually analogous to the legacy.] |
| Mod V2 | **Revision on proposal 1.A to further clarify the issue** |
| Qualcomm | **Proposal 1.A.1**: We appreciate the FL for the effortsto accommodate more companies’ understanding.  We think   * (i.e. ) works OK for the case when a same SD basis is selected for both layers; * Then for , our view is min(, 1) (i.e. and with min( , 1) operation, where =2)   In short, in our view, we can void using the parameter if we respectively discuss for the above two cases.  Since our view is included in the revision, we are generally fine with current version of **Proposal 1.A.1**  Together with another minor, we suggest the following changes:   |  | | --- | | **Proposal 1.A.1:** For the Rel-19 Type-I SP codebook refinement for 48, 64, and 128 CSI-RS ports, regarding per-layer scaling factor applied to each of the selected SD basis vectors associated with RI=*v=*2 for the 3-bit scaling factor(s):   * The scaling formula is where is a multiplicative factor independent of *i*, and if a same SD basis is selected for both layers   + Reuse legacy precoder normalization (per discretion of the spec editor)   + FFS: Whether min(, 1) operation is needed   + FFS: Whether other than 1 (baseline) is needed (e.g. or ) * Regarding the configuration of the value (3-bit indicator per SD basis vector group), decide, by RAN1#119, between the following:   + Alt1. RI=1 and RI=2 are separately configured (RI-specific)   + Alt2. A same configuration is used for RI=1 and RI=2 (RI-common) |   [Mod: The 1st change introduces implicit dependence on I which contradicts the definition of rho. The second change is ok]  **Proposal 1.C**: OK in general with the direction, since PUCCH format 4 only has one RB, thus at most 12RE\*12sym\*2 = 288 encoded bits (12-symbol is due to 2-symbol for DMRS, and QPSK is assumed for modulation)  It is restricted as at most 115 payload bits including CRC in 214 (Section 5.2.4) – also mentioned in Samsung t-doc.  **Proposal 1.D**: A bit more explanations for this proposal.  The motivation of this proposal is due to prevent too many zero-padding for one-part CSI (since one-part CSI need to maintain a same payload size for different ranks, to avoid blind decoding).  But then, we found legacy PUCCH format 2 does not support two-part CSI (i.e. subband CSI is not supported on PUCCH format 2 in Rel-15) – to save implementation efforts, we tend to keep it as legacy one-part.  **Proposal 1.E**: We are OK with the principle of “based on the RI value that results in the largest UCI payload.”  We have some detailed questions:  (1) Does the UCI include CQI of the 2nd CW? Note that legacy two-part CSI is not with similar payload size if we take into account the 2nd CQI (but we are open to discuss this question different from legacy);  (2) The current wording seems only includes the case where a PUCCH resource is configured for a CSI report, but note that there is another case: CSI multiplexed with HARQ-A/N, where the PUCCH resource (set) is also determined based on the UCI payload size (copy a table from our contribution as following, which shows how a PUCCH resource (set) is determined by a total UCI payload size)  A screen shot of a blue and white box  Description automatically generated  Therefore, editorial suggestion for due to the above (2):   |  | | --- | | **Proposal 1.E**: For the Rel-19 Type-I SP codebook refinement for P=48, 64, 128 CSI-RS ports, regarding Scheme-B, when the UE is ~~configured~~ to report or multiplex the CSI on PUCCH, the PUCCH resource, the number of PRBs for the PUCCH resource and/or the number of Part 2 CSI reports are determined based on the RI value that results in the largest UCI payload. |   [Mod: Thanks for pointing this out. I agree with the assessment and suggested changes]  Note that the change does not preclude the original case (CSI report on the configured PUCCH resource);  Actually the above change is just trying to “copy” existing 213 (Section 9.2.5) more completely. |
| China Telecom | Proposal1.A: Support the proposal. We prefer a simpler scaling formula with rho=1. Besides, we think RI-common configuration of the si is sufficient.  Proposal1.B： Support the proposal. At least Rel-19 SP Type-I scheme A need to be extended to <=32 point to align the codebook design for RI = 3-4. |
| Samsung | **Proposal 1.A.1**  Support and the simple scaling formula of si is sufficient in our view.  **Proposal 1.B.**  Support the proposal.  Especially, in our SLS results, Scheme B yields significant UPT gains (8%/4.5% for 32/16 ports) over both Scheme A and Rel-15 T1 in the legacy number of CSI-RS ports, so at least Scheme B should be supported for 16 and 32 CSI-RS ports for all applicable RI values.  **Proposal 1.C**  @Google. As FL mentioned, UCI omission is designed for an emergency purpose when UL RA is not sufficient. Without any restriction, the UE has to always perform UCI omission or drop all the information when subband Scheme-B with a normal configuration (64 ports and 13 SBs) is configured to report on PUCCH F4  As an example, the possible CSI overhead is summarized in the following table, depending on the numbers of ports (64/128 ports) and SBs (13 or 18). As highlighted by red color in the following table, when RI >2, the CSI overhead of Rel-19 Type-I Scheme-B exceeds 104 bits, i.e., the UE has to always perform UCI omission or drop all the information when RI>2 is selected.   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  | **# of ports** | **# of SBs** | **RI=1** | **RI=2** | **RI=3** | **RI=4** | **RI=5** | **RI=6** | **RI=7** | **RI=8** | | **Rel-19 T1 Scheme B** | 64 | 13 | 68 | 99 | 130 | 161 | 134 | 121 | 152 | 139 | | 18 | 88 | 129 | 170 | 211 | 174 | 156 | 197 | 179 | | 128 | 13 | 69 | 101 | 133 | 165 | 137 | 124 | 156 | 143 | | 18 | 89 | 131 | 173 | 215 | 177 | 159 | 201 | 183 |   Rel-19 Type-I Scheme-B CSI (RI/PMI/CQI) overhead  Using the two restrictions in the Proposal 1.C, the maximum CSI overhead becomes smaller than 104 bits for all Ris less than 7 as shown in the following table:   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  | **# of ports** | **# of SBs** | **RI=1** | **RI=2** | **RI=3** | **RI=4** | **RI=5** | **RI=6** | **RI=7** | **RI=8** | | **Rel-19 T1 Scheme B** | 64 | 9 | 43 | 57 | 71 | 85 | 93 | 93 | 107 | 107 | | 128 | 9 | 44 | 59 | 74 | 89 | 96 | 96 | 111 | 111 |   Rel-19 Type-I Scheme-B CSI (RI/PMI/CQI) overhead with BPSK co-phase selection  Also, we would like to refer to our previous SLS results in R1-2402460 that Scheme-B with BPSK co-phase selection performs sufficiently well (comparable to that of Scheme-B with QPSK), so it may make sense to restrict it since the main source incurring feedback overhead is QPSK co-phase selection per SB per layer.  **Proposal 1.D**  The payload difference among different RI is not that large (up to 24 bits at max) as shown in the following table. So, the motivation for supporting WB two-part CSI seems weak in our view.   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  |  | **RI=1** | **RI=2** | **RI=3** | **RI=4** | **RI=5** | **RI=6** | **RI=7** | **RI=8** | | R19 eType-I SP WB when (N1,N2)=(8,8),  128 ports | Scheme B | 12 | 20 | 28 | 36 | 26 | 26 | 32 | 32 |   **Proposal 1.E**  We are fine with this proposal. |
| NTT DOCOMO | **Proposal 1.A.1:**  The two new FFS are related and should be decided together in our view, as well as the two alts on RI-common/specific configuration.  [Mod: That’s obviously my preference as well but as you can clearly see what you suggested is IMPOSSIBLE. As a moderator, I will try to make progress one step at a time and currently this is what we can do.]  **Proposal 1.C**:  We see the issue. But we think NW implementation could handle this issue, e.g., not configure PUCCH format 4 for certain CSI configurations with very large CSI bit size.  [Mod: This cannot be handled by NW implementation – unless you think that dropping a big part of UCI often is fine for NW 😊 which makes the CSI useless. Having said that, the rule you suggested is another valid solution, i.e. not to use PF4 for subband SP-CSI]  **Proposal 1.D**:  We tend to agree with SS’s assessment of payload size difference for different Ris for wideband CSI. We’d also like to clarify its spec. impact. Is there any other spec. impact besides the CSI mapping order of CSI part 1 and CSI part 2?  **Proposal 1.E**:  First, we agree with QC to add the case of CSI multiplexing on PUCCH in main bullet. Second, to make ‘RI value that results in the largest UCI payload’ clearer, we prefer to say ‘min (4, maximum configured rank per CSI report configuration)’ directly.  [Mod: I don’t think your suggested revision is the same as the intention of the proposal – RI>4 doesn’t necessarily result in larger overhead compared to RI<=4] |
| Mod V8 | **Some revisions per Qualcomm’s and DOCOMO’s inputs**  **@Yushu/Google, JD/Qualcomm, Jing/DOCOMO: please check my response** |
| Qualcomm | **Proposal 1.D**:  For wideband CSI, bit-width of each field is (assuming 128port i.e. =64, and Scheme-B rank1-4)   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Part1 (follow subband case) | | Part2 (follow subband case): PMI | | | | RI | Wideband CQI |  | x-pol cophase |  | | 3 | 4 | 6 | 2 | 4 |   Thus rank1 has total 19 bits, while rank4 has total 43 bits.  Given that payload is only 19, zero-padding of 24 bits is too much.  Re @DOCOMO, for CSI-part1/2, it can follow legacy subband case, as in the table above  Editorial:   |  | | --- | | * For PUCCH formats 3 and 4, two-part CSI is used where SD basis selection is reported in CSI-part2   + CSI fields in CSI-part1 or part2 follows legacy subband case |   **Proposal 1.E**:  I think DOCOMO’s suggestion is about the case of RImax<4 when RI restriction is configured, not about RI>4 – since the proposed min(4,xx) operation would not results in value>4.  But anyway, I think it is like a further detail of current description. |
| MediaTek | **Proposal 1.A.1**  Support same scaling as RI=1 (i.e., ). When the beams for the two layers are not the same, the 3dB loss due to precoder normalization can be taken care by beam common power boosting by NW implementation.  **Proposal 1.C**  Support.  Upon further study, we found that Rel-19 Type I MP codebook also suffers from this issue when Ng = 4. This is due to independent SD basis and inter-polarization co-phasing selection per panel/resource. The PMI overhead when number of SB N3 = 13, Ng=4, rank = 1 is shown below:   |  |  | | --- | --- | |  | PMI overhead = | | 64 | bits | | 128 | bits |   With the sub-band size restriction and inter-polarization co-phasing restriction to two phases, the overheads above are reduced to 78 and 82 bits respectively. The inter-polarization co-phasing is already restricted to {1,j} for rank > 1, so it is possible to have the same alphabet for the restriction for rank = 1. Therefore, we suggest a related proposal as follows:  Proposal: For the Rel-19 Type-I MP codebook refinement for P=48, 64, 128 CSI-RS ports, when Ng = 4, and when sub-band SP-CSI is configured to be reported on PUCCH format 4:   * a UE is not expected to be configured with the smaller sub-band size between the two configurable sub-band sizes for a given BWP; and * the UCI for intra-panel inter-polarization co-phase selection is restricted to the alphabet {1,j}   [Mod: I will include this in Rd2]  **Proposal 1.E**  Support |
| Xiaomi | **Proposal 1.A.1:**  When =1 and two SD basis vector with different scaling factors, the power corresponding to the restricted beam will be reduced by half, which is not expected by NW.  Regarding the comments given by MTK for the proposal, the reduced power is compensated through NW’s implementation. This may result the calculated CQI by UE mismatch the channel with power boosting at NW side for the beams, since the CQI was calculated without considering the power boosting at UE side.  **Proposal 1.C and Proposal 1.D**:  We are open to discuss.  **Proposal 1.E**:  Support |
| CMCC | **Proposal 1.C**  We think this issue can be avoided by implementation. If it has to be reported on PUCCH F4, then gNB could avoid UCI dropping by proper *csi-ReportingBand* and RI restriction.  [Mod: Relying on RI restriction just to fit the payload to a small PUCCH format – hence reducing NW throughput due to lower data rate – doesn’t seem to be a good/wise “NW implementation” 😊]  In addition, the second bullet will also increase UE implementation complexity.  [Mod: How can UE complexity increase with smaller alphabet? 😊 The W2 complexity is actually lower by 50% and there is no additional implementation change since BPSK is a subset of QPSK]  **Proposal 1.D**  The difference of UCI payload among different RI values is not so big, two-part CSI for WB CSI on PUSCH is not needed.  **Proposal 1.E**  OK with this proposal. |
| NTT DOCOMO2 | **Proposal 1.E**:  We’d like to reply to Mod’s comment above.  With ‘min (4, maximum configured rank per CSI report configuration)’, when configured rank > 4, UE assumes rank=4 which has the largest payload size; when configured rank < 4, UE assumes the configured rank.  We think this revision is aligned with the original intention and clearer than the principle description of ‘RI value that results in the largest UCI payload’.  [Mod: Thanks for the clarification. I understand now]  But if other companies would like to agree with the high-level principle first and then discuss the details in next step, we’re also okay.  [Mod: Yes we can revisit once it is agreed. There could be other similar cases, e.g. for HBF] |
| Lenovo/ MotM | **Proposal 1.B**:  Low priority, OK if vendors on both side are interested.  **Proposal 1.C**:  We do not see the necessity of supporting >32 ports Type-I CB for PUCCH format 4. Either no spec. changes or exclude Type-I from PUCCH reporting with Format 4  [Mod: I agree not supporting PF4 (very strange PUCCH format from Rel-15 – or in general large PUCCH formats for CSI) just as DOCOMO proposed is another good solution.]  **Proposal 1.D**:  Not a priority. Prefer less conditions/codebook configuration restrictions with respect to PUCCH format.  **Proposal 1.E**:  Fine |
| Mod V17 | **P1.D revised per JD’s comment** |
| Nokia | **Proposal 1.A.1**  We copy below our simulation results for the three alternative assumptions of PDSCH power scaling discussed offline. Although technically we still think Alt B and C apply scaling more accurately to restrict emissions above the horizon, in practice Alt A is sufficient to achieve the EIRP mask and performance is slightly better than Alt B and C.  [Mod: I apologize for missing your results (thanks). Added in Table 1B]  Therefore, we are also fine with the simple scaling      **Proposal 1.B**  We would like to share some additional results for ports, comparing Rel15 Type-I with Scheme-A where the extended orthogonal set for the second beam selection is applied to ranks 1-4. In our view, it makes sense to adopt this extended set also for ranks 1-4 and for ports, given the significant throughput-overhead benefit and given that this is a separate UE capability      Therefore, we suggest to add the following FFS  **Proposal 1.B**: For the Rel-19 Type-I SP codebook refinement for 48, 64, and 128 CSI-RS ports, extend the agreed Scheme-A and Scheme-B to 16, 24, and 32 CSI-RS ports, for all applicable RI values with K=1 only, and without any further modification/enhancement of the sub-features pertinent to the Rel-19 Type-I SP design (including, e.g. the Rel-19 Type-I SP CBSR, soft scaling).   * For the Rel-19 Type-I SP codebook, the support for 16, 24, and 32ports are 3 separate UE capabilities from the support for the previously agreed number of ports (48, 64, 128 ports) * The Rel-18 SD NES schemes applicable to Rel-15 Type-I SP codebooks are also applicable to the extension of the Rel-19 Type-I SP codebook to 16, 24, and 32 ports * FFS: whether to adopt the extended orthogonal set for the 2nd SD basis for Scheme-A, RI=2-4 and 16, 24, and 32 CSI-RS ports   **Proposal 1.C**  The legacy text in 214 seems sufficient “A UE is not expected to report CSI with a total number of UCI bits and CRC bits larger than 115 bits when configured with PUCCH format 4”. The NW should follow this general restriction for a correct configuration, for example, by configuring csi-ReportingBand for Scheme-B with a number of subbands that does not exceed the maximum UCI payload  [Mod: Indeed]    **Proposal 1.E**  Open to discuss, but a simpler rule is to assume rank 4, without having to calculate the maximum payload for any sub-band reporting with Scheme-B, for all the allowed rank  [Mod: This can be discussed after 1.E is agreed. Please check the comments from JD/Qualcomm and Jing/DOCOMO] |
| Mod V20 | **Revisions per Nokia’s inputs** |
| NEC | **Proposal 1.A.1:** Support. And Alt 1 RI specific configuration is preferred.  **Proposal 1.E:** OK. |
| OPPO | **Proposal 1.A.1**  We are fine with for different RIs with RI-specific scaling factor, or min( , 1) with when the SD basis for different layers are different and otherwise.  **Proposal 1.B**:  For scheme A: Based on current evaluation results, we only see marginal gain from Scheme A compared to Rel-15 design. Considering Rel-15 Type I CB has been implemented by UE and network, though the structure is not perfect, we don’t think a different codebook with similar performance is meaningful.  For Scheme B: The overhead is significantly higher than Rel-15 Type I CB, which is even comparable to eType II CB. Further evaluation to compare the performance and overhead between eType II CB and scheme B is needed. If there is no evidence for performance or overhead gain for scheme B with <=32 ports compared to eType II CB (not result yet), we don’t think it is needed either.  **Proposal 1.C**  We think “A UE is not expected to report CSI with a total number of UCI bits and CRC bits larger than 115 bits when config-ured with PUCCH format 4” in 214 is sufficient. Also fine with not to support PUCCH format 4 for subband SP-CSI.  **Proposal 1.D**:  We prefer not to have this optimization. |
| Fraunhofer IIS/HHI | **Proposal 1.A.1**: If normalization factor (i.e., ) is considered in the precoder equation similar to legacy codebooks, then scaling factor works regardless of whether the two beams are identical or not. Therefore, we support the proposal in its current form.  **Proposal 1.B**: Since the Rel. 19 Type-I codebook Mode A gain is negligible compared to Rel. 15 Type I codebook, we can support the proposal only for scheme B.  **Proposal 1.C/1.D**: Open to discuss |
| Fujitsu | **Proposal 1.D:** Our suggestion is not to change the legacy one-part CSI for WB CSI on PUCCH.  **Proposal 1.E:** Support. |
| Tejas | **Proposal 1.D:**  Open to discuss.  **Proposal 1.E:**  Support. |
| ZTE | **Proposal 1.A.1:**  Fine with the proposal. Besides, we think RI-common configuration of the scaling factor (Alt2) is sufficient.  **Proposal 1.B:**  Support at least extending Scheme-A to <= 32 port to align the codebook structure of RI = 3-4 for different number of CSI-RS ports.  Do NOT support the FFS, which reverts the previous agreements. Moreover, if the FFS is supported, the codebook structure of RI = 3-4 for different numbers of CSI-RS ports becomes more complicated.  [Mod: Since there was no agreement for extending Scheme-A for <=32 ports, the FFS doesn’t revert any previous agreement. Anyway if the FFS is not agreed, the default is not to have it. So I will keep the FFS for now.]  **Proposal 1.C:**  Do NOT support the proposal, because it reverts the legacy rules of subband size configuration and previous agreements. If NW configures the codebook type as Rel-19 SP Type-I Scheme-B, then NW should guarantee that the CSI report can be completely carried by scheduled UL resources (i.e., the NW should NOT configure that the CSI report is carried by PUCCH format 4). So, the payload size issue for PUCCH format 4 can/should be avoided by NW implementation.  [Mod: Please read my previous comments to other companies (scroll up), e.g. DOCOMO, CMCC re “avoided by NW implementation”. Again, I agree that excluding PF4 as you and other said is also a viable and simpler solution]  **Proposal 1.D:**  It seems unnecessary to change the legacy rule of CSI reporting on PUCCH format 2, 3, 4.  **Proposal 1.E:**  Support. |
| Fraunhofer IIS/HHI | Corrected a typo in our response |
| CATT | **Proposal 1.B**:  We have updated our tdoc with some simulation results for 32 ports, comparing Rel-15 Type-I with Scheme A and scheme B.  Figure 1 Average throughput performance comparison between Rel-15 Type I SP codebook and extension of scheme A with 32 ports, up to 4 layers  The simulation result reveals that scheme A extension has no performance gain with respect to Rel-15 type I codebook. It confirms our view that there is no need to introduce scheme A extension on legacy port numbers.  Figure 2 Average throughput performance comparison between Rel-15 Type I SP codebook and extension of scheme B with 32 ports, up to 2 layers  It exhibits that scheme B extension has promising performance gain with respect to Rel-15 type I codebook. Therefore, scheme B extension can be introduced to legacy port numbers as a complementary high performance codebook.  In conclusion, we are ok for scheme B but have concerns for scheme A. we suggest to remove scheme A from the proposal.    **Proposal 1.D**:  To our understanding, this proposal is an overhead optimization to save around 20 bits in one-part CSI zero padding. Comparing with the marginal overhead reduction, we prefer to maintain the UCI design for wideband CSI on PUCCH.  [Mod: I agree that the saving isn’t much for a single report. But for Nrep>1, the difference in payload across Ris becomes more pronounced]  **Proposal 1.E**: Support |
| InterDigital | **Proposal 1.C, Proposal 1.E:** Support |
| Mod V31, 32 | **No revision** |
| Samsung | **Proposal 1.C**  For Scheme-B, as we analysed above, the CSI payload exceeds the limit of PF 4 in most of the useful configurable number of SBs, so it doesn’t make sense to argue this can be avoided by NW implementation. Basically, the argument means we defined PUCCH channel to report CSI for Scheme B that can’t convey the information of Scheme B in most cases, and then it is okay not to fix since NW will avoid this by NW implementation. Why do we specified things NW will not use in most of the cases? That part seems not reasonable to us and we think this issue needs to be refined for supporting Scheme B properly.  [Mod: Agree that the spec shouldn’t include a feature that has no use for NW. But apart from this, some companies simply mentioned that more straightforward alternatives exist. For instance using BPSK alphabet for this case may not be desirable since BPSK was already excluded in previous conclusions.]  **Proposal 1.D**  After we checked with other companies, although the payload difference among different RI is not that big in a single CSI report, we realized that it can be much larger when multiple CSI reports are configured to be reported on the same PUCCH, as the FL described.  Based on our understanding, the maximum number of CSI reports is 48, so theoretically 48x24 bit difference could be achieved in the worst case. Hence, after further thought, two-part WB UCI seems useful for Scheme-B, and we are OK with this proposal.  Re another aspect, as far as we know, there is no rationale not using two-part CSI for PF 2 (the maximum bits that PF 2 can convey is larger than that of PF 4). We prefer to unify to support two-part WB CSI for all PF 2,3, and 4.  [Mod: Agree, although for PF2 the proponent would like to minimize spec impact] |
| Spreadtrum | **Proposal 1.C**: If gNB doesn’t want UE to perform UCI dropping, gNB should determine the CSI reporting configuration more carefully. We don’t prefer to have different UE implementation on co-phase selection.  [Mod: This doesn’t mean that we leave it all to gNB to choose from a bunch of features that may be useless.  But, I tend to agree with you that different UE implementation (even if BPSK is a subset of QPSK – hence no complexity increase) isn’t desirable especially since we have ruled out BPSK in Changsha]  **Proposal 1.D**: We also think the issue is not critical. The proposal is not needed.  **Proposal 1.E**: Support. |
| Mod V37 | **P1.E: added DOCOMO’s proposal as a bullet point in bracket so companies can start thinking about this for round-2** |
| Qualcomm | **Proposal 1.D**: As added by the new version of FL assessment, indeed zero-padding bits are not negligible with multiple reports.  Actually Nrep>1 on PUCCH is practical for CA in field today, since only one or two UL cells can have PUCCH (Pcell and PUCCH-Scell), where the second one (i.e. PUCCH-Scell) is according to UE capability.    Therefore, UE may only have one (or two) UL cell with PUCCH to convey all DL CCs’ CSI reports.  Appreciate to have the above explanation into FL assessment (if make sense):   |  | | --- | | * From moderator perspective, **the difference in payload across Ris will be much larger when Nrep>1 is configured to be reported on the same PUCCH**.   + Nrep>1 on PUCCH is practical for CA, since only one (or optionally, two) cell can have PUCCH to convey all DL CCs’ CSI reports. |   [Mod: OK, JD 😊] |
| Vivo | **Proposal 1.A**  We support rho = 1 only. We can be fine with the current proposal assuming we will discuss the details of rho and rho=1 is the baseline.  We support rank specific si configuration, which simplifies the formula to obtain the per-layer power/scaling. With rank specific si, the final per-layer scaling can simply be si.  **Proposal 1.B**  We do not support this proposal. Based on our simulation results, the performance benefit is very marginal. The complexity and effort caused for UE vendors are significant.  **Proposal 1.C**  We share similar as Nokia. The current specification seems sufficient to address this issue.  **Proposal 1.D**  We think it is an optimization, but we are open to discuss further to understand whether it is a significant issue.  **Proposal 1.E**  We support this proposal, and we think it is an important correction. Given the maximum number of bits varies for different rank values, and the maximum size is not rank 1 any more, it is not correct to use rank 1 to determine the PUCCH resource/RBs. |
| Sharp | **Proposal 1.C:** We support to exclude PUCCH format 4 in this case.  **Proposal 1.D:** Considering with 48x24 bit difference, we are OK to support the two-part WB CSI.  **Proposal 1.E:** Support. |
| KDDI | **Proposal 1.A.1**  Support and we are fine with RI common configuration.  **Proposal 1.B**  Fine with the proposal.  **Proposal 1.C**  Open to discuss.  **Proposal 1.E**:  Support. |
| Intel | **Proposal 1.A.1**: Support the proposal. Regarding configuration of the scaling factor, we think that there is no strong need to increase RRC overhead with RI-specific configuration. So, we support RI-common configuration.  **Proposal 1.B**: We are fine to support both Scheme A and Scheme B. We prefer to limit the further spec impact to UE capability discussion only.  **Proposal 1.C**: Agree with Nokia. Proposal is not needed.  **Proposal 1.D**: We prefer the legacy design with single CSI part for WB CSI to avoid unnecessary specification complication.  **Proposal 1.E**: Fine with the proposal. |
| NTT DOCOMO | **Proposal 1.D**:  Thanks for reminding the scenario of multiple reports. We’re okay with this proposal. |
| Rakuten | **Proposal 1.A.1**  We support RI common configuration.  For RI=v=2, we support reuse the scaling formular for RI=v=1 without additional operations nor normalization  **Proposal 1.B**  We support extend Scheme-B to 16, 24, and 32 CSI-RS ports, all RI and K=1 only.  **Proposal 1.E**  We support the proposal. |
| Ericsson | **Proposal 1.A.1**  Support the proposal. Our preference is to use .  As for RI-Specific vs RI-Common, our first preference is RI-Common. In our evaluations, we used RI-Common. We can be ok with RI-Specific as a 2nd choice.  **Proposal 1.B**  Support the proposal. According to our results, for 32 ports, we see Scheme A gives some gains while Scheme B shows much bigger gains.  **Proposal 1.C**  Agree with Nokia that the legacy text in 214 “A UE is not expected to report CSI with a total number of UCI bits and CRC bits larger than 115 bits when configured with PUCCH format 4” is sufficient.  **Proposal 1.E**  Ok |
| Apple | **Proposal 1.A.1:** We are fine. We prefer, i.e., rank common configuration  **Proposal 1.B**: We are fine. But for Scheme-A, and RI=3/4, since we change the spatial basis, the spatial basis selection needs to be discussed. Legacy uses fragmented spatial basis, but scheme-A uses the same spatial basis for the other scenarios.  **Proposal 1.C**: We prefer to exclude PF4, or up to NW configuration. 115 bits (including CRC) limitation is already in the 38.214.  **Proposal 1.D**: We are open to discuss since there are similar specification in TS38.214. The other solution is to support PUSCH only.  **Proposal 1.E**: We are okay. The assumptions on the rank for PUCCH resource selection is needed. We are okay with the proposal in bracket on how to determine the rank assumption for PUCCH resource selection. |
| Mod V52 | **Added conclusion 1.C since proposal 1.C isn’t acceptable by super-majority**  **Added JD-proposed note on FL assessment for proposal 1.D re Nrep>1** |
| Huawei, HiSilicon | **Proposal 1.A.1:** we are fine with current formation. We support , and min() is needed. As analysed in our contribution, simply using *si* will result in power penalty and thus performance loss. And we think RI common *si* configuration is enough.  **Proposal 1.B**: Considering there has been deployment of legacy codebooks, our first preference is to not extend the Rel-19 codebooks, which further separates the markets. We can accept the extension of Scheme-A 1-4 to RI 3-4 for 16/24/32 ports, which can simply the legacy codebook.  The extension of extended orthogonal set will further complicate the legacy codebook, therefore we don’t support this extension in FFS.  **Conclusion 1.C:** Agree with FL’s assessment and other companies’ view, the conclusion is not needed.  **Proposal 1.D**: The splitting of two parts when wideband granularity is configured may result in different encoding methods for part 2, between RM encoding and Polar coding, because the part 2 may be smaller than 11 or larger than 11. This will make the UCI processing more complicated.  **Proposal 1.E**: Support, this is needed to avoid unnecessary UCI dropping.   * From our evaluated UCI overhead below, Scheme-A also has large difference between RI 1-4 and RI 5-8, therefore, Scheme-A should also be included in the main bullet. * For the subbullet in bracket, it is not good for schemeA, the RI value that results in the largest UCI payload seems to be more general.  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | |  | RI=1 | RI=2 | RI=3 | RI=4 | RI=5 | RI=6 | RI=7 | RI=8 | | SchemeA 128port | 10+2n | 12+n | 12+n | 12+n | 31+n | 31+n | 39+n | 39+n | | SchemeB 128port | 10+2n | 16+4n | 22+6n | 28+8n | 24+4n | 24+7n | 28+5n | 28+4n | |
| Mod V55 | **P1.E: revision per Yubo’s/Huawei’s input** |
| TCL | **Proposal 1.D:**  We are open to discuss.  **Proposal 1.E:**  We support this proposal. |
| New H3C | **Proposal 1.A.1:** Support  **Proposal 1.B**: support  **Proposal 1.C**: we are fine with “Not Support”  **Proposal 1.D**: Not support  **Proposal 1.E**: Support |
| Mod V60 | **No revision** |
| NTT DOCOMO | **Proposal 1.E**:  Support to consider both Scheme-A and Scheme-B.  But current sub-bullet is applied to Scheme-B only. For Scheme-A, generally the payload increases with rank. Thus, we suggest following revisions.   * [For Scheme-B, the RI value that results in the largest UCI payload is determined as min(4, maximum configured rank per CSI reporting configuration)] * [For Scheme-A, the RI value that results in the largest UCI payload is determined as maximum configured rank per CSI reporting configuration] |
| Mod VFinal | **P1.E: revision per DOCOMO’s input** |

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

Table 2A Summary: issue 2

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| --- | --- | --- |
| **#** | **Issue** | **Companies’ views** |
| 2.1 | **[116bis] Agreement**  For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports, on the configured KS>1 NZP CSI-RS resources, reuse the legacy CMR and IMR rules for the Rel-15 CRI-based reporting. This includes:   * All the KS NZP CSI-RS resources are associated with a same CSI-RS resource set * …   **Proposal 2.A**: For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports, regarding aperiodic CSI-RS resource configuration, an RRC-configured resource-level slot offset (relative to the resource-set-level slot offset, using the same design as Rel-19 Type-I/II codebook refinement for 48, 64, and 128 ports) is supported for aperiodic CSI-RS resource set   * FFS: The number of bits for indicating the resource-level slot offset (relative to the resource-set-level slot offset) for KS resources, including the value(s) of the slot offset * FFS: Whether, in addition, configuring an *available* slot offset for each CSI-RS resource within the aperiodic CSI-RS resource set   + Note: “*Available* slot offset” is analogous to the Rel-17 SRS triggering offset enhancement   **FL assessment**: The proposal is unclear. It was agreed that all the KS resources are associated with a same resource set. In this case, all the restrictions apply including the permitted resource-level slot offset | **Support/fine**: Huawei/HiSi, ZTE, Qualcomm, China Telecom, Samsung, NTT DOCOMO, NTT CORP, MediaTek, CMCC, NEC, Tejas, CATT, IDC, vivo, Sharp, Intel, Rakuten, Ericsson, Apple, Huawei/HiSi, TCL,  **Not support**: Google (configure 1 vs 2 slots), Xiaomi, Lenovo/MotM, OPPO, Fujitsu, Spreadtrum, New H3C, |
| 2.2 | **Proposal 2.B**: For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports, regarding UCI reported in CSI part-1, if resource-specific RI restriction is configured, zero padding bits are introduced in CSI part 1 for each of the (MMR) reported CRIs:   * For a k-th CRI from the (MMR) reported CRIs (where k=1, 2, …, (MMR)), zero padding bits are inserted after RI field for the k-th CRI, where:   + - , where is the size of RI field corresponding to the i-th CRI, and is the set of CRIs corresponding to the (KsMR) resources     - is the size of RI field corresponding to the k-th CRI   **FL assessment**: The proposal is needed to ensure that the payload for CSI part 1 stays the same for a given RRC configuration. Resource-specific RI restriction (not supported in legacy) implies that the variation of RI bit-width can vary depending on which CRI(s) are selected. So padding bits are needed (following the legacy method of ensuring constant payload). | **Support/fine**: Samsung, Google, NTT DOCOMO, NTT CORP, Qualcomm, MediaTek, Xiaomi, CMCC, NEC, Fujitsu, Tejas, ZTE, CATT, IDC, Spreadtrum, OPPO (ok), Sharp, KDDI, Intel, Rakuten, Ericsson, Apple, Huawei/HiSi (open), TCL, New H3C,  **Not support**: Nokia/NSB (leave to editor), vivo (bitwidth for each RI= max(RI)), |
| 2.3 | **Proposal 2.C**: For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports, regarding one-part CSI wideband reporting, if resource-specific RI restriction is configured, the zero padding bits for each of the M reported CRI are determined as follows:   * For a k-th CRI from the M reported CRIs, , where:   + , where *Q* is the set of CRIs corresponding to Ks resources and is the maximum payload size of associated CSI fields for a j-th CRI, and , where is the set of rank values that are allowed to be reported for the j-th CRI;   + , where is the reported rank for k-th CRI;   + Note: is the size of RI field corresponding to k-th CRI.   + Note: The definition of the operator B(∙) is as legacy (as defined in 38.212).   + Note: the is in the same place as legacy padding bits.   **FL assessment**: The proposal is needed analogous to CSI part 1. | **Support/fine**: Samsung, Google, Qualcomm, NTT DOCOMO, NTT CORP, MediaTek, Xiaomi, CMCC, NEC, Fujitsu, Tejas, ZTE, CATT, IDC, Spreadtrum, OPPO (ok), Sharp, KDDI, Intel, Rakuten, Ericsson, Apple, Huawei/HiSi (open), TCL, New H3C,  **Not support**: Nokia/NSB (leave to editor), vivo bitwidth for each RI= max(RI), |
| 2.4 | **Proposal 2.D**: For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports, if the UCI associated with each of the M CRIs comprises two parts and is multiplexed on PUCCH, the UE determines the PUCCH resource, the number of PRBs for the PUCCH resource, assuming that the CSI associated with each of the M reported CRIs corresponds to rank 1  **FL assessment**: The proposal (addressing the use of two-part UCI on PUCCH) can benefit from more discussion. It is unclear whether rank-1 is the best assumption for resource determination since it represents the lowest overhead. | **Support/fine**: Samsung, Google, Qualcomm, NTT DOCOMO, NTT CORP, MediaTek, Xiaomi, CMCC, Lenovo/MotM, Nokia/NSB, NEC, OPPO, Fujitsu, ZTE, CATT, IDC, Spreadtrum, vivo, Sharp, KDDI, Intel, Ericsson, Apple, Huawei/HiSi (open), TCL, New H3C,  **Not support**: |
| 2.5 | **Proposal 2.E**: For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports, regarding packing order and priority levels of *NRep* CSI reports with *M* CRIs, the UCI packing order and the consecutive priority levels (higher to lower) are as follows:   * The UCI for the *M* CRIs of the first CSI report * The UCI for the *M* CRIs of the second CSI report * *…* * The UCI for the *M* CRIs of the *NRep*-th CSI report   Note: The UCI packing order and the associated priority level for the UCI for the M CRIs in each report follows the previous agreements.  **FL assessment**: The proposal addresses the priority and packing order when NRep>1 reports. This proposal seems needed for completion. | **Support/fine**: Tejas, [Google], Qualcomm, Samsung, NTT DOCOMO, NTT CORP, MediaTek, Xiaomi, CMCC, Fujitsu, CATT, IDC, Spreadtrum, OPPO (ok), vivo, Sharp, KDDI, Ericsson, Apple, TCL, New H3C,  **Not support**: Lenovo/MotM, Nokia/NSB, Intel (RI\*SE sorting), Huawei/HiSi, |
| 2.6 | Proposal 2.F: For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports, regarding UCI omission for the UCI reported in CSI part-2, support the following method for assigning priority levels to multiple CRIs in a single CSI instance.   * For the non-reported *MR* CRIs, priority order (from higher to lower) is assigned based on the RRC configured order of *MR*. * For the reported *M*-*MR* CRIs (or *M* CRIs if *MR* is not configured), priority order (from higher to lower) is assigned based on a beam quality measure like, CRIs’ SINR or CRIs’ RSRP or a combination of resource specific RI and resource specific CQI.   **FL assessment**: The proposal introduces additional priority rules for the (M-MR) CRIs. Given the previous agreement on priority rules and packing order (along with M CRIs), it is unclear why this additional set of rules is needed. | **Support/fine**: Tejas, IDC (open), Huawei/HiSi (open),  **Not support**: Google, Qualcomm, NTT DOCOMO, NTT CORP, MediaTek, Xiaomi, CMCC (UE implementation), Lenovo/MotM, OPPO, ZTE, CATT, Spreadtrum, Intel, Apple, TCL, New H3C, |
| 2.7 | **Proposal 2.G**: For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports,select between the following priority functions:   * Alt1: * Alt2: * Alt3: No change to legacy , and, when configured with a multi-CRI report with M>1 CRIs and *reportConfigID* “”, UE does not expect to be configured with another CSI report with *reportConfigID* value from “” to “” while having the same parameter value “” “” and “” as the multi-CRI report “”   where   * *m =* 0 for non-*M* CRI based CSI reports (legacy CSI reports up to Rel-18), * *m =* 1 for *M* CRI based CSI reports. is the maximum number of CRIs configured for multi-CRI CSI reports not carrying L1-RSRP or L1-SINR   **FL assessment**: The proposal introduces additional priority rule for the (M-MR) CRIs. Whether this is needed or not can be discussed (currently unclear to the moderator). | **Support/fine**: Tejas (Alt1/2), Qualcomm (Alt3), MediaTek, Lenovo/MotM (Alt3), IDC, Samsung (ok), Huawei/HiSi (open),  **Not support**: Google, NTT DOCOMO, NTT CORP, CMCC, OPPO, Fujitsu, ZTE, Spreadtrum, vivo, Ericsson, Apple, TCL, New H3C, |
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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 think one possible way is to configure whether a CSI-RS resource is in the first or second slot, instead of configuring a resource level slot offset.  Proposal 2.B/C: OK  Proposal 2.D: We think rank 1 (as legacy) could be sufficient. But is number of PRBs for PUCCH resource dynamically selected?  Proposal 2.E/F: It seems previous agreement already covers these two?  Proposal 2.G: We failed to see the necessity. The CSI omission is in CSI level. We do not see the necessity to modify the equation of the priority calculation. |
| Mod V2 | **No revision** |
| Qualcomm | **Proposal 2.A**: We can be fine.  For the FFS regarding “*available* slot offset”, we think negative and feel it as “over-engineering.”  **Proposal 2.B**: I am not sure.  When triggered, whether the MR CRIs are needed or not seems already known by gNB, thus CSI-part1 should already have pre-known payload size by gNB.  But I may be wrong.  [Mod: The issue has nothing to do with MR. It is because of the unfortunate and unnecessary knee-jerk online agreement (IMO 😊) that RI restriction is resource-specific despite the legacy resource common]  **Proposal 2.C**: OK in general.  But should we exclude the MR bundle(s) of {RI,CQI,PMI etc.} from the set of “*Q*” (i.e. Ks resources)?  [Mod: I am not sure what you mean. Please suggest rewording]  **Proposal 2.D**: OK, and reusing rank1 should be OK (exact same as legacy).  BTW, the wording of this proposal is a more direct copy (than **Proposal 1.E**) from 213, thus we have no comments to the wording.  **Proposal 2.E**: Seems previous agreement already covers it? Similar understanding as Google  [Mod: Please see comments from Tejas and DOCOMO. The previous agreement doesn’t cover Nrep>1]  **Proposal 2.F**: Not support.  Agree with FL assessment, that previous agreement is “along with M CRIs” – and UE implementation has the freedom to use the order of RSRP or SE (determined by RI+CQI)  **Proposal 2.G**: The new Pri( ) functions look a bit complicated.  If I understand correctly, both Alt1 and Alt2 result in higher value of Pri( ) for Rel-19 multi-CRI resport due to “*m*=1” and “”  To simplify the discussion, instead of adding new function formula, we want to add the following Alt3:   |  | | --- | | Alt3: No change to legacy , and, when configured with a multi-CRI report with M>1 CRIs and *reportConfigID* “”, UE does not expect to be configured with another CSI report with *reportConfigID* value from “” to “” while having the same parameter value “” “” and “” as the multi-CRI report “” | |
| Tejas | **Proposal 2.E**:  The previous agreements define the packing order and priority for M CRIs in a single CSI reporting instance, without reference to *NRep* CSI reports wherein each report can have M CRIs. In our understanding, legacy spec separately defines the priority reporting levels for Part 2 CSI for *NRep* CSI reports, and we think this proposal is desirable for spec completeness of UCI packing of UCI with M CRIs.  **Proposal 2.F**:  We appreciate the views of others, yet think the proposal helps to clarify that, while *MR* CRIs are reported in the same order as configured CRIs (CSIRS Resource id), the remaining *M*-*MR* CRIs are reported by the UE not based on the CSIRS Resource id, but based on the beam quality. (It could be the order of RSRP or SE and flexible as per the UE implementation as agreed earlier)  **Proposal 2.G**:  The legacy Pri( ) is an efficient expression to capture priority as a function of report config id by maintaining the priority due to other factors like, cell index, L1-RSRP/L1-SINR, periodicity of reports.  The new Pri( ) function is a simple and straightforward enhancement to legacy (though looks complicated merely because of the additional term), and is beneficial for M CRI based CSI reporting in Rel 19. Weighing the report priority values as a function of *M* or *M*-*MR* helps to manage CSI omission more efficiently compared to legacy in the presence of M CRIs, and in our view this enhancement is needed as legacy CSI did not have M CRI based quadruple reporting.  While still maintaining all the legacy priority rules, Alt 1 and Alt2 help to redefine and improve the priority levels of CSI reports with smaller payload size due to smaller M values. This helps UE to prioritize critical smaller reports to gNB from being not blocked by a larger beam refinement/enhancement report with larger M values, merely because its report config id is larger due to even a latter CSI request. Hence, in our view this enhancement in packing is useful for improving overall beam management performance of the network in scenarios with CSI dropping or delaying.  @Qualcomm,as you correctly interpreted, both Alt1 and Alt2 result in higher value of Pri( ) for Rel-19 multi-CRI resport due to “*m*=1” and “” and other terms. But while weighing the priority as a combination of report config id and report size (CRIs), this is inevitable to not disrupt with some of the existing priority rules that,  - priority value of reports directed to second cell id is always greater than the priority values of first cell id  - priority value of every report is unique  And even in legacy, in our understanding, the priority value could be very large for SP and P reports. But as these values are translated to priority levels in increasing indices 1,2 3,…., we think that the absolute values are insignificant.  Hence, we think the proposal is an incremental change, even not requiring too many complex conditions and is also backward compatible. |
| China Telecom | Proposal 2.A: Support the proposal. Support reusing the configuration mechanism of resource-level slot offset of resource aggregation and extending the maximum resource-level slot offset. |
| Samsung | **Proposal 2.A.**  Fine with this proposal  **Proposal 2.D.**  Fine with rank=1.  **Proposal. 2.E**  Support. |
| NTT DOCOMO | **Proposal 2.A**:  We support it. We agree the multiple CMRs could be in different slots.  **Proposal 2.B/C:**  Support to discuss zero padding bits details.  **Proposal 2.D:**  Since multi-CRI is based on legacy codebook type, rank=1 can be assumed as legacy.  **Proposal 2.E:**  OK. Seems existing agreements define the priority of M CRIs in one CSI report only.  **Proposal 2.F:**  Not support. For first sub-bullet, the legacy agreements (i.e., first/…/last configured CMR) have covered it. For second sub-bullet, we donot think additional rule is needed.  **Proposal 2.G:**  Not support. For multi-CRI reporting, we have defined CSI omission rule considering per CMR’s CSI in one CSI report. We don’t need to additionally consider each CMR’s CSI in priority equation. |
| Mod V8 | **Some revision mainly due to Qualcomm’s inputs**  **@JD/Qualcomm: Please check my response** |
| Qualcomm | **Proposal 2.B**: OK for us now, after the explanation.  So this proposal is RI field bit-width alignment only for the case of two-part CSI (and RI field is the only filed in CSI-part1 possibly with different bit-width).  **Proposal 2.C**: I meant to say, similar as **Proposal 2.B**:, seems we should describe the MR reported contents differently from the (M-MR) reported.  Editorial (better for more companies to double check):   |  | | --- | | **Proposal 2.C**: For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports, regarding one-part CSI wideband reporting, if resource-specific RI restriction is configured, the zero padding bits for each of the M reported CRI are determined as follows:   * For a k-th CRI from the (M-MR) reported CRIs, , where:   + , where *Q* is the set of CRIs corresponding to (Ks-MR) resources and is the maximum payload size of associated CSI fields for a j-th CRI, and , where is the set of rank values that are allowed to be reported for the j-th CRI;   + ,where is the reported rank for k-th CRI;   + Note: is the size of RI field corresponding to k-th CRI.   + Note: The definition of the operator B(∙) is as legacy (as defined in 38.212).   + Note: the is in the same place as legacy padding bits. * For a j-th CRI from the MR reported CRIs, , where:   + is the maximum payload size of associated CSI fields for a j-th CRI, same as the above definition. |   **Proposal 2.E/.G**: These two proposals are related.  Let’s look at the issue from the starting point.  According to legacy priority function: , the “innermost” index is *reportConfigID* “”, and a legacy report is only with **one** Pri( ) value.  Then the issue is:   * How to define needed **M>1 consecutive** Pri( ) values for a multi-CRI report?   A natural thought can be: To use for the M>1 consecutive Pri( ) values – but it may conflict with another report with ID  Therefore, we propose Alt3 for **Proposal 2.G**: UE does not expect such Pri( ) value conflict.  Then for **Proposal 2.E** with multiple *reportConfigID*s e.g. “” “”…, it seems that it can reuse existing Pri( ) function to determine their packing order based on their IDs “” “”…, and thus no need to additionally define the packing order.  Hope it clarifies, and companies can give a second thought. |
| MediaTek | **Proposal 2.A, 2.B, 2.C** OK  **Proposal 2.D**. Rank 1 should be fine since this report is for Type-I SP PMI per CRI  **Proposal 2.E** OK  **Proposal 2.F** Do not support. The beam quality measure is a UE implementation issue.  **Proposal 2.G**  We do not have a strong view, but we think that the intention of Alt 1 and 2 is justified in the sense that smaller-M multi-CRI reports should have a higher priority than larger-M reports. However, we are not sure whether the proposed equations are the best way to capture it.  As for Alt 3, without modifying the reportconfigID for M-CRI report, it seems that the priority value is still the same (single value) for all M CRIs ? |
| Xiaomi | **Proposal 2.A**:  Regarding to the Rel-19 Type-I and Type-II codebook refinement for 48, 64, and 128 CSI-RS ports, we have agreed that AP-CSI-RS where the K NZP CSI-RS resources are located in two consecutive slots. Such agreement could be reused for Rel-19 CRI-based CSI reporting. I.e., KS resources are configurated in one or two slots. When the K NZP CSI-RS resources are located in two consecutive slots, one bit is used to indicate whether 1-slot offset relative to the legacy resource-set-level slot offset configuration should be assumed or not.  **Proposal 2.B, 2.C**:  We are open to discuss.  **Proposal2.D, 2.E**:  Support  **Proposal 2.F:**  Do not support. For the first bullet, we agree with FL’s assessment, the previous agreement has defined the priority rules. For the second bullet, we have same view with MTK. How to report M-MR CRIs depends on UE implementation.  **Proposal 2.G**:  In our understanding, M CRIs based CSI is reported in one CSI reporting configuration. I.e., there is only one reporting configuration ID. Hence, the legacy priority functions could be reused. Does the proposal is used to define the priority of non-M CRI based CSI reports and M CRI based CSI reports? |
| CMCC | **Proposal 2.A**  OK to support resource specific slot offset. But we have agreed to have 1-bit per resource configuration to indicate whether 1-slot offset relative to the resource-set-level slot offset configuration should be assumed or not for Rel-19 Type-I and Type-II codebook for up to 128 ports, a unified design is preferred.  **Proposal 2.B**  Support.  **Proposal 2.C**  Support. Even for the MR resource, with some special RI restriction configuration, the can be larger than the M-MR resource.  **Proposal 2.D/E**  Support.  **Proposal 2.F**  It may be beneficial when UCI dropping, but UE implementation can handle it.  **Proposal 2.G**  With previous agreements on UCI packing and dropping rule, this proposal is not needed. All the CSI with different CRIs in on CSI report is with the same priority. |
| Lenovo/ MotM | **Proposal 2.A**:  Agree with Xiaomi, CMCC, better to use a configurable parameter for 1,2 bits spacing to be consistent with slot offsets agreed, e.g., for Rel-19 Type-I CB or Rel-18 CJT CB  **Proposal 2.B**:  The proposal is not clear to us. Under RI restriction, the UE is not expected to report certain RI values but this does not require updating the RI field bitwidth. Prefer to discuss in the offline session for more clarity  [Mod: RI restriction actually affects RI bitwidth since Rel-15 for any codebook 😊]  **Proposal 2.C**:  Still not clear, similar to Proposal 2.B. Also do we need any specification update? The zero padding bits already specified suffices to fill in the gap in UCI size regardless of the field causing UCI payload variation.  [Mod: See comment above. No the current spec isn’t sufficient for this new M-CRI feature]  **Proposal 2.D**:  Fine with Rank 1  **Proposal 2.E**:  The packing order for *NRep* CSI reports has been already agreed, which is inferred from priority levels table in Table 5.2.3-1 in TS38.214 remains the same (we have already reused G0, G1 and G2 for Part 2 similar to legacy). We don’t think this is needed. The indexing of the NRep CSI reports is what remains, which is discussed in Proposal 2.G  [Mod: There is no agreement on packing order for Nrep>1. While I agree that Table 5.2.3-1 suggests a natural solution for this new M-CRI feature, procedurally we need a RAN1 agreement for this.]  **Proposal 2.F**:  We believe the legacy UCI omission procedure suffices, which follows Table 5.2.3-1 in TS38.214 priority levels.  **Proposal 2.G**:  Alt3 suffices. Based on the CPU and ARC assumed for Rel-19 CRI-based reporting, chances of multiplexed CSI reports is small anyway |
| Mod V17 | **Some revision per JD’s and CMCC’s comments** |
| Nokia | **Proposal 2.B/2.C**  In our understanding Proposal 2.B is for Part-1 of 2-part sub-band reporting on PUCCH (padding may only include RI), whereas Proposal 2.C is for Part-1 of 1-part wideband reporting on PUCCH (padding may include RI, PMI(s), CQI(s), LI(s)). Because the general rule is the same as legacy, i.e., Part-1 needs to be of fixed size for a given configuration, and the formulation can be reused from 38.212 (NCJT UCI mapping), our preference is to agree the legacy principle and leave the details to calculate the number of padding bits to the editor of 212.  [Mod: This is a possibility but leaving this to 212 editor would cause more problem later since based on our experience, companies will comment that such issue would need a formal RAN1 agreement during maintenance. So from moderator perspective, it is much better to have agreements 😊 Of course if there are better/simpler solutions, they can also be discussed.]  **Proposal 2.D**  We prefer rank-1 assumption as in legacy PUCCH reporting  **Proposal 2.E**  This does not seem needed. If there are multiple reports of the same types, the priority level is already determined by their reportConfigID |
| Samsung | **Proposal 2.C**  The revised proposal from QC is incorrect, since MR is only applicable to AP CSI and this proposal is for single part CSI which is not applicable to AP CSI.  The revised part should be removed.  [Mod: Thanks, you are correct, removed] |
| Mod V20 | **Removed previous revision on 2.C from Qualcomm** |
| NEC | **Proposal 2.A:** OK.  **Proposals 2.B/2.C/2.D:** Fine with the proposals. |
| OPPO | **Proposal 2.A**:  Agree with Xiaomi and CMCC to reuse current design for Rel-19 Type-I and Type-II CB. For the available slot, we don’t think it is needed at all.  **Proposal 2.B**  One simple way can be saying that “The payload of Ris for different CRIs is determined regardless of the resource-specific RI restriction” (without considering RI restriction, just like CBSR in Rel-15), which makes the UE behaviour and specification much simpler.  [Mod: Actually your “simple” proposal deviates from legacy behaviour since the payload for RI is affected by RI restriction. This is different from CBSR (where PMI payload is not affected). Since this deviates from legacy ehaviour, your assessment that this is much simpler is incorrect. On the other hand, padding has been the solution for PUCCH in legacy.]  **Proposal 2.C**  The same view as Proposal 2.B.  [Mod: Same comment as 2.B]  **Proposal 2.D**  Fine  **Proposal 2.E/F**  We don’t think they are needed. For UCI ordering for multiple CSI reports, we can just follow legacy rules in 38.212, and it seems no further agreement is needed.  **Proposal 2.G**  We also think the legacy priority formula is sufficient, and even restriction in Alt3 is not needed. |
| Fujitsu | **Proposal 2.A**:  For Rel-19 M-CRI reporting, UE will report M CSIs independently based on M selected CMRs. Thus, UE doesn’t need joint calculation across Ks CMRs. This is different from Rel-19 Type I/II or Rel-18 CJT Type II because UE needs joint PMI calculation across K CMRs for Rel-19 Type I/II or Rel-18 CJT Type II. Thus, we can just follow Rel-15 rules without any other restrictions.  **Proposal 2.B/C/D**: Support  **Proposal 2.E**: We think this is very natural solution in priority level defined in 38.214.  **Proposal 2.G:** Since M CSIs is reported in one CSI report, we think all 3 alternatives are not needed. |
| Tejas | **Proposal 2.A:**  Support the proposal.  **Proposal 2.B**  Support.  **Proposal 2.C**  Support for spec completion.  **Proposal 2.F**  Based on the earlier agreement, our view is also aligned with other companies that beam quality measure is a UE implementation issue. However, we think that beam report order of *M-MR* reports is of interest to the network as the ordering is beneficial when UCI dropping/delaying occurs and is not yet captured in earlier agreements.  For clarity and simplicity, based on some good inputs, we could request for a rewording of the second bullet as “For the reported *M-MR* CRIs (or *M* CRIs if *MR* is not configured), priority order (from higher to lower) is assigned based on the beam quality measure and not the RRC configured order of resource config ids.”  ~~FFS which beam quality measure.~~  **Proposal 2.G**  The motivation of Alt 1 and 2, and the proposal itself, is that the smaller-*M*, multi-port, multi-CRI reports should have a higher priority than larger-*M* reports. The priority enhancement suggested ensures that there is only one reporting configuration ID associated with a CSI report as in legacy and also applies to legacy CSI reports up to Rel 18 (with *m*=0 and *Mm* =1, the equation falls back to legacy).  In our view, Alt 1 and Alt 2 have the following benefits;  -Maintains the legacy priority rules in terms of all other priority determining parameters like *y, k, c* (no conflict with any other report, as shown in the sample illustration)  -Priority levels are redefined and improved for CSI reports with smaller payload size due to smaller *M* values. Hence, instead of *s* as in legacy, the new rule determines priority for a combination of *s* and *M* in Alt 1 (or *s* and *M-MR* in Alt 2).  Sample illustration:    Another point is, in legacy with multiple reports of the same types, the priority level is already determined by their reportConfigID (legacy did not have large payload difference for multiple reports of same type). But in Rel 19 the multiple reports could be of largely varying size due to multiple RI/PMI/CQI values. Hence, from gNB point of view, prioritizing lower M reports are highly beneficial omission efficiently when resources are constrained.  Alt 3, in our understanding opposes with the legacy assumption that a single CSI report is associated with a single report config id. Hence, it can be a large change, with impacts on report config id definitions of other sub-reports like G0/G1 reports, etc., and is not applicable in this context. Agree with MTK, without modifying the reportconfigID for M-CRI report, Alt 3 may not be suitable as an alternative to priority enhancement. |
| ZTE | **Proposal 2.A:**  Support the proposal. However, we have concern that the ‘available slot’ may complicate the spec.  **Proposal 2.B/2.C/2.D:**  Fine with the proposal.  **Proposal 2.F:**  Do NOT support. We did NOT see the necessity.  **Proposal 2.G:**  Do NOT support. The proposal is unclear to us. We did NOT see the necessity of introducing new priority rules for CRIs-based CSI reports. If NW want to configure higher/lower priority for the new CRIs-based CSI reports over legacy CSI reports, the NW can configure lower/higher CSI report ID for the new CRIs-based CSI reports. |
| CATT | **Proposal 2.A**:ok  **Proposal 2.B**: support  **Proposal 2.C**: support  **Proposal 2.D**: support  For the PUCCH based transmission, since each CRI is with Rel-15 Type-I SP codebook, for each of the M reported CRIs, legacy rank-1 assumption is fine.  **Proposal 2.E**:  It seems to be the same as legacy report-ID-based priority level among multiple CSI reports.  **Proposal 2.F**:  We do not support. There are already agreements on priority and UCI packing order. |
| InterDigital | **Proposals 2.A, 2.B, 2.C, 2.D, 2.E, and 2.G:** Support  **Proposal 2.F:** We are open to discuss proposal 2.F. We share a similar understanding with Tejas, i.e., the previous agreement does not cover Nrep > 1. |
| Mod V31, 32 | **Minor revision 2.F per Tejas’ request** |
| Samsung | **Proposal 2.G**  It is not clear to us re the reason we have to assign higher priority for smaller M value, since its priority certainly depends on situation the NW takes care of. Assigning Config ID would be OK to manage the priority of the reports.  Having said that, if the majority wants, we are OK with this proposal. |
| Spreadtrum | **Proposal 2.A**: Agree with Xiaomi and CMCC, a unified design is preferred for R19 Type-I CB and CRI-based CSI reporting.  **Proposal 2.B/2.C**: We are fine with the proposal in principle. OPPO’s suggestion seems simpler without adding more variables and equations.  **Proposal 2.D**: Support.  **Proposal 2.E**: We think the proposal is technically correct. We are fine to support it.  **Proposal 2.F**: We already have an agreement on this issue. No need to discuss it again.  **Proposal 2.G**: The proposal introduces priority for each CRI, which we think is not necessary. |
| OPPO | **Proposal 2.B/C**: Though we think the padding is a bit complex, we could accept if companies are fine.  [Mod: Thank you, Wenhong]  **Proposal 2.E**: The proposal is redundant considering previous agreements on UCI package. However, we cannot say it is wrong, so we can live with it.  [Mod: Thank you, Wenhong] |
| Mod V37 | **No revision** |
| vivo | **Proposal 2.A**  OK  **Proposal 2.B & 2.C**  We think it is simpler just to define the bit-width for each of the RI fields based on the maximum allowed rank among the multiple selected resources.  **Proposal 2.D**  OK  **Proposal 2.E**  We think it is a natural outcome combining the agreement we had and the legacy ordering of Nrep>1 reports. But it seems Priority level 0 is missing in the proposal.  **Proposal 2.G**  We see no issue to reuse legacy. |
| Sharp | **Proposal 2.A:** Support, and we prefer 1-bit offset indication (i.e., 0 or 1 slot offset).  **Proposal 2.B:** Support.  **Proposal 2.C:** Support.  **Proposal 2.D:** Support.  **Proposal 2.E:** Support. |
| KDDI | **Proposal 2.B/2.C Support.**  **Proposal 2.D/2.E Support.** |
| Intel | **Proposal 2.A**: Support the proposal.  **Proposal 2.B, C**: Fine in principle.  **Proposal 2.D**: Fine with the proposal.  **Proposal 2.E**: In our view UE should sort the CRIs based (RI\*SE (Spectral Efficiency), where SE is taken from the CQI table in 38.214). Our preference is to specify this rule.  **Proposal 2.F**: We don’t see strong need to change the legacy rules. |
| Rakuten | **Proposal 2.A:** Support.  **Proposal 2.B and 2.C:** Support. |
| Ericsson | **Proposal 2.A**  Ok  **Proposal 2.B**  Ok  **Proposal 2.C**  Ok  **Proposal 2.D**  Ok  **Proposal 2.E**  Ok  **Proposal 2.G**  Not support the proposal at this point. As mentioned by others, it is unclear why smaller-*M*, multi-port, multi-CRI reports should have a higher priority than larger-*M* reports. |
| Apple | **Proposal 2.A:** We are fine with the proposal. But we think how to configure needs further discussion, i.e., at the CSI-ResourceConfig level, or at the AP CSI association level  **Proposal 2.B**: We are fine with the proposal  **Proposal 2.C**: We are fine with the proposal  **Proposal 2.D**: We are fine with the proposal  **Proposal 2.E**: We are fine with the proposal  **Proposal 2.F**: We do not prefer additional priority rule for UCI omission, it is overdesign.  **Proposal 2.G**: We do not prefer additional priority rule for UCI omission, it is overdesign. |
| Tejas | **Proposal 2.G:**  Agree with other companies’ views that network could take care of this issue through a careful assignment of reportConfigIDs. In our understanding, this could be an additional overhead on gNBs with heavy traffic load and dynamic channel learning requirement.  Also, the same strategy, of n/w taking care of reportConfigID assignment, could have been employed in legacy for primary and secondary cells’ reports or L1-RSRP, L1-SINR and non- L1-RSRP, L1-SINR reports. But the current priority rule handles the report sequencing very efficiently irrespective of the config ids. Our preference is to not entrust this additional responsibility on gNB for M CRI based reports, similar to legacy and in our view this simple enhancement through Alt1 or Alt2 can handle the requirement and is needed. |
| Mod V52 | **No revision** |
| Xiaomi | **Proposal 2.A**:  In the main bullet, it clarifies that the same design as Rel-19 Type-I/II codebook refinement for 48, 64, and 128 ports is reused to configurate CSI-RS resource for Rel-19 CRI-based CSI refinement. This has implicitly illustrated that 1-bit is used to whether 1-slot offset relative to the legacy resource-set-level slot offset configuration should be assumed or not. It seems that the two FFS in the sub-bullet is not needed.  [Mod: If not needed, they can be excluded in later rounds] |
| Mod V55 | **No revision** |
| Huawei, HiSilicon | **Proposal 2.A**: Support.  Unlike Rel-19 Type-I/II codebook refinement for 48, 64, and 128 ports, gNB transmits CSI-RS resources corresponding to different analog beams in TDM manner under HBF architecture, which means multi-beam channel measurement can distribute among up to Ks slots.  **Proposal 2.B/C/D**: Open to further discuss.  **Proposal 2.E**: Seems unnecessary given the existence of Pri().  **Proposal 2.F/G**: Open to further discuss. |
| TCL | **Proposal 2.A, 2.B, 2.C, 2.D, 2.E:**  Support  **Proposal 2.F**:  Not support  **Proposal 2.G**:  We do not see the necessary. |
| New H3C | **Proposal 2.B, 2.C, 2.D, 2.E:** Support  **Proposal : 2.A, 2.F and 2G**: Not support |
| Mod V60 | **No revision** |

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

Table 3A Summary: issue 3

|  |  |  |
| --- | --- | --- |
| **#** | **Issue** | **Companies’ views** |
| 3.1.1 | **[118bis] Agreement**  For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured with two separate triggers, to indicate *whether or not* the UE should perform delay offset (DO) compensation based on the latest linked CJTC Dd report when calculating the Rel-18 Type-II CJT CSI, introduce a 1-bit indicator per CSI trigger state:   * … * FFS (RAN1#119): Whether the 1-bit indicator applies to all the NTRP CSI-RS resources, or 1-bit indicator per CSI-RS resource * …   **Proposal 3.A.1**: For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured with two separate triggers, to indicate *whether or not* the UE should perform delay offset (DO) compensation based on the latest linked CJTC Dd report when calculating the Rel-18 Type-II CJT CSI, the 1-bit indicator per CSI trigger state applies to all the NTRP configured CSI-RS resources.  **FL assessment**: This was discussed OFFLINE [1]. | **Support/fine**: Ericsson, New H3C, Huawei/HiSi, Samsung, vivo, ZTE, Apple, Lenovo/MotM, NTT DOCOMO, NTT CORP, OPPO, Qualcomm, CATT, Intel, TCL, Xiaomi, Spreadtrum, UNISOC, Fujitsu, NEC, KDDI, MediaTek, Sony, Google, IDC, Sharp, Nokia/NSB, CMCC, HONOR, NICT, China Telecom, New H3C,  **Not support**: |
| 3.1.2 | **[118bis] Agreement**  For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured with two separate triggers, to indicate *whether or not* the UE should perform delay offset (DO) compensation based on the latest linked CJTC Dd report when calculating the Rel-18 Type-II CJT CSI, introduce a 1-bit indicator per CSI trigger state:   * … * FFS (RAN1#119): How this applies to a single CSI trigger state associated with >1 CSI reports   **Proposal 3.A.2**: For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured with two separate triggers, to indicate *whether or not* the UE should perform delay offset (DO) compensation based on the latest linked CJTC Dd report when calculating the Rel-18 Type-II CJT CSI, when a single CSI trigger state associated with >1 Rel-18 Type-II CJT CSI reports, the 1-bit indicator per CSI trigger state applies to all the Rel-18 Type-II CJT CSI reports linked with a CJTC Dd report.  **FL assessment**: This was discussed OFFLINE [1].  **From moderator perspective, including the 1-bit indicator in the CSI-AssociatedReportConfigInfo seemingly reverts the previous agreement (even if this parameter is inside the trigger state IE). In addition, it allows additional flexibility of having different values for the 1-bit indicator across different Rel-18 Type-II CJT CSI reports linked with the CJTC Dd report.** | **Support:** Ericsson, New H3C, Huawei/HiSi, Samsung, vivo (ok), Apple, Lenovo/MotM, NTT DOCOMO, Qualcomm, CATT, Intel, TCL, Xiaomi, Spreadtrum, UNISOC, Fujitsu, NEC, KDDI, MediaTek, Sony, OPPO, IDC, Sharp, IDC, CMCC, Nokia/NSB, NICT, China Telecom, New H3C,  **Not support (1-bit indicator in CSI-AssociatedReportConfigInfo, so it becomes NW implementation):** Google,Nokia/NSB,ZTE, |
| 3.2.1 | **[118bis] Agreement**  For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured with a joint trigger:   * Reuse the CPU occupation and active resource counting for the Rel-18 eType-II CJT * FFS (RAN1#119): Re timeline, decide whether to reuse or further relax the timeline for the Rel-18 eType-II CJT   **Proposal 3.B.1**: For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured with a joint trigger, the timeline (Z/Z’) is determined as Z/Z’ associated with the Rel-18 eType-II CJT, plus Drelax   * The value of Drelax is a UE capability, taken from {0, drelax}   + FFS: The value of drelax (>0), including whether it depends on SCS * For linking CJTC Dd and Rel-18 eType-II CJT CSI, joint triggering is a separate UE feature group from separate triggering   **FL assessment**: This was discussed OFFLINE [1]. | **Support/fine**: Samsung, vivo, New H3C, Ericsson, Huawei/HiSi, Apple, NTT DOCOMO, NTT CORP, OPPO, Qualcomm, Intel, TCL, Xiaomi, Spreadtrum, UNISOC, Fujitsu, NEC, KDDI, MediaTek, Sony, Sharp, CMCC, ZTE, CATT, Nokia/NSB, NICT, Google (ok), China Telecom, New H3C,  **Not support**: |
| 3.2.2 | **Proposal 3.B.2**: For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured with a joint trigger, the UE does not perform DO compensation on the Rel-18 type II CJT CSI associated with TRP(s) that are either ‘out of range’ or whose 1-bit inside/outside indicator dn is reported as ‘outside’.  **FL assessment**: Since linkage assumes UE-specific PDSCH digital DO pre-compensation akin to Rel-18 Type-II CJT Mode-1, a proper use case would assume that the selection of NTRP TRPs already removes TRPs that result in dn=’outside’. So the need for this proposal is unclear. | **Support/fine**: MediaTek, Samsung, Xiaomi, NEC, Spreadtrum, vivo (open), Sharp, Sony, Apple,  **Not support**: Google, NTT DOCOMO, NTT CORP, Lenovo/MotM, Nokia/NSB, OPPO, Fujitsu, ZTE, CATT, Rakuten, Huawei/HiSi, KDDI, TCL, |
| 3.2.3 | **Proposal 3.B.3**: For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured with a joint triggering carried on a same PUSCH (hence on a same slot), the UCI associated with the CJTC Dd is placed in the part of UCI as TS 38212 Table 6.3.1.1.2-13; the CSI part 1 of Rel-18 eType-II CJT CSI is placed in the part of UCI as TS 38.212 Table 6.3.1.1.2-13 and the CSI part 2 of Rel-18 eType-II CJT CSI is placed in the part of UCI as TS 38.212 Table 6.3.1.1.2-14   * The previously agreed UCI design and mapping order for CJTC Dd report are reused * The legacy UCI design, UCI mapping order, and UCI omission for the Rel-18 eType-II CJT CSI are reused   **FL assessment**: This proposal is needed since joint triggering introduces a new PUSCH reporting format within 1 slot. | **Support/fine**: CMCC, Samsung (ok), Qualcomm (ok), NTT DOCOMO (ok), NTT CORP, Xiaomi, TCL,  **Not support**: Fujitsu, Huawei/HiSi, [OPPO], |
| 3.3 | **[118bis] Agreement**  For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured, support linking the CMRs in the two CSI Report Settings so that UE knows which CMRs in the two report settings correspond to the same TRP.   * Based on a fixed correspondence between the set of TRS resource set IDs in sequential order and the set of CSI-RS resource IDs in sequential order of configuration in their respective Resource Setting   FFS: linking, when the number of resources configured for CJT CSI is < number of resource sets configured for CJT Dd, in case of separate triggers  **Conclusion 3.C:** 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 linking the CMRs in the two CSI Report Settings, for separate triggering, the UE expects that the number of CSI-RS resources associated with the Rel-18 eType-II CJT CSI is always the same as the number of TRS resource sets associated with the Rel-19 CJTC Dd report  **Question 3.C:** 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 linking the CMRs in the two CSI Report Settings, please share your views, if any, on   * Whether or not, for separate trigger, the UE can assume that the number of CSI-RS resources associated with the Rel-18 eType-II CJT CSI is always the *same* as the number of TRS resource sets associated with the Rel-19 CJTC Dd report   + If not, whether an additional mapping between the CMRs is needed or not   **Yes** **(always same, baseline)**: Apple, CATT, Lenovo/MotM, Samsung, OPPO, Google, Qualcomm, NTT DOCOMO, NTT CORP, Xiaomi, NEC, ZTE, IDC, Spreadtrum, Sharp, Intel, Rakuten, Sony, Apple, Huawei/HiSi, KDDI,  **Not always (need justification)**: Fujitsu, MediaTek, Nokia/NSB,  **FL assessment**: This FFS can be discussed. If there is no resolution, the baseline is that there is no additional mapping needed and hence the number of CSI-RS resources associated with the Rel-18 eType-II CJT CSI is always the same as the number of TRS resource sets associated with the Rel-19 CJTC Dd report. | |
| 3.4 | **[118] Agreement**  For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, to facilitate UE-specific frequency offset pre-compensation on PDSCH by the NW, *decide*, by RAN1#118, whether to support configuring a UE (via RRC ignalling) to perform PMI calculation for the Rel-18 eType-II CJT CSI report assuming pre-compensation using the UE-reported frequency offset (when ReportQuantity is ‘cjtc-F’). And if supported, whether any of the following is additionally supported or not:   * NW indicates the frequency offset value to be compensated for the Rel-18 eType-II CJT CSI report, and/or * The two separately configured reports (i.e. Rel-18 eType-II CJT CSI report and the CJTC frequency offset report) are always jointly triggered and carried on a same PUSCH (hence on a same slot) * The frequency offset value to be compensated is the latest reported fO before the DCI triggering the CJT CSI reporting   FFS: AP-CSI-RS can be configured for the Rel-18 eType-II CJT report  The above only applies when the CMRs do not share common QCL source for Doppler shift indication  **Proposal 3.D.1**: For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, to facilitate UE-specific frequency offset pre-compensation on PDSCH by the NW, support configuring a UE (via RRC signalling) to perform PMI calculation for the Rel-18 eType-II CJT CSI report assuming pre-compensation using the UE-reported frequency offset (when ReportQuantity is ‘cjtc-F’), using the same mechanisms as that for UE-reported delay offset (when ReportQuantity is ‘cjtc-Dd’).   * This implies that all the supported sub-features associated with ReportQuantity = ‘cjtc-Dd’ linked to Rel-18 eType-II CJT CSI are extended to ReportQuantity = ‘cjtc-F’ linked to Rel-18 eType-II CJT CSI   **FL assessment**: The above issue needs some discussion. | **Support/fine**: vivo, Xiaomi, Fujitsu, Sony, Samsung, ZTE, Rakuten,  **Not support (NW implementation)**: Huawei/HiSi, MediaTek, CMCC, CATT, Nokia/NSB, Qualcomm, Lenovo/MotM, NTT DOCOMO, NTT CORP, OPPO, Google, Spreadrum, Sharp, Intel, Apple, KDDI, TCL, New H3C, |
| 3.5.1 | **Proposal 3.E.1**: For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured with two separate triggers, introduce a UE capability for the following:   * The UE capability is used to inform the NW on the maximum duration of 2 sec the UE can store the latest CJTC Dd report, measured from the transmission of the linked CJTC Dd report * When the UE does not report this UE capability, it is assumed that the UE can store a CJTC Dd report [indefinitely]   **FL assessment**: Wording is based on the outcome of Monday and Wednesday **OFFLINE** sessions in RAN1#118bis.  This is intended to avoid stale Dd report from being utilized. However, it can be argued that this can be handled via NW implementation. | **Support/fine**: Lenovo/MotM, ZTE, Qualcomm, vivo, Xiaomi, Huawei/HiSi, NEC, HONOR, Sharp, KDDI, MediaTek, NTT DOCOMO, NTT CORP, Apple, Google, Spreadtrum, CATT, China Telecom, TCL, New H3C,  **Not support**: Intel, Ericsson, Nokia/NSB, OPPO, |
| 3.5.2 | **Proposal 3.E.2**: For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured with two separate triggers, when at least one of the NTRP reported delay offset (DO) values in a linked CJTC Dd report is ‘out of range’, the UE does not perform DO compensation on the triggered Rel-18 eType-II CJT CSI associated with TRP(s) that are ‘out of range’  **FL assessment**: Tuesday **OFFLINE** outcome in RAN1#118bis. | **Support/fine**: Huawei/HiSi, Qualcomm, Samsung, Ericsson, Sony, Lenovo/MotM, Xiaomi, NEC, HONOR, OPPO, Google, NTT DOCOMO, NTT CORP, MediaTek, Spreadtrum, vivo (open), Sharp, Intel (ok), Sony, Apple, KDDI, New H3C,  **Not support**: Nokia/NSB, ZTE, IDC, CATT, Fujitsu, Rakuten, TCL, |
| 3.6 | **[117] Agreement**  For the Rel-19 aperiodic standalone CJT calibration reporting, regarding the applicable type(s) of the configured NTRP NZP CSI-RS resources/resource sets when ReportQuantity is ‘cjtc-P’ (DL/UL phase offset),   * all the ‘CSI-RS for CSI’ resources within each resource set follow the legacy pre-Rel-19 rules of CSI-RS resources associated with a same resource set * all the resources across the NTRP CSI-RS resources/resource sets are configured with the same bandwidth   **Proposal 3.F**: For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when *ReportQuantity* is *‘cjtc-P’* (DL/UL phase offset), the NTRP P/SP CSI-RS resources are configured within X={1,[2]} slots, without DL/UL switching in between the NTRP resources, where X=1 implies that the NTRP resources are configured within a same slot, and X=2 implies that the NTRP resources are configured within two adjacent slots.  **FL assessment**: This is analogous to legacy CMR behaviours for Rel-17 NCJT and Rel-18 Type-II CJT.  This proposal may be helpful to identify NTRP CSI-RS occasions linked to a latest SRS occasion for refer-ence antenna port determination. | **Support/fine**: Qualcomm, OPPO, NTT DOCOMO, NTT CORP, Nokia/NSB, Apple, Huawei/HiSi, Google, Mediatek, Xiaomi, vivo, Sharp, KDDI,  **Not support**: Samsung, Ericsson, ZTE, CATT, Fujitsu, Intel, TCL (X=1), |
| 3.7.1 | **Proposal 3.G.1:** For the Rel-19 aperiodic standalone CJT calibration reporting, support joint Dd + phase offset (PO) reporting as follows:   * Only wideband (=1) PO is supported * No further optimization of CSI reporting format, e.g. configurability of not reporting {dn} * The UCI parameters are captured in the table below   *When ReportQuantity is ‘cjtc-Dd-P’ (joint Doffset+d and PO)*   |  |  | | --- | --- | | Parameter | Details/description | | nref1 | Reference TRS resource set index for Doffset+d, based on the ordering from RRC configuration:  bits | | nref2 | Reference TRS resource set index for PO, based on the ordering from RRC configuration: bits | | {Dn,offset,  n=0, 1, …, NTRP – 1 n≠nref1} | Delay offset for CSI-RS resource set n:  bits | | {dn,  n=0, 1, …, NTRP – 1, n≠nref1 } | 1-bit inside/outside indicator for CSI-RS resource set n: bits | | {POn ,  n=0, 1, …, NTRP –1, n≠nref2} | Wideband phase offset for CSI-RS resource n:  bits |  * The UCI mapping order is as follows:   + nref1,   + nref2,   + {Dn,offset, n=0, 1, …, NTRP – 1, n≠nref} ordered from the lowest to highest CSI-RS resource set ID,   + {dn, n=0, 1, …, N TRP – 1, n≠nref} ordered from the lowest to highest CSI-RS resource set ID   + {POn, n=0, 1, …, NTRP – 1, n≠nref} ordered from the lowest to highest CSI-RS resource ID,   **FL assessment**: This proposal (from RAN1#118) is an optimization since each can be reported separately. | **Support/fine:** Qualcomm, Sony, Samsung (ok), Google, ZTE, Fujitsu, Sony, Ericsson (open), Apple,  **Not support**: Huawei/HiSi, MediaTek, NTT DOCOMO, NTT CORP, NEC, Intel, TCL, Huawei/HiSi, Xiaomi, IDC, Sharp, KDDI, CMCC, ETRI, OPPO, Apple, vivo, New H3C, Nokia/NSB, Spreadtrum, TCL, Lenovo/MotM, Rakuten, |
| 3.7.2 | **Proposal 3.G.2:** For the Rel-19 aperiodic standalone CJT calibration reporting, support reporting, as a new ReportQuantity in one CSI reporting instance and one CSI Reporting Setting, L1-RSRPs associated with the configured NTRP CSI-RS resources and the following CJT calibration report type:   * ReportQuantity is ‘cjtc-Dd’ (delay offset)   The legacy L1-RSRP is fully reused, where the L1-RSRP associated with nref is the reference for the other (NTRP-1) differential L1-RSRP(s)   * The NTRP CRI(s) are not reported   **FL assessment**: This proposal (from RAN1#118) is an optimization primarily for TRP selection (which utilizes both RSRP and CJTC report).  As a possible compromise, the proposal is limited to Dd only to add NW to select TRP with only one CSI Report Setting.  @Those not supporting or against: please check if this helps 😊 | **Support/fine:** NEC, NTT DOCOMO, NTT CORP, Lenovo/MotM (low priority), Samsung, Sony,  **Not support**: ZTE, Xiaomi, Fujitsu, Ericsson, Apple, Huawei/HiSi, OPPO, TCL, ETRI, New H3C, Google, Nokia/NSB, vivo, Sharp, Intel, KDDI, Spreadtrum, TCL, China Telecom, CMCC, IDC, Rakuten, |
|  |  |  |

Table 3B LLS/SLS results: issue 3

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| --- | --- | --- | --- |
| **Company** | **SLS results** | | |
| **Issue #** | **Metric** | **Observation** |
| ZTE | 3.4 | Cell-edge and average UPT gains | SLS throughput results for non-compensated CJT and UE-specific DO/FO pre-compensated CJT  *It is observed in the figure of SLS results that, UE-specific FO pre-compensation CJT (130.26% performance for cell-edge UE, 107.77% performance in average) outperforms non-pre-compensated CJT (100% performance for cell-edge UE, 100% performance in average) and DO pre-compensated CJT (127.18% performance for cell-edge UE, 106.61% performance in average), and both DO and FO pre-compensated CJT provides the best performance (156.41% performance for cell-edge UE, 117.81% performance in average).* |
| Qualcomm | 3.7.1 | Relative UPT gain vs DL SNR | A graph of different types of data  Description automatically generated with medium confidence  Performance comparison between PO+delay/TAE and subband phase with MRT-precoded CSI-RSs (left figure) and non-MRT-precoded CSI-RSs (right figure)  *From the SLS results, the following observations can be made:*   * *For MRT-precoded CSI-RSs, Opt1 (wideband/initial PO + delay/TAE) outperforms Opt2 (subband PO) for the case of all 16 subbands (which is with massive UCI overhead).*   *For non-MRT-precoded CSI-RS), the benefit of Opt1 (wideband/initial PO + delay/TAE) over Opt2 (subband PO) is reduced.* |
|  |  |  |  |

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.2: Just to clarify a bit on our understanding. We think this depends on where to add this new RRC parameter. If this is added under *CSI-AssociatedReportConfigInfo*, then there will be no problem. If this is added under *CSI-AperiodicTriggerState*, we will need to clarify whether this is applied to all the triggered reports or not. Usually, new RRC parameter for AP CSI report is added under *CSI-AssociatedReportConfigInfo*. So we think that way is already sufficient.  [Mod: Since we already agreed that the indicator (RRC parameter) is included in each trigger state (not in report config), the second possibility you mentioned is the only solution, i.e. proposal 3.A.2 😊]  Proposal 3.B.1: If no other company has concern on “0”, we can accept it.  [Mod: Thanks]  Proposal 3.B.2: We failed to see the necessity.  Question 3.C: We think they should be the same, otherwise we need to define orphan CMR handling mechanism.  Proposal 3.D.1: We failed to see the necessity. The impact of FO is different from PO.  Proposal 3.E.2: Support. It is impossible for UE to do DO compensation when it is out of range.  Proposal 3.F: OK, but it seems this is already covered according to previous agreement?  Proposal 3.G.1: Support  Proposal 3.G.2: Do not support. L1-RSRP is usually measured based on SSB/CSI-RS for BM instead of TRS. |
| Mod V2 | **No revision** |
| Qualcomm | **Question 3.C**: Yes, always same.  **Proposal 3.F**:  One more point input to further think about this proposal.  In last meeting, we agree to use “the latest SRS transmission occasion before the occasions of the NTRP CSI-RS resources” for reference antenna port determination.  If the NTRP CSI-RS occasions can be distributed across arbitrary slot offsets, how do we define the combination of NTRP CSI-RS occasions? E.g. with 2-TRP in the following figure, is it which two occasions (to determine the latest SRS occasion)?    If the above question makes sense, appreciate if the following can be added into “FL assessment”:   |  | | --- | | This proposal can be helpful to identify NTRP CSI-RS occasions linked to a latest SRS occasion for reference antenna port determination. |   [Mod: Yes sir!] |
| China Telecom | Proposal 3.A.1: Support the proposal.  Proposal 3.A.2: Fine with the proposal. From implementation perspective, one trigger state triggering more than one CJT Type-2 reports is a corner case.  Proposal 3.B.1: Support the proposal. Fine with extendinh the timeline.  Proposal 3.E.1: Support the proposal.  Proposal 3.G.2: Do NOT support. We didn’t see the necessity of this proposal. |
| Samsung | **Proposal 3.B.1**  We would like to mention again the majority has been to reuse the Rel-18 eType-II CJT CSI timeline since the last meeting. We are okay with the proposal for progress as long as Drelax=0 is not deleted.  **Proposal 3.B.2**  We see that a relevant case to the proposal may happen, where NW initially (at the beginning or in a transition case) configures the two reports of CJTC and CJT CSI with a joint trigger before NW could be able to remove the TRPs resulting in dn=’outside’. So it would make sense to consider this proposal.  **Question 3.C**  Assuming the number of CSI-RS resources associated with CJT CSI is the same as the number of TRS sets associated with the CJTC Dd seems straightforward/natural, and we are not quite sure the scenario where the numbers for the TRS sets and CSI-RS resources are different. NW anyway will exclude the unnecessary TRS sets from the configuration.  **Proposal 3.D.1**  Support  **Proposal 3.G.2**  We support the proposal (please remove (ok) next to Samsung). Although we understand it is an optimization and can be implemented with another way utilizing different configurations, the joint report of ‘cjtc-Dd’ and ‘L1-RSRP’ can reduce at least # of CSI reporting settings when the NW needs the two quantities for TRP selection. |
| Mod V8 | **No revision.** |
| NTT DOCOMO | **Proposal 3.B.2**  We agree with FL assessment. Not sure how essential it is.  **Question 3.C**  Yes. “**always same**” should be straightforward.  **Proposal 3.E.2**:  We support this. |
| MediaTek | **Proposal 3.B.2**  While we understand it could be a corner-case, this proposal is needed when the Dd status changes during the joint reporting compared to a previous Dd report from which NW selects TRPs. We propose a slightly modified wording for clarity and completeness:  For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured with a joint trigger, ~~the CJT CSI report with delay offset (DO) compensation considers only the reference TRS set index and those TRS set indices whose 1-bit inside/outside indicator d~~~~n~~ ~~is reported as ‘inside’~~ the UE does not perform DO compensation on the Rel-18 type II CJT CSI associated with TRP(s) that are either ‘out of range’ or whose 1-bit inside/outside indicator dn is reported as ‘outside’.  **Question 3.C**  For separate triggering, it may be possible that NW selects a subset of TRPs from a previous Dd report and configures this subset for CJT CSI report with DO compensation. In such cases, unless the number of TRS resource sets for DO reporting is reconfigured, the number of CMRs for CJT CSI < number of CMRs for (previous) DO reporting.  Since we agreed that the CJT CSI linkage will be with the previously reported (latest) DO value, we are not sure whether TRS resource sets will be reconfigured before triggering the linked CJT CSI report.  **Proposal 3.E.2, 3.F** Support |
| Xiaomi | **Proposal 3.B.2**  Support. Similar to the case in Proposal 3.E.2, such TRP will be not selected for PDSCH transmission. So, delay offset compensation doesn’t need to consider such TRP. In addition, it is better to spec that UE doesn’t need to consider such TRP when performing CJT CSI calculation.  **Question 3.C**  Yes, we prefer ‘always same’ for simplification. Otherwise, new mapping rule needs to be specified.  **Question 3.F**  Support |
| Lenovo/ MotM | **Proposal 3.A.1**:  Support  **Proposal 3.A.2**:  Support under the condition that the NR reports are configured via the same CSI report config  **Proposal 3.B.2**:  Not clear, does “outside” here means the delay value is out of range? If so, it should be clear there is no compensation possible, so the proposal is not needed in our opinion.  **Question 3.C**:  Yes, nTRS and nCSI-RS resources should be assumed to be equal, otherwise this linkage is not supported.  **Proposal 3.D.1**:  The network already adjusts the frequency based on TRS, implying that the PMI is adjusted may lead to doubling the FO compensation and leading to further frequency misalignment.  **Proposal 3.E.2**:  Support  **Proposal 3.G.1**:  Do not support. Such configuration would allow for two distinct sets of resources for channel measurement (based on TRS for DO and single-port CSI-RS for PO), which will require more spec impact especially in RAN2.  **Proposal 3.G.2**:  Not a priority. |
| Mod V17 | **P3.B.2: revision per MTK’s comment**  **Added conclusion 3.C given companies’ inputs** |
| Nokia | **Proposal 3.A.2**  We share similar view as Google. In our understanding, a trigger state contains a sequence of CSI-AssociatedReportConfigInfo, one for each CSI report associated with the trigger state. The simplest solution is to have this 1-bit included in the CSI-AssociatedReportConfigInfo of the relevant trigger state.  We are also fine to let RAN2 decide in which IE of the trigger state to add the 1-bit indicator.  [Mod: Please find the previous agreement below.  **[118bis] Agreement**  For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured with two separate triggers, to indicate *whether or not* the UE should perform delay offset (DO) compensation based on the latest linked CJTC Dd report when calculating the Rel-18 Type-II CJT CSI, introduce a 1-bit indicator per CSI trigger state:  Including the RRC parameter in the ReportConfig is a possibility, this is not a natural implementation of the agreement which suggests that the RRC parameter is included in the trigger state directly. Your suggestion IMO is a stretch to the agreement … And there is no reason to overcomplicate this issue by outsourcing things to RAN2 (which is already overloaded because of MIMO) ]  **Proposal 3.B.2**  We agree with FL that the need for this proposal is unclear  **Question 3.C**  Not always.  For separately triggered CJTC-Dd and CJT CSI, the network knows which TRPs are out of range from the Dd report, so forcing the gNB to include these out-of-range TRPs in the triggered CJT CSI seems an unnecessary and problematic restriction.  On the other hand, if the set of TRPs configured for Dd and CSI is always the same, how can a gNB exclude certain TRPs from the Dd configuration before knowing which ones are out of range? The only possibility in this case is to configure dynamic TRP selection for CJT CSI  **Proposal 3.E.2**  With this proposal, it is not clear if a UE reports CJT CSI for the out-of-range TRPs, without delay compensation, or if it excludes these TRPs from the CSI report |
| Mod V20 | **No revision** |
| NEC | **Proposal 3.B.2:** Support. If it’s not agreed, to remove the “outside” TRPs, does it mean TRP selection should be enabled for CJT CSI? While TRP selection is only an optional feature.  **Conclusion 3.C:** Fine.  **Proposal 3.E.2:** Support. Especially based on the Conclusion 3.C, the UE ehaviou should be defined in case of reported DO value is ‘out of range’ (i.e. ), it’s an infinite interval where network can not even know the rough DO value. So what should the UE do in case of ‘out of range’ should be clearly defined, for example, UE will not do pre-compensation or UE can do pre-compensation just based on value , which can at least pre-compensate a part of the delay offset, and the remaining offset can be reflected in CJT codebook.  **Proposal 3.G.2:** Support. The combined of CJT calibration of delay offset with RSRP reporting can provide more useful information to network, which can provide better scheduling and configuration. For example, it’s possible a TRP with suitable delay but poor RSRP, it’s not available for CJT. |
| OPPO | **Proposal 3.A.1/2**:  Support  **Proposal 3.B.1**:  Support  **Proposal 3.B.2**:  We don’t think it is needed.  **Conclusion 3.C:**  Fine. Even when the number of CMRs is not the same, we think current mapping, i.e. the fixed correspondence between the set of TRS resource set IDs and the set of CSI-RS resource IDs in sequential order, can also be applied, though some of the TRS may not be mapped to any CMR (not selected).  **Proposal 3.D.1**:  Not needed at all.  **Proposal 3.E.1**:  The large duration for the UE capability makes the proposal useless. Considering the memory for the CJTC Dd report is very small, we are fine without this UE capability. Please remove us from supporting companies. |
| Fujitsu | **Proposal 3.B.2**:  The CJT-based CSI/PMI calculation will be inaccurate if only some TRPs are DO compensated and other TRPs are not compensated. This is because that PMI is calculated by assuming all the TRPs participate in CJT transmission. However, it is more reasonable that the CJT transmission finally comes from the TRPs not including the out-of-range TRP. Therefore, the calculated PMI does not match with the real CJT transmission. In Rel-18 CJT Type II, UE can select a subset of TRPs for CSI reporting by its implement. Thus, if UE reports ‘out of range’ or ‘Outside’ of some TRPs, a more reasonable way is that the UE does not select these TRPs for PMI reporting. So we think this proposal is not needed.  **Conclusion 3.C:** Not support. We share the similar views as MTK and Nokia. For separate triggering, when UE reports ‘out of range’ or ‘Outside’ of some TRPs, gNB may not configure the CMRs of these TRPs. For joint triggering, we agree that it is reasonable to assume same number of TRS sets and CMR because gNB doesn’t know the reported DO values before the joint triggering. However for separate triggering, the number of CMRs can be smaller than the number of TRS sets, since the gNB can exclude the out-of-range TRP based on the reported DO values.  **Proposal 3.E.2**: Based on our views for Conclusion 3.C, this case will not happen because gNB will not configure the CMRs of those TRPs.  **Proposal 3.F**: We think this can be up to NW implement. |
| ZTE | **Proposal 3.A.1:**  Support.  **Proposal 3.A.2:**  To avoid an ambiguity, we prefer to include the 1-bit indicator in the CSI-AssociatedReportConfigInfo in the trigger state (similar view as Google and Nokia). Then the 1-bit indicator is only applied to the associated CJT Type-II report.  [Mod: This can be perceived as reverting the previous agreement even if the associated report config is inside the trigger state IE 😊]  **Proposal 3.B.1:**  Support. Our first preference is that drelax = ZCJTC/ZCJTC’, i.e., drelax = Z2/Z2’. We are also open to consider smaller values of drelax.  **Proposal 3.B.2:**  Do NOT support. We share similar view with FL that, the need for this proposal is unclear.  **Conclusion 3.C:**  Fine with this conclusion.  **Proposal 3.D.1:**  Support. This issue is very similar to the linkage between CJTC DO report and CJT Type-II report. The inter-TRP frequency misalignment could cause significant phase changing between the CSI-RS resources used for CJT Type-II phase measurement. To guarantee the CJT performance, the phase changing needs to be mitigated by frequency pre-compensation at UE side. So, the linkage is needed to align the understanding of frequency pre-compensation at both UE and NW sides.  **Proposal 3.E.2:**  This proposal is similar to Proposal 3.B.2. We failed to the necessity of this proposal.  **Proposal 3.F:**  Do NOT support. Technically we agree that the time gap between the CSI-RS resources should be limited and there should NOT be UL/DL changing between the CSI-RS resources. However, this can be simply achieved by NW scheduling.  **Proposal 3.G.1:**  Support.  **Proposal 3.G.2:**  Do NOT support. This proposal is unnecessary optimization. |
| CMCC | **Proposal 3.A.1**  Support. The motivation of resource-specific 1-bit indicator is to facilitate DO compensation for only a subset of TRPs. However, in this case, it is unclear how to indicate QCL assumptions for PDSCH for a UE considering that only up to two TCI states can be indicated for PDSCH CJT.  **Proposal 3.A.2**  Since the linkage of CJTC Dd and Rel-18 eType-II CJT CSI reports is configured per CSI report configuration, when a CSI trigger state is associated with NR >1 Rel-18 Type-II CJT CSI reports, it is possible that only NL < NR reports are configured to be linked with a CJTC Dd report. So, we support this proposal with the following refinement.  **Proposal 3.A.2**  For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured with two separate triggers, to indicate *whether or not* the UE should perform delay offset (DO) compensation based on the latest linked CJTC Dd report when calculating the Rel-18 Type-II CJT CSI, when a single CSI trigger state associated with NR >1 Rel-18 Type-II CJT CSI reports, the 1-bit indicator per CSI trigger state applies to all the reports configured to be linked with a CJTC Dd report.  [Mod: Thanks for spotting this, you are correct, indeed it’s not always the case that all the T2 CJT CSIs in a trigger state are linked with the Dd report]  **Proposal 3.G.2**  Do not support. It is clearly stated in WID that the CJT calibration report is a stand-alone aperiodic reporting on PUSCH. So, in our view, this optimization is out of scope. |
| CATT | **Proposal 3.B.2**:  We agree with FL that the need for this proposal is unclear |
| InterDigital | **Question 3.C:** Support “Yes, always same, baseline”.  **Proposal 3.G.2:** Not sure why this is needed. UE can perform TRP selection through Type-II CJT CSI report, and network has RSRP from the BM CSI reports. |
| Mod V31, 32 | **Revised 3.A.2 per input from Yan/CMCC**  **Added (missing) proposal 3.B.3 based on a proposal CMCC Tdoc** |
| Samsung | **Proposal 3.B.3**  NW needs to know the UCI order hence we think it is needed. Placing the CJTC Dd in CSI Part 1 before the UCI of the Rel-18 eType-II CJT CSI seems natural and straightforward. So we are OK with this proposal. |
| Spreadtrum | **Proposal 3.B.2**: For the modified version, a unified UE behaviour can be defined for both joint trigger and separate trigger (in proposal 3.E.2). If NW vendors think Type-II CJT codebook with a subset of TRPs being compensated is helpful, we are fine to support it.  **Conclusion 3.C:** Support.  **Proposal 3.D.1**: not needed.  **Proposal 3.E.2**: Similar view as for proposal 3.B.2. If NW vendors think Type-II CJT codebook with a subset of TRPs being compensated is helpful, we are fine to support it. |
| CMCC | **Proposal 3.B.3**  Thanks for providing this proposal. To avoid ambiguity, we suggest modifying the proposal as follows.  **Proposal 3.B.3**: For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when linking CJTC Dd and Rel-18 eType-II CJT CSI reports is configured with a joint triggering carried on a same PUSCH (hence on a same slot), the UCI associated with the CJTC Dd is placed in the part of UCI as TS 38212 Table 6.3.1.1.2-13; the CSI part 1 of Rel-18 eType-II CJT CSI is placed in the part of UCI as TS 38212 Table 6.3.1.1.2-13 and the CSI part 2 of Rel-18 eType-II CJT CSI is placed in the part of UCI as TS 38212 Table 6.3.1.1.2-14   * The previously agreed UCI design and mapping order for CJTC Dd report are reused * The legacy UCI design, UCI mapping order, and UCI omission for the Rel-18 eType-II CJT CSI are reused   [Mod: Thanks, your proposed wording is better than mine 😊] |
| OPPO | **Proposal 3.B.3**:  We have agreed that UCI associated with the CJTC Dd includes only one part, then we don’t think further agreement is needed since all the one part CSIs are defined in Table 6.3.1.1.2-13. For Rel-18 CJT CSI, we can just follow Rel-18 spec. without any modification.  In current 38.212 how to multiplex multiple CSI reports within one PUSCH has been clearly specified. If the intention of this proposal is to define a new rule overriding current rule, we don’t think it is necessary at this stage.  [Mod: Please check the revised version from Yan which should address some of your points] |
| Mod V37 | **P3.B.3: revision per Yan’s (CMCC) inputs** |
| Qualcomm | **Proposal 3.B.3**: OK.  This should be the common understanding, anyway no harm to clarify. |
| NTT DOCOMO | **Proposal 3.B.3**: The intention is OK. We wonder a bit if there is a need to update the spec, but ok to agree with this (as QC said, no harm to clarify). |
| Vivo | **Proposal 3.B.2 & 3.E.2**  We are open to discuss.  **Proposal 3.F**  We are okay if it is limited to P and SP CSI-RS. There is no need to discuss AP as one slot restriction has already applied on AP. |
| Sharp | **Proposal 3.B.2:** Support. It is impossible that the gNB cancels CSI-RS resource(s) for eType-II CJT CSI corresponding to ‘out-of-range’ TRP(s) when jointly triggering, so at least an additional UE ehaviour is needed. In our view, it is reasonable that the UE does not perform DO compensation.  **Proposal 3.C:** Support. Even if the separate triggering is configured, and even if CSI resource(s) correspond to ‘out-of-range’ TRP, the same number of TRPs for CJTC and eType-II CJT CSI should be configured in RRC level. Furthermore, no DO compensation should be applied to such CSI resource(s).  **Proposal 3.D.1:** We change our view, and don’t support the proposal. For DO, each TRP cannot physically compensate for the reported DO due to CLI, and the UE or TRP may digitally compensate for it. However, for FO, each TRP can physically compensate for the reported FO, and the pre-compensation for FO is not needed.  **Proposal 3.E.2:** Support.  **Proposal 3.F:** Support. |
| Fujitsu | **Proposal 3.B.3**: In our understanding, although one joint triggering on the same PUSCH, these two CSI reports are still transmitted independently. So we have confusion on the motivation for this proposal. If this proposal just clarifies their respective UCI mapping order without any other new priority across these two CSI reports, we agree with OPPO’s view that we can follow the current agreements without any enhancement. If this proposal wants to introduce a new rule that Rel-19 CJTC should be reported before Rel-18 Type II CJT, we think it can be up to NW implement. NW just needs to configure Rel-19 CJTC *reportConfigID <* Rel-18 Type II CJT *reportConfigID* based on priority in section 5.2.5 in spec 214. Thus, we fail to see the necessity for this proposal. |
| Intel | **Proposal 3.A.1:** Support, we don’t see the use-case for per-resource indicator  **Proposal 3.A.2:** Ok, we expect usually NR = 1 anyways  **Proposal 3.B.1:** Ok  **Question 3.C:** We agree that the natural assumption is that it’s always the same, the need to have additional mapping needs to be justified.  **Proposal 3.D.1**: we also think this to be handled by NW side link-adaptation/compensation  **Proposal 3.E.1**: This seems unnecessary given the UE burden is trivial to maintain DO  **Proposal 3.E.2**: We can be okay with this if everyone is okay. Our proposal is that UE does not do any pre-compensation is any of the Dos is ‘out of range’  **Proposal 3.F**: We prefer to have legacy behavior with X={1,2}  **Proposal 3.G.1:** Not needed  **Proposal 3.G.2:** Not needed |
| Rakuten | **Proposal 3.B.2:** We do not see the proposal is necessary. In particular, we support that the UE does pre-compensation and report JTC CSI to the NW for any cases. It is implementation specific in dealing with reported CSI while we do not think UE needs to calculate CSI differently for with or without reporting when d\_n is ‘outside’.  **Proposal 3.C:** We support the UE assumes “the number of CSI-RS resources associated with the Rel-18 eType-II CJT CSI is always the same as the number of TRS resource sets associated with the Rel-19 CJTC Dd report” for separate trigger.  **Proposal 3.D.1:** We support configuring a UE to pre-compensate frequency offsets in calculation PMI. It will help the network sharing CSI-RS to different UE in moving with different speeds.  **Proposal 3.E.2:** Not support. For separate trigger, the UE should compensate the PMI for all the TRPs even the DO is ‘out of range’. The true DO may just ‘out of range’ and the NW still can see the usefulness of the pre-compensated PMI if the NW decides to use the ‘out of range’ TRP(s) for CJT.  **Proposal 3.G.1:** Not support. The reasons is two different scopes should not be combined in a single report. Dd tends to be UE specific while PO is used for DL/UL phase calibration, which can be common for all the Ues with CJT support.  **Proposal 3.G.2:** Not support. The proposal makes the specification look unnecessarily complicated while the benefits are not clear. |
| Sony | **Proposal 3.A.1:** Support.  **Proposal 3.A.2:** Support.  **Proposal 3.B.1:** Support.  **Proposal 3.B.2:** We support this proposal. In our understanding, TRP selection is an optional feature, and thus, when processing a Rel-18 eType-II CJT CSI report, the UE might need to include TRP(s) reported as ‘out of range’ or whose 1-bit inside/outside indicator dn is reported as ‘outside’ in the linked and jointly triggered CJTC Dd report. The standard should specify that the UE applies no DO compensation in this case. Also, it should be clarified whether DO compensation is not applied to any TRP to just the ‘out-of-range’ and/or ‘outside’ TRP(s).  **Proposal 3.C:** We support the conclusion. The number of TRS sets and CMR can be kept the same.  **Proposal 3.D.1**: We support further discussion.  **Proposal 3.D.1**: Support in principle.  **Proposal 3.E.2**: Support for reasons similar to Proposal 3.B.2. It should be clarified whether DO compensation is not applied to any TRP to just the ‘out-of-range’ and/or ‘outside’ TRP(s).  **Proposal 3.G.1**: Support.  **Proposal 3.G.2:** We are okay with this proposal. The network can use the RSRP values to assess the quality of the main reported quantity. For example, two Ues can report Fos, and the network can use the associated RSRP values to merge the reported Fos for frequency compensation of the TRPs. |
| Ericsson | **Proposal 3.E.1**  Do not support this proposal. Our reasoning is the same as last meeting that such a capability may neither benefit the network nor the UE.  **Proposal 3.E.2**  Support. Not sure how a UE perform can perform DO pre-compensation, when the DO value is out of range?  **Proposal 3.F**  Not support. For ‘cjtc-P’ report, a single port CSI-RS is sufficient. So, we don’t see the need for the network to split the resources among more than 1 slot. |
| Apple | **Proposal 3.A.1**: We are okay with the proposal  **Proposal 3.A.2**: We are okay with the proposal  **Proposal 3.B.1**: We are okay with the proposal  **Proposal 3.B.2**: We are fine.  **Conclusion 3.C:** We think the right way should be “UE expects that the number of …” instead of “UE can assume that the number of …”  **Proposal 3.D.1**: We prefer not to have more pre-compensated CJT eport  **Proposal 3.E.1**: We are fine  **Proposal 3.E.2**: We are fine  **Proposal 3.F:** We support the proposal  **Proposal 3.G.1:** We are fine  **Proposal 3.G.2:** We slightly prefer not to introduce this |
| Mod V52 | **Minor revision on conclusion 3.C per Haitong’s /Apple input** |
| Huawei, HiSilicon | **Proposal 3.B.2:** The proposal seems not necessary, if a TRP is reported as ‘out of range’ or ‘outside’, it means the TRP would have a very low SINR or too large delay, and this TRP will not be used as a cooperative TRP for PDSCH transmission. So how UE process the CSI is not important.  **Proposal 3.B.3:** in our understanding, the legacy UCI multiplexing procedure can be reused.  **Conclusion 3.C:** fine with the conclusion. |
| Xiaomi | **Proposal 3.B.3**  Support. It is better to clarify. |
| Mod V55 | **No revision** |
| KDDI | **Proposal 3.B.2:** We think that this proposal is not necessary. If some of TRPs are reported as ‘out of range’ or ‘outside’ by joint triggering, the first thing the gNB does is to exclude those TRPs from the cooperated TRPs. Therefore, how the Rel-18 eType-II CJT CSI reports triggered together are calculated at the UE side is not considered very important.  **Conclusion 3.C:** We are fine with this conclusion.  **Proposal 3.D.1:** This proposal is not needed. The UEs that perform CJT are considered to be static or low-speed Ues. Therefore, it is considered to be a typical case that some of those Ues represent and report Fos and the gNB physically compensates the Fos. That’s why this proposal is unnecessary.  **Proposal 3.E.2:** We support this proposal. The fact that Rel-18 eType-II CJT CSI is triggered even though the UE reported ‘out of range’ as a CJTC Dd report means that the gNB has determined that Rel-18 eType-II CJT CSI is still needed by the gNB. Therefore, the ambiguity in the calculation of Rel-18 eType-II CJT CSI in this case should be eliminated by this proposal.  **Proposal 3.F:** We support this proposal. |
| TCL | **Proposal 3.B.2**:  Not support, we think that the TRP is reported as ‘out of range’ or ‘outside’ would not participate in CJT transmission.  **Proposal 3.B.3:**  We are OK for this proposal.  **Proposal 3.D.1**  Not support.  **Proposal 3.E.1**  Support  **Proposal 3.E.2**  Not support.  **Proposal 3.F**  Not support, we prefer X=1. |
| New H3C | **Proposal 3.A.1:** OK  **Proposal 3.A.2:** Ok  **Proposal 3.B.1:** Ok  **Proposal 3.D.1**: Not support  **Proposal 3.E.1**: OK  **Proposal 3.E.2**: OK  **Proposal 3.G.1:** Not support  **Proposal 3.G.2:** Not support |
| Mod V60 | **No revision** |

# References

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| --- | --- | --- | --- |
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| 2 | R1-2409587 | Moderator Summary for OFFLINE discussion on Rel-19 CSI enhancements | Moderator (Samsung) |
| 3 | R1-2409371 | CSI enhancements | MediaTek Inc. |
| 4 | R1-2409378 | Discussion on CSI enhancements | ZTE Corporation, Sanechips |
| 5 | R1-2409428 | On 128 CSI-RS ports and UE reporting enhancement | Huawei, HiSilicon |
| 6 | R1-2409432 | CSI enhancements for Rel. 19 MIMO | Fraunhofer IIS, Fraunhofer HHI |
| 7 | R1-2409460 | Further Details on Rel-19 Enhancements of CSI | InterDigital, Inc. |
| 8 | R1-2409505 | Discussion on CSI enhancements | CMCC |
| 9 | [R1-2409589](https://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_119/Docs/R1-2409589.zip) | Views on Rel-19 CSI enhancements | Samsung |
| 10 | R1-2409630 | Discussion on CSI enhancements | Spreadtrum, UNISOC |
| 11 | R1-2409674 | Remaining issues on Rel-19 CSI enhancements | vivo |
| 12 | R1-2409747 | CSI enhancements for MIMO | Intel Corporation |
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| 14 | R1-2409793 | Views on R19 MIMO CSI enhancement | Apple |
| 15 | R1-2409851 | Discussion on CSI enhancements | NEC |
| 16 | R1-2409889 | Further discussion on Rel-19 MIMO CSI enhancements | Xiaomi |
| 17 | R1-2410657 | Views on NR MIMO CSI enhancements Phase 5 | CATT |
| 18 | R1-2409970 | Discussion on CSI enhancements | Lenovo |
| 19 | R1-2410040 | CSI enhancements | TCL |
| 20 | R1-2410054 | Discussion on Rel-19 CSI enhancements | Fujitsu |
| 21 | R1-2410109 | CSI enhancements for Rel-19 MIMO | OPPO |
| 22 | R1-2410154 | CSI Enhancement for NR MIMO | Google |
| 23 | R1-2410176 | Discussion on CSI enhancements | HONOR |
| 24 | R1-2410220 | Further views on CSI enhancements | Sony |
| 25 | R1-2410303 | Discussion on Open Issues of CSI Enhancement | Rakuten Mobile, Inc |
| 26 | R1-2410667 | CSI enhancement for NR MIMO Phase 5 | Nokia |
| 27 | R1-2410353 | Remaining issues on CSI enhancements for large antenna arrays and CJT | Ericsson |
| 28 | R1-2410382 | Discussion on CSI enhancements | NTT DOCOMO, INC., NTT CORPORATION |
| 29 | R1-2410436 | CSI enhancements | Sharp |
| 30 | R1-2410472 | CSI enhancements for >32 ports and UE-assisted CJT | Qualcomm Incorporated |
| 31 | R1-2410549 | Discussion on CSI enhancements for NR MIMO Phase 5 | KDDI Corporation |
| 32 | R1-2410586 | Discussion on CSI enhancements | NICT |
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