**3GPP TSG RAN WG1 #119 R1-2410751**

**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
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## Summary of companies’ proposals and views

|  |  |  |
| --- | --- | --- |
| 2.3 | **Proposal 2.C**: For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports, regarding wideband P/SP-CSI reported using one-part CSI, 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: Here k, j=1, 2, …, KSNote: How this is captured in the spec (including exact formulation) is up to the editor(s).**FL assessment**: OFFLINE-1 agreement.The proposal is needed analogous to CSI part 1. From 1st online session, some comments on the applicability for one-part PUSCH were made and need resolution. The proposal is now further clarified that it is intended for P/SP-CSI (where MR is not applicable).  | **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, Nokia/NSB (ok), Lenovo/MotM (ok), vivo (ok)**Not support**:  |
| 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**: OFFLINE-1 agreement. 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, Lenovo/MotM (ok), OPPO (ok), Google (ok), Xiaomi (ok),**Not support**: [Fujitsu, Spreadtrum, New H3C]  |
| 1.5.2 | **[119] Agreement**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]
* FFS: Whether the largest UCI payload includes the CQI associated with the 2nd CW when RI>4

**Proposal 1.E.2**: 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 that include Part 2 CSI reports 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-A, the RI value is:
	+ 8 when the RI value(s) allowed by the configured RI restriction per CSI reporting configuration include 5, 6, 7, and/or 8,
	+ 1 otherwise
* For Scheme-B, the RI value is 4

**FL assessment**: OFFLINE-1 agreementThe three bullets need some resolution**Question 1.E.2**: 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, please share your view, if any, on the 3 yellow highlighted bullets* None needed: Google, Lenovo/MotM, Spreadtrum, Xiaomi, Huawei/HiSi,
* Use 1st bullet for both Scheme-A and B: Samsung, Lenovo/MotM (2nd), OPPO, Apple,
* Support the 1st 2 FFSs: NTT DOCOMO, NTT CORP, vivo
* Scheme-A rank-1, Scheme-B rank-4: Nokia/NSB, Apple, Samsung,
* 3rd FFS yes: ZTE, vivo,
* 3rd FFS no: NTT DOCOMO, NTT CORP, Nokia/NSB,
* Add “The RI value allowed by the configured RI restriction per CSI reporting configuration”: ZTE
 | **Support/fine:** Nokia/NSB, Ericsson, Samsung, Apple, Qualcomm, ZTE, Huawei/HiSi, **Not support:** |
| 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 report is multiplexed in CSI Part 1 * 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

Note: The above proposal reuses the legacy UCI design principles, where 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**FL assessment**: OFFLINE-2 agreement. This proposal is needed since joint triggering introduces a new PUSCH reporting format within 1 slot. | **Support/fine**: CMCC, Samsung (ok), Qualcomm, NTT DOCOMO (ok), NTT CORP, Xiaomi, TCL, Nokia/NSB (ok), Huawei/HiSi (ok), Ericsson, OPPO, ZTE**Not support**: [Fujitsu] |
| 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 UE assumes that the NTRP CSI-RS resources are transmitted without DL/UL switching in between the NTRP resources**FL assessment**: OFFLINE-2 agreement. This is analogous to legacy CMR behaviours for Rel-17 NCJT and Rel-18 Type-II CJT. **[From JD] This proposal may be helpful to identify NTRP CSI-RS occasions linked to a latest SRS occasion for reference antenna port determination.** | **Support/fine**: Qualcomm, OPPO, NTT DOCOMO, NTT CORP, Nokia/NSB, Apple, Huawei/HiSi, Google, MediaTek, Xiaomi, Sharp, KDDI, TCL, Samsung, Ericsson, ZTE, CATT, vivo, Intel (ok)**Not support**: [Fujitsu],  |
| 1.1.3 | **[119] Agreement**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 )
* ...

**Proposal 1.A.3:** 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),* Note: In this case, the min(si,1) operation is not needed

**FL assessment**: OFFLINE-2 agreementIf no consensus is reached on something else different from ρ=1 (baseline), ρ=1 is the natural outcome. In this case min(.) operation is not needed. **Question 1.A.3:** 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), please share your view, if any, on the following issues:* Whether other than 1 (baseline) is needed (e.g. or )
	+ 1 when b0=b1, else : Qualcomm, Xiaomi, NTT DOCOMO, NTT CORP,
	+ : Huawei/HiSi
	+ No ( only): Ericsson, Intel, Rakuten, Samsung, vivo, NTT DOCOMO, NTT CORP, Lenovo/MotM, ZTE, Fujitsu, OPPO, Nokia/NSB, MediaTek,
* Whether min( , 1) operation is needed
	+ Yes: NTT DOCOMO, NTT CORP,
	+ No: Samsung, NTT DOCOMO, NTT CORP, Lenovo/MotM, ZTE, Fujitsu, OPPO, Nokia/NSB, MediaTek,
 | **Support/fine:** Ericsson, Intel, Rakuten, Samsung, vivo, NTT DOCOMO, NTT CORP, Lenovo/MotM, ZTE, Fujitsu, OPPO, Nokia/NSB, MediaTek, Spreadtrum, Apple (ok), Huawei/HiSi (ok), Tejas, **Not support:**  |
| 1.1.2 | **[119] Agreement**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):* …
* 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)

**Proposal 1.A.2:** 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 for the 3-bit scaling factor(s), the configuration of the value (3-bit indicator per SD basis vector group) is RI-common (a same configuration is used for RI=1 and RI=2)**FL assessment**: Discussed during OFFLINE-1 and almost agreed (except vivo) While it can be argued that RI-specific is a better choice, the only two simulation results available in this meeting (from Ericsson and Nokia) suggest that RI-common setting performs well enough. It can be argued that RI-common is the baseline due to, e.g. its lower RRC overhead.  | **Support/fine:** ZTE, Huawei/HiSi, Samsung, Ericsson, Apple, Xiaomi, Qualcomm, NTT DOCOMO, NTT CORP, Intel, MediaTek, Tejas, Sharp, Nokia/NSB, Fraunhofer IIS/HHI, IDC, KDDI, Rakuten, CATT, Lenovo/MotM (ok), Fujitsu, OPPO (ok), Spreadtrum, NEC (ok), **Not support (RI-specific): [**Google,vivo, New H3C, CMCC] |
| 2.9 | **Conclusion 2.I**: For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports with the Rel-15 Type-I SP codebook, joint operation with the Rel-18 NES framework is not supported.**FL assessment**: The proposal attempts to avoid ambiguity since Rel-18 SD NES supports Rel-15 Type-I codebook**Support joint operation:** Google, NTT DOCOMO, NTT CORP,**No support for joint operation**: Lenovo/MotM, Samsung (no bullet), Spreadtrum, CATT, ZTE, Fujitsu, OPPO, Nokia/NSB, Huawei/HiSi (open), Apple, vivo, Xiaomi, Samsung, Tejas,  |
| 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] as well as OFFLINE-2. We have tried the possibilities of extending only Scheme-A, but the number of companies raising concerns is very large. The same goes with only Scheme-B. FFS:* Yes: Nokia/NSB,
* No: NTT DOCOMO, NTT CORP, ZTE, Tejas,
 | **Support/fine:** 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,**Strong concern:** vivo, CATT, OPPO |

***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

|  |  |  |
| --- | --- | --- |
| **#** | **Issue/proposal** | **Companies’ views** |
| **New issues**  |
| 1.1.2 | **[119] Agreement**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):* …
* 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)

**Proposal 1.A.2:** 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 for the 3-bit scaling factor(s), the configuration of the value (3-bit indicator per SD basis vector group) is RI-common (a same configuration is used for RI=1 and RI=2)**FL assessment**: Discussed during OFFLINE-1 and almost agreed (except vivo) While it can be argued that RI-specific is a better choice, the only two simulation results available in this meeting (from Ericsson and Nokia) suggest that RI-common setting performs well enough. It can be argued that RI-common is the baseline due to, e.g. its lower RRC overhead. * We can also check if RI-specific is acceptable to the supporters of RI-common
 | **Support/fine:** ZTE, Huawei/HiSi, Samsung, Ericsson, Apple, Xiaomi, Qualcomm, NTT DOCOMO, NTT CORP, Intel, MediaTek, Tejas, Sharp, Nokia/NSB, Fraunhofer IIS/HHI, IDC, KDDI, Rakuten, CATT, Lenovo/MotM (ok), Fujitsu, OPPO (ok), Spreadtrum, NEC (ok), **Not support (RI-specific):** Google,[vivo, New H3C, CMCC] |
| 1.1.3 | **[119] Agreement**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 )
* ...

**Proposal 1.A.3:** 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),* Note: In this case, the min(si,1) operation is not needed

**FL assessment**: OFFLINE-2 agreementIf no consensus is reached on something else different from ρ=1 (baseline), ρ=1 is the natural outcome. In this case min(.) operation is not needed. **Question 1.A.3:** 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), please share your view, if any, on the following issues:* Whether other than 1 (baseline) is needed (e.g. or )
	+ 1 when b0=b1, else : Qualcomm, Xiaomi, NTT DOCOMO, NTT CORP,
	+ : Huawei/HiSi
	+ No ( only): Ericsson, Intel, Rakuten, Samsung, vivo, NTT DOCOMO, NTT CORP, Lenovo/MotM, ZTE, Fujitsu, OPPO, Nokia/NSB, MediaTek,
* Whether min( , 1) operation is needed
	+ Yes: NTT DOCOMO, NTT CORP,
	+ No: Samsung, NTT DOCOMO, NTT CORP, Lenovo/MotM, ZTE, Fujitsu, OPPO, Nokia/NSB, MediaTek,
 | **Support/fine:** Ericsson, Intel, Rakuten, Samsung, vivo, NTT DOCOMO, NTT CORP, Lenovo/MotM, ZTE, Fujitsu, OPPO, Nokia/NSB, MediaTek, Spreadtrum, Apple (ok), Huawei/HiSi (ok), Tejas, **Not support:**  |
| 1.5.2 | **[119] Agreement**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]
* FFS: Whether the largest UCI payload includes the CQI associated with the 2nd CW when RI>4

**Proposal 1.E.2**: 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 that include Part 2 CSI reports 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-A, the RI value is:
	+ 8 when the RI value(s) allowed by the configured RI restriction per CSI reporting configuration include 5, 6, 7, and/or 8,
	+ 1 otherwise
* For Scheme-B, the RI value is 4

**FL assessment**: OFFLINE-1 agreementThe three bullets need some resolution**Question 1.E.2**: 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, please share your view, if any, on the 3 yellow highlighted bullets* None needed: Google, Lenovo/MotM, Spreadtrum, Xiaomi, Huawei/HiSi,
* Use 1st bullet for both Scheme-A and B: Samsung, Lenovo/MotM (2nd), OPPO, Apple,
* Support the 1st 2 FFSs: NTT DOCOMO, NTT CORP, vivo
* Scheme-A rank-1, Scheme-B rank-4: Nokia/NSB, Apple, Samsung,
* 3rd FFS yes: ZTE, vivo,
* 3rd FFS no: NTT DOCOMO, NTT CORP, Nokia/NSB,
* Add “The RI value allowed by the configured RI restriction per CSI reporting configuration”: ZTE
 | **Support/fine:** Nokia/NSB, Ericsson, Samsung, Apple, Qualcomm, ZTE, Huawei/HiSi, **Not support:** |
| 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] as well as OFFLINE-2. We have tried the possibilities of extending only Scheme-A, but the number of companies raising concerns is very large. The same goes with only Scheme-B. FFS:* Yes: Nokia/NSB,
* No: NTT DOCOMO, NTT CORP, ZTE, Tejas,
 | **Support/fine:** 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,**Strong concern:** vivo, CATT, OPPO |
| **From previous round(s)** |
| 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, |
|  |  |
|  |  |  |

Table 1B SLS results: issue 1

|  |  |
| --- | --- |
| **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. |
|  |  |  |  |

Table 1C Additional inputs: issue 1

|  |  |
| --- | --- |
| **Company** | **Input** |
| Mod V0 | **Please share your inputs on each of the issues and, if applicable, proposals in TABLE 1A** |
| Google | 1.A.2: We support RI specific configuration. Q1.A.3: We think this depends on whether it is configured in RI specific or RI common manner. Q1.E.2: We think the main-bullet only should be sufficient |
| Samsung | **Proposal 1.A.2**Support. After further checking with other companies SLS results, it seems RI-common works well sufficiently, and don’t need to overoptimize. **Question 1.A.3.**No.**Question 1.E.2**We prefer a unified solution for both scheme-A and scheme-B, given that we agreed to use the RI value that results in the largest UCI payload. Considering Rank 5-8 is not a common scenario (there is no handset UE using more than 4RX in FR1), we prefer to consider the overhead for the cases of RI=1-4. And in this case, we don’t have to consider FFS.So, we suggest as follow for the yellow part: * For both Scheme-A/B, the RI value that results in the largest UCI payload is determined as min(4, maximum configured rank per CSI reporting configuration)
 |
| Mod V4 | **No revision** |
| CATT | **Proposal 1.A.2:** OK**Proposal 1.D**:The CA scenario mentioned by Qualcomm where one or two cells can have PUCCH for all CC’s CSI reports is indeed a valid case. However, consider the fact that CSI reporting is not super urgent, multiple trigger states where each one is associated with limited number of CC’s CSI reports can be configured. Therefore, the concern for too large overhead after zero padding for all CC’s CSI reports can be relieved. |
| NTT DOCOMO | **Proposal 1.A.2 and Question 1.A.3**No strong view. But we list our preferences in the following order.1. RI-common, 1 when b0=b1, else , Yes for min( , 1) operation2. RI-common, No (ρ=1 only), No min( , 1) operation3. RI-specific, No (ρ=1 only), No min( , 1) operation**Question 1.E.2**We support the first two FFS. Regarding the third FFS, we think it only impacts the first FFS for Scheme-B. Considering the payload difference between RI=4 and RI=8 is significantly large for Scheme-B (e.g., 4 \* the number of subbands for co-phasing payload difference), even after considering CQI payload of 2nd CW, it will not change the payload size relations in most cases. Thus, this FFS does not need to be considered.**Proposal 1.B**:Do not support the FFS.The extended orthogonal set is not even supported for RI<=4 for new large port number. We donot think we need to discuss it for legacy port number. |
| Lenovo/ MotM | **Proposal 1.A.2:**We are fine. **Question 1.A.3:**Looks from Ericsson and Nokia’s results that Alt-A suffices, i.e., *ρ*=1**Question 1.E.2:**First preference: remove all highlighted bullersSecond preference: wording update provided by Samsung |
| ZTE | **Proposal 1.A.2:**Support RI-common configuration of *si*.**Question 1.A.3:**For the sake of simplicity, we prefer without min(\*) operation.**Question 1.E.2:**For scheme-B, we agree that the RI value corresponding to the maximum payload size is min(4, maximum allowed rank configured by RI-restriction per CSI reporting configuration).For scheme-A, the RI value corresponding to the maximum payload size may NOT be the maximum allowed rank configured by RI-restriction per CSI reporting configuration. For instance, when the report granularity is subband, RI = 1 corresponds to the maximum payload size among RI = 1~4.At current stage, we think the main sentence is sufficient as a general description, and the first two sub-bullets can be further discussed in the TP phase. Moreover, we suggest the following wording modification to make the main sentence clearer:

|  |
| --- |
| 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 allowed/unrestricted RI value (configured by RI-restriction per CSI reporting configuration) that results in the largest UCI payload. |

For the FFS, we think the largest UCI payload should include the CQI associated with the 2nd CW when RI>4. |
| Fujitsu | **Proposal 1.A.2:** Support**Proposal 1.A.3:** We thinkρ=1 only is sufficient. |
| OPPO | **Proposal 1.A.2/3:**We could follow the majority.**Question 1.E.2:**We also prefer a unified solution for both scheme-A and scheme-B, e.g. the first sub-bullet.  |
| Nokia | **Question 1.A.3**Based on our simulation results above-the-horizon power restriction can be achieved with good performance with and without the min operation, so our preference is for a simple solution:* no min operation

**Question 1.E.2**Our preference is to follow the legacy assumption, i.e. without considering the CQI of the second codeword, which means the largest payload for Scheme-A is rank 1 and for Scheme-B is rank 4.Second preference is to assume the RI value that results in the largest UCI payload amongst the configured ranks per CSI reporting configuration.Both the first and the second bullet seem to have issuesfor the first bullet, if rank is restricted to 1 and 2, the assumption will min min(4,2)=2 which is not the highest payload for Scheme-A or B. Also, the first and second bullet do not work for Scheme-A because the max payload for ranks 1 to 4 is with rank 1. |
| MediaTek | **Question 1.A.3:**Support without any min () operation.**Question 1.E.2**The first two bullets seem needed for Scheme A and BThe FFS may not be needed since reporting RI > 4 on PUCCH is not a common scenario in our opinion.**Proposal 1.B**Do not support the FFS for extended orthogonal set for Scheme A, RI = 2-4. Similar as mentioned by Docomo, this is an entirely new codebook different from Rel-15 and Rel-19 and is not in line with the motivation of this proposal. |
| Spreadtrum | **Proposal 1.A.2:** Based on the discussion and FL’s assessment, we can support the proposal.**Question 1.E.2**: We have similar view as Google, the agreed main bullet is sufficient. Based on previous discussion, the 1st and 2nd bullets are natural outcome and should be mark as ‘note’. Besides, the main bullet can also be considered as a unified solution for both Scheme-A/B. |
| Apple | **Proposal 1.A.2:** we are okay with the proposal **Question 1.A.3:** we are fine with any solution. However, we do think the following is the best solution is the goal is to restrict the energy on a particular spatial basis Our understanding is that we have the following notation * The configured PDSCH EPRE for CSI calculation is denoted as which is configured by *powerControlOffset* in *NZP-CSI-RS-Resource*
* The intention for NW to configure scaling factor is that the total energy on layer does not exceed
* For the actual scaling applied, i.e., , the actual energy on layer is

With the above analysis, . However, we should also avoid scaling up the energy, therefore, we should have .**Question 1.E.2**: We do not have strong preference. For scheme-A, we believe legacy uses rank 1 which can be reused. For scheme-B, we are fine with the proposed first bullet.  |
| Mod V15 | **Added proposal 1.A.3 per inputs** |
| Vivo | **Question 1.A.3:**We think only rho=1 is needed, and no min(.) operation is needed. For either rank 1 or rank 2, the UE behavior is simple, i.e., using the s\_i configured by NW.**Question 1.E.2**We are okay to discuss Scheme B and Scheme A separately as the rank which achieves maximum payload is different for Scheme A and Scheme B. Hence these two sub-bullets are fine to us.For the last FFS question, we think it is reasonable to consider CQI in UCI given the spirit is to make sure the final UCI payload can be carried as much as possible. |
| Xiaomi | **Question 1.E.2**:We think the three sub-bullets are not needed, since the main bullet have provided the unified solution. |
| NEC | **Proposal 1.A.2:** Even we prefer RI specific configuration, regarding the situation, we are fine to follow the majority view. [Mod: Thanks Yukai] |
| Mod V20 | **No revision** |
| Mod V23 | **Added Offline-1 outcome** |
| ZTE | **Proposal 1.E.2:**After some further check with previous agreements and table 6.3.1.1.2-1 of TS 38.212 (it is better if other companies can double check), for scheme-A:* RI = 1 results in the highest payload size when the report granularity is subband (where the inter-polarization co-phase indicator occupies a lot overhead);
* RI = 8 results in the highest payload size when the report granularity is wideband (where the SD basis indicator occupies a lot overhead).

 So, we suggest the following modification:

|  |
| --- |
| **Proposal 1.E.2**: 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-A, the RI value is 1 for subband report and 8 for wideband report
* For Scheme-B, the RI value is 4
 |

 |
| ZTE | **Proposal 1.E.2:**With some additional further check, to our understanding, this proposal only applies for subband CSI reporting. Then we are ok with the proposal and we suggest the following modifications to make the proposal clearer.

|  |  |
| --- | --- |
| **Proposal 1.E.2**: 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 that include Part 2 CSI reports 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-A, the RI value is ~~[~~1~~]~~
* For Scheme-B, the RI value is 4
 |  |

Please see related contents in TS 38.214 and 38.213 as follows:

|  |
| --- |
| **38.214:**When the PUCCH carry Type I CSI with wideband frequency granularity, the CSI payload carried by the PUCCH format 2 and PUCCH formats 3, or 4 are identical and the same irrespective of RI (if reported), CRI (if reported). For type I CSI sub-band reporting on PUCCH formats 3, or 4, the payload is split into two parts. The first part contains RI (if reported), CRI (if reported), CQI for the first codeword. The second part contains PMI (if reported), LI (if reported) and contains the CQI for the second codeword (if reported) when RI > 4.**38.213:**If a UE would multiplex CSI reports that include Part 2 CSI reports in a PUCCH resource, the UE determines the PUCCH resource and a number of PRBs for the PUCCH resource or a number of Part 2 CSI reports assuming that each of the CSI reports and, if any, each CSI sub-report included in a CSI report, indicates rank 1, or rank combination of {1, 1} if applicable. |

  |
| Huawei, HiSilicon | **Proposal 1.A.3:** Considering the power penalty, the optimal value of rho=1 when two beams are the same, and rho= otherwise. Considering the majority view, we can accept the proposal.**Proposal 1.E.2**: As evaluated in table below, the RI value can be 1 for schemeA RI=1-4. However, for RI=5-8, the UCI overhead is much larger than RI=1-4. Therefore, we prefer RI=7 or 8 for SchemeA RI=5-8.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | RI=1 | RI=2 | RI=3 | RI=4 | RI=5 | RI=6  | RI=7 | RI=8 |
| SchemeA 128port(N1,N2)=(8,8) | 10+2n | 12+n | 12+n | 12+n | 31+n | 31+n | 39+n | 39+n |

 |
| Tejas | **Question 1.A.3:**Our preference is , baseline and hence without the min operation.**Proposal 1.E.2:**We think that the main proposal text is satisfactory. In our view, the main text can be considered as a unified solution for both Scheme-A/B by limiting the RI value to 4 “…..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 and limited to 4”. Align with companies that the FFS for RI > 4 need not be considered.[Mod: This wont work since for Scheme-A the paylaod for RI=1 is larger than RI=4]**Proposal 1.B:**Do not support extended orthogonal set for the 2nd SD basis for Scheme A RI=2-4. |
| Mod V32 | **P1.E.2: Revised for Scheme-A to address inputs from ZTE and Huawei. I hope the compromise proposal for Scheme-A is acceptable for everyone** |
| Mod V33 | **Added Offline-2 outcome** |

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

Table 2A Summary: issue 2

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| --- | --- | --- |
| **#** | **Issue** | **Companies’ views** |
| **New issues**  |
| 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**: OFFLINE-1 agreement. 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, Lenovo/MotM (ok), OPPO (ok), Google (ok), Xiaomi (ok),**Not support**: Fujitsu, Spreadtrum, New H3C,  |
| 2.3 | **Proposal 2.C**: For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports, regarding wideband P/SP-CSI reported using one-part CSI, 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: Here k, j=1, 2, …, KSNote: How this is captured in the spec (including exact formulation) is up to the editor(s).**FL assessment**: OFFLINE-1 agreement.The proposal is needed analogous to CSI part 1. From 1st online session, some comments on the applicability for one-part PUSCH were made and need resolution. The proposal is now further clarified that it is intended for P/SP-CSI (where MR is not applicable).  | **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, Nokia/NSB (ok), Lenovo/MotM (ok), vivo (ok)**Not support**:  |
| 2.8 | **Proposal 2.H**: For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports, support dropping of CSI part-2 (PMI, LI, CQI for 2nd CW) for a CRI corresponding to out-of-range WB CQI reported in the CSI part-1**FL assessment**: The proposal intends to reduce CSI part-2 overhead | **Support/fine**: Intel, Google, NTT DOCOMO, NTT CORP, Fujitsu, Huawei/HiSi (open), Xiaomi (open), **Not support**: Spreadtrum, CATT, Lenovo/MotM, ZTE, OPPO, Apple, vivo, Ericsson,  |
| 2.9 | **Conclusion 2.I**: For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports with the Rel-15 Type-I SP codebook, joint operation with the Rel-18 NES framework is not supported.**FL assessment**: The proposal attempts to avoid ambiguity since Rel-18 SD NES supports Rel-15 Type-I codebook | **Support/fine**: Lenovo/MotM, Samsung (no bullet), Spreadtrum, CATT, ZTE, Fujitsu, OPPO, Nokia/NSB, Huawei/HiSi (open), Apple, vivo, Xiaomi, Samsung, Tejas, **Not support**: Google, NTT DOCOMO, NTT CORP, |
| **From previous round(s)** |
| 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), Xiaomi (Alt3)**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** |
| Mod V1 | **P2.C: revision to clarify that the proposal is intended only for P/SP-CSI**  |
| Google | 2.H: OK2.I: We failed to see the reason to preclude the R18 NES. |
| Samsung | 2.C.Fine with the revised proposal.2.H.We don’t have strong view on this but wondering why we need this dropping rule suddenly for CRI-based CSI. In the legacy, we don’t have such a dropping rule.2.IThe main sentence seems OK but we are not sure what the exact meaning of the first bullet. Need some clarification from the proponent. |
| Mod V4 | **P2.I: put bullet in brackets per Samsung’s input** |
| CATT | **Proposal 2.C**: Ok with the modification.**Proposal 2.H**:We don’t see strong motivation of such enhancement, which does not exist in legacy.**Proposal 2.I**:We are fine with the proposal. A minor comment is that this proposal is more like a conclusion. |
| NTT DOCOMO | **Proposal 2.A**:We support the principle in general. But after further consideration, we think the case is different from Rel-19 Type-I/II codebook refinement. For Rel-19 Type-I/II codebook refinement, the per-resource indication is relative to the legacy resource-set-level slot offset because the K resources are located in 1 or 2 slots. However, for multi-CRI reporting, we think it is possible to configure the Ks resources in larger than 2 slots, e.g., 8 slots location is also possible for Ks=8. In that case, it is not good to use the same design as Rel-19 Type-I/II codebook refinement in our view.Thus, for the main bullet, we think it is also good to study ‘relative to the previous CSI-RS resource’ for the per-resource slot offset. And we suggest the following revisions.**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: each resource-level slot offset is relative to resource-set-level slot offset, or the resource-level slot offset for first resource is relative to resource-set-level slot offset and each resource-level slot offset for rest resources is relative to previous one)
* 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

[Mod: The proposed revision would negate the main point of the proposal to reuse the existing solution for Rel-19 Type-I/II – which also opens up a few other issues.]**Proposal 2.H**:No strong view. OK.**Proposal 2.I**:Not support. Do not understand why this configuration should be prohibited. |
| Lenovo/ MotM | **Proposal 2.A:**OK with the concept, agree with Google to limit supported value to 1 or 2 **Proposal 2.C:**While we acknowledge the issue, we believe many solutions exist, so prefer to move forward with the simplest approach including vivo’s (RI bitwidth set to maX) or just leave it to the editor to decide[Mod: Whether to set it to max bit width or zero pad doesn’t change the functionality, i.e. overhead. But zero padding is what legacy uses, not setting to max bitwitdh]**Proposal 2.H:**Lowest MCS level is QPSK modulation and code rate of 0.076. Following this argument the UE should just then drop the entire CSI report if such extremely low MCS level cannot be achieved. Also, agreeing on this procedure will open the door for a train of CRs for prior releases to include similar amendments for legacy Type-II CBs with large UCI overhead. Prefer to skip**Proposal 2.I:**Support. The CRI-based reporting implies CSI reporting for multiple CRIs for Rel-15 Type-I CB with a similar antenna port layout, which very much resembles SD Type-2 NES. Without this agreement/conclusion, the spec is not clear with regards to support of Rel-15 SP Type-I CB in conjunction with Rel-19 CRI-based reporting. @Google: if we agree to support Rel-18 NES, CPU, ARC and timeline need to be revisited to account for multiple adaptation patterns per each reported/selected CRI. |
| ZTE | **Proposal 2.C:**Support the revised version.**Proposal 2.H:**Do NOT support. This new UCI dropping rule seems an unnecessary optimization. We never have such dropping rule in legacy.**Proposal 2.I:**We are generally fine with the main sentence. However, we did NOT understand how the sub-bullet correlates with the main sentence. |
| Fujitsu | **Proposal 2H:** Fine with the proposal**Proposal 2I:** We are open to discussing the refinement on Rel-18 NES in Rel-19 M-CRI reporting. In addition, for the sub-bullet, we think it’s not needed. Because in legacy, PC offset can be configured per CSI-RS resource without any restriction.  |
| OPPO | **Proposal 2.A:**Fine with the FL’s proposal. The value can be restricted to 1 or 2.**Proposal 2.H**:We don’t think we need a new rule for UCI dropping in this stage.**Proposal 2.I**:Fine with the main bullet only.  |
| Nokia | **Proposal 2.C**In our view in the legacy description and , so we don’t really need this intermediate variable . One simpler description is:* For a k-th CRI from the M reported CRIs, , where:

, where is the set of allowed ranks for any of the resources where is the reported rank for the -th CRI[Mod: N\_RI shouldn’t be a part of B(r) since the size depends on the number of allowed ranks (per rank restriction)]**Proposal 2.I**Support. Bullet is not clear |
| Huawei, HiSilicon | **Proposal 2.A**: Support.**Proposal 2.C/H/I**: Open to further discuss. |
| Spreadtrum | **Proposal 2.H**: Logically, it is also possible to generate out-of-range WB CQI in legacy CSI reporting. But we didn’t drop the CSI based on CQI value. Besides, based on the related contribution, the proponent admitted that this issue is a corner case…Therefore, we think this proposal is over optimization.**Proposal 2.I**: We are fine to support the proposal. |
| Apple | **Proposal 2.A**: We are okay with the proposal **Proposal 2.C**: We are okay with the proposal **Proposal 2.H**: We prefer not to further complicate UCI dropping rule**Proposal 2.I**: We slight prefer not to extend Rel-19 MIMO codebook enhancement to NES further  |
| Mod V15 | **Removed bullet in conclusion 2.I****@DOCOMO, Lenovo, Nokia: please check my responses** |
| vivo | **Proposal 2.H**The benefit is not clear. We did not have such optimization in legacy. We are not sure why we need this for now. It will further complicate things like UCI omission, etc. Hence we don’t support it.**Proposal 2.I:**OK with the main bullet. The sub-bullet seems like an issue which can be separately discussed. Thus we don’t support to have the sub-bullet. |
| Nokia | **Proposal 2.C**Fixing a problem with the notation in our previous comment, thanks to Samsung for pointing that outIn our view in the legacy description and , so we don’t really need this intermediate variable . One simpler description is:* For a CRI indicating resource of the resources, , where:

, where is the set of allowed ranks for the j-th resource where is the reported rank for the selected -th resource where is the size of the RI field corresponding to the j-th resource[Mod: Thanks Filippo, In my understanding this is mathematically equivalent to the current formulation. To avoid optimizing formulas without changing functionality, I added a Note that the final formulation is up to the editor] |
| Xiaomi | **Proposal 2.H**:We are open to discuss the proposal. If the CRI corresponding to out-of-range WB CQI is one of MR CRIs, how to deal with such case? If it is still not reported, this violates the previous agreements. **Proposal 2.I**:We have agreed that Pcoffset and PcoffsetSS are CSI-RS-resource-specific. The sub-bullet is not needed.**Proposal 2.G**:In our view, the priority of M CRIs based CSI reporting according to the configurated *reportConfigID* is sufficient.  |
| Mod V20 | **P2.C: added note that it’s up to the editor** |
| Samsung | **Conclusion 2.I**Conclusion is fine with usProposal 2.CAdding the note is ok |
| Mod V23 | **Added Offline-1 outcome** |
| Ericsson | **Proposal 2.H:**We do not support such optimization which seems unnecessary. |
| Tejas | **Conclusion 2.I**Okay with the conclusion. |
| Mod V32 | **No revision** |
| Mod V33 | **Added Offline-2 outcome** |

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

Table 3A Summary: issue 3

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| **#** | **Issue** | **Companies’ views** |
| **New issues** |
| 3.2.1 | **[119] 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, 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

**Proposal 3.B.4:** 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, drelax is Z1’ of table 5.4-2 in TS38.214 (corresponding to WB Type I CSI report with at most 4 ports)**FL assessment**: Discussed during OFFLINE-1. The FFS needs to be resolved**Question 3.B.4:** 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, please share your view, if any, on the value of drelax (>0):* Z1’ of table 5.4-2 in TS38.214 (corresponding to WB Type I CSI report with at most 4 ports): MediaTek, Google, Lenovo/MotM, ZTE,
* *Z2/Z2’:* ZTE
* *:* ZTE
* *Z1/Z1’:* ZTE
* UE feature session: Samsung, CATT, OPPO, Spreadtrum, Apple,
 | **Support/fine**: MediaTek, Google, Lenovo/MotM, ZTE, Xiaomi, NEC, OPPO, **Not support (UE feature session, or need more time):** vivo, Samsung, CATT, Spreadtrum, Apple, Ericsson, Huawei/HiSi,  |
| 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’ **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, Google (OOR), Lenovo/MotM, Sony, **Not support**: NTT DOCOMO, NTT CORP, 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 report is multiplexed in CSI Part 1 * 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

Note: The above proposal reuses the legacy UCI design principles, where 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**FL assessment**: OFFLINE-2 agreement. This proposal is needed since joint triggering introduces a new PUSCH reporting format within 1 slot. | **Support/fine**: CMCC, Samsung (ok), Qualcomm, NTT DOCOMO (ok), NTT CORP, Xiaomi, TCL, Nokia/NSB (ok), Huawei/HiSi (ok), Ericsson, OPPO, ZTE**Not support**: Fujitsu |
| 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 UE assumes that the NTRP CSI-RS resources are transmitted without DL/UL switching in between the NTRP resources**FL assessment**: OFFLINE-2 agreement. This is analogous to legacy CMR behaviours for Rel-17 NCJT and Rel-18 Type-II CJT. **[From JD] This proposal may be helpful to identify NTRP CSI-RS occasions linked to a latest SRS occasion for reference antenna port determination.** | **Support/fine**: Qualcomm, OPPO, NTT DOCOMO, NTT CORP, Nokia/NSB, Apple, Huawei/HiSi, Google, MediaTek, Xiaomi, Sharp, KDDI, TCL, Samsung, Ericsson, ZTE, CATT, vivo, Intel (ok)**Not support**: Fujitsu,  |
| **From previous round(s)** |
| 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 reportThe 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,  |
| 3.7.1 | **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)*

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| --- | --- |
| 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,  |
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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 confidencePerformance 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.* |
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Table 3C Additional inputs: issue 3

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| **Company** | **Input** |
| Mod V0 | **Please share your inputs on each of the issues and, if applicable, proposals in TABLE 3A** |
| Google | 3.B.4: Support Z1’3.B.2: Support this for “out of range” |
| Samsung | 3.B.4We prefer to handle this in UE feature session. |
| Mod V4 | **P3.B.2: put small dn in brackets per Google’s input** |
| CATT | **Question 3.B.4:**Fine to handle in UE feature |
| Lenovo/ MotM | **Proposal 3.B.4:**Z1’ suffices**Proposal 3.B.2:**Please update our preference to support. Makes sense given Monday’s agreement |
| ZTE | **Proposal 3.B.4:**At least drelax>0 is needed, because UE needs to firstly process the CJTC Dd report and then process the CJT Type-II report. Regarding the specific value of drelax, we are ok with drelax = Z1’.**Proposal 3.B.2:**Do NOT support. We agree with FL assessment that the need of this proposal is unclear. |
| OPPO | **Question 3.B.4:**Fine to discuss it in UE feature**Proposal 3.B.3**:We still think this can be up to the editor. At least for Rel-18 eType-II CJT CSI, we don’t have any enhancement on UCI in Rel-19. Then what is the spec. impact for this part? |
| MediaTek | **Question 3.B.4**Since the extra time is needed for computation of CSI report rather than CSI-RS occasion, we think Z1’ is sufficient.**Proposal 3.B.2**We are OK with removing dn. When dn is removed, we think 3.B.2 (for joint trigger) and 3.E.2 (for separate trigger) can be unified into a single proposal since they have the same functionality. |
| Spreadtrum | **Question 3.B.4:** Fine to discuss in UE feature session. |
| Apple | **Question 3.B.4:** We prefer to discuss in UE feature session**Proposal 3.B.2**: We are okay with the proposal |
| Mod V15 | **Added proposal 3.B.4.****Removed small dn in 3.B.2** |
| vivo | **Question 3.B.4:**We prefer to discuss this in UE feature session in future meetings after we have more input. |
| Xiaomi | **Question 3.B.4**Fine with Z1’**Proposal 3.E.2**Similar to proposal 3.B.2, in addition to ‘out of range’, [or whose 1-bit inside/outside indicator dn is reported as ‘outside’.] should also be added. |
| NEC | **Question 3.B.4:** Z1’ is sufficient. |
| Mod V20 | **No revision** |
| Sony | **Proposal 3.B.4**: Support.**Proposal 3.B.2**: Support. Okay to remove .**Proposal 3.E.2**: Support. |
| Mod V23 | **Added Offline-1 outcome** |
| Qualcomm | **Proposal 3.F**: During off-offline discussion, some companies mentioned that 2-slot is not needed due to:1. Not difficult to accommodate up-to-4 single-port CSI-RSs into a same slot (Note that for 128-port we can also do that)
2. Regardless how large FO may be, shorter duration is always beneficial to reduce PO mismatch.
	* Assuming a maximum 0.2ppm inter-TRP FO, Tx phases may change much faster than channel variation.
		+ Even with a low band e.g. 30kHz@700MHz, 1 slot (0.5msec) can have a Tx phase variation of 25.2° – not to mention middle-to-high FR1 bands.
		+ 0.2ppm@700MHz is 140Hz (equivalent to Doppler caused by a UE speed of at least 30m/sec=108km/h, assuming UE moves away from TRP1 and towards TRP2).

Therefore, we suggest to remove 2-slot;Besides, for AP-CSI-RSs, although existing agreement already restricts them within a same slot (by a same triggering slot offset), this proposal actually has an additional requirement “without DL/UL switching in between the NTRP resources” – so we feel also beneficial to include AP-CSI-RS

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| **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~~ transmitted within ~~X={1,[2]}~~a same slot~~s~~, without DL/UL switching in between the NTRP resources~~, where X=1 implies that the N~~~~TRP~~ ~~resources are configured within a same slot, and X=2 implies that the N~~~~TRP~~ ~~resources are configured within two adjacent slots~~. |

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| Rakuten | **For both Proposal 3.B.2 and 3.E.2:** We do not support the proposals.For the case of ‘out of range’, between uncompensated CSI and compensated CSI, compensated CSI looks more useful. ‘uncompensated CSI’ is seen as an abrupted change and this information does not give much value to the NW. |
| Mod V26 | **Revised P3.F per JD’s revision** |
| Huawei, HiSilicon | **Proposal 3.B.4:** fine to discuss it in UE feature.**Proposal 3.B.3:** would like to understand the spec impact compared with legacy UCI multiplexing. |
| Ericsson | **Proposal 3.B.3:** We would also like to understand what spec changes would be needed beyond what is supported in legacy UCI multiplexing.**Proposal 3.F**We can understand the intension of the revised proposal. But we wonder if such restrictions need to be captured in the specifications. Can’t this be left to gNB implementation? |
| Mod V32 | **No revision** |
| Mod V33 | **Added Offline-2 outcome** |

# References

|  |  |  |  |
| --- | --- | --- | --- |
| 1 | RP-242394 | Revised WID: NR MIMO Phase 5 | Samsung (Moderator) |
| 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 |
| 13 | R1-2409761 | CSI enhancements  | Tejas Networks Limited |
| 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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