**3GPP TSG RAN WG1 #118bis R1-2408630**

**Hefei, China, October 14th – 18th, 2024**

**Agenda item:** 9.2.2

**Source:** Moderator (Samsung)

**Title:** Moderator Summary#2 on Rel-19 CSI enhancements: Round 2

**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]):

|  |
| --- |
| 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

***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/proposals** |
| 1.1.2 | FFS (by RAN1#118bis): Whether there is impact on mapping between CWs to CSI-RS ports **Question 1.A.2:** For a UE configured with a total of PSRS=6 or 8 ports across ≥1 SRS resources for antenna switching intended for xT6R or xT8R, respectively, when SRS port grouping is configured, please share your view, if any, on the following alternatives:* Alt1. ‘*non-PMI-PortIndication*’ is always configured (hence mapping between CI-RS ports and SRS port groups are not needed)
* Alt2. ‘*non-PMI-PortIndication*’ can be configured. If not configured, use the following pre-defined mapping between CSI-RS ports and the two SRS port groups (where denotes the rank):
	+ CSI-RS port {0, 1, ...,-1} are associated with SRS port group#0, and
	+ CSI-RS port {4, 5, ..., 4+-1} are associated with SRS port group#1.”

Alt1:* Support/fine: OPPO, HONOR, vivo, NTT DOCOMO, Spreadtrum, CMCC
* Not support:

Alt2:* Support/fine: Qualcomm, NTT DOCOMO, LG
* Not support:

**FL assessment**: This issue needs to be discussed and resolved. Alt1 requires less spec impact and can be regarded as the baseline. For example, the following is vivo’s explanation: “*gNB can simply configure a proper non-PMI-PortIndication to address this issue.Specifically, gNB can simply divide all the 8 CSI-RS ports to two non-overlap groups, and configures the CSI-RS ports for each CW from each of the two non-overlap groups. For example, for the layers associated with the first CW, gNB can configure CSI-RS ports from the first non-overlap group (e.g., 0, 1, 2, 3), and for the layers with the second CW, gNB can configure CSI-RS ports from the second non-overlap group (e.g., 4, 5, 6, 7)*.” |
| 1.2.2 | **Proposal 1.B.2**: For the Rel-19 Type-I SP and Type-II codebook refinements (except based on Rel-18 Type-II Doppler) for 48, 64, and 128 CSI-RS ports, change the *maxNumberTxPortsPerResource* to *maxNumberTxPortsPerReport* for Rel-19 codebook triplet capability * Note: Since ARC=1 was agreed, the K aggregated resources are perceived as 1 resource for ARC, and *maxNumberTxPortsPerResource* cannot be larger than 32.

**FL assessment**: This proposal is technically sound. | **Support/fine:** vivo **Not support:**  |
| 1.2.3 | **[117] Agreement**For the Rel-19 Type-I SP and Type-II codebook refinements (except based on Rel-18 Type-II Doppler) for 48, 64, and 128 CSI-RS ports, regarding CPU occupation* For Capability 1 timeline: OCPU = ceil(P/32)
* For Capability 2 timeline: OCPU = 1

**Question 1.B.3**: For the Rel-19 Type-I SP and Type-II codebook refinements (except based on Rel-18 Type-II Doppler) for 48, 64, and 128 CSI-RS ports, to match Capability 2 timeline, please share your view on the following proposal: “scale the associated CSI reference resource slot location nCSI\_ref by ceil(P/32)”* Yes: vivo
* No:

**FL assessment**: The above issue needs some discussion. For a given issue, if there is no consensus on ‘Yes’, we will assume that the answer is ‘No’ |
| 1.3.2 | **Proposal 1.C.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 associated with RI=*v* {1,2} for the 3-bit scaling factor(s), decide, by RAN1#119, from the following alternatives:* Alt1:
* Alt2:
* Alt3:
* Alt4:
* Alt5:

The same scheme applies to both Mode-A and Mode-B.Note: as agreed in RAN1#117 | **Support/fine:** Ericsson, Qualcomm, Nokia/NSB, Huawei/HiSi, **Not support:**  |
| 1.6.2 | **Question 1.F.2:** For the Rel-19 Type-I SP codebook refinement for P (the total number of aggregated ports)=48, 64, 128 CSI-RS ports, regarding CPU occupation for the port subset indication for the SD NES Type-1, instead of the original version from Samsung shared in Round-1, please check if you are also fine with the revised version from NTT DOCOMO and Qualcomm (which seems closer to legacy)?**Proposal 1.F.2 (original)**: For the Rel-19 Type-I SP codebook refinement for P (the total number of aggregated ports)=48, 64, 128 CSI-RS ports, regarding CPU occupation for the port subset indication for the SD NES Type-1, * For Capability 1 timeline: OCPU = where is the number of CSI-RS ports in i-th sub-configuration derived from the corresponding antenna port subset indicator *portSubsetIndicator*
* For Capability 2 timeline: OCPU =

**Proposal 1.F.2 (revised)**: For the Rel-19 Type-I SP codebook refinement for P (the total number of aggregated ports)=48, 64, 128 CSI-RS ports, regarding CPU occupation for the port subset indication for the SD NES Type-1, * For Capability 1 timeline
	+ for periodic CSI reporting, ~~where is the total number of CSI-RS resources corresponding to the~~ *~~i~~*~~-th sub-configuration,~~ where is the number of CSI-RS ports in *i*-th sub-configuration derived from the corresponding antenna port subset indicator [*port-subsetIndicator*] according to clause 5.2.1.4.2 if configured, otherwise , the number of ports configured by *nrofPorts.*
	+ for aperiodic and semi-persistent CSI reporting, ~~where is the total number of CSI-RS resources corresponding to the~~ *~~i~~*~~-th sub-configuration,~~ where is the number of CSI-RS ports in *i*-th sub-configuration derived from the corresponding antenna port subset indicator [*port-subsetIndicator*] according to clause 5.2.1.4.2 if configured, otherwise , the number of ports configured by *nrofPorts,* and where the *i*-th sub-configuration is from *N* indicated sub-configurations out of *L* sub-configurations contained in a *CSI-ReportConfig*, where and .
* For Capability 2 timeline, Rel-18 OCPU rule for SD NES Type-1 is reused.

**Original version**: * Support/fine: Samsung, Lenovo/MotM, IDC, Google, ZTE (open), Xiaomi, Nokia/NSB, Huawei/HiSi, Fujitsu, HONOR, Sharp, Intel, Apple, TCL, Spreadtrum, CMCC,
* Not support: NTT DOCOMO, Qualcomm,

**Revised version**: * Support/fine: NTT DOCOMO, Qualcomm,
* Not support:
 |
|  |  |  |
| **Issues/proposals from previous round(s)** |
| 1.5 | **Proposal 1.E**: 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 the legacy number of CSI-RS ports (i.e. 4, 8, 12, 16, 24, and 32 ports) for all applicable RI values (1, …, min(PCSI-RS,8)) 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).* [The following of Rel-19 Type-I SP are four separate UE features: (1) Scheme-A >32port; (2) Scheme-B >32port; (3) Scheme-A ≤32port; (4) Scheme-B ≤32 port.]

**FL assessment**: This proposal is sound for the completeness of Rel-19 Type-I SP codebook. Note that this doesn’t impact the legacy Rel-15 Type-I SP design.Re whether this is OOS or not, the WID says “… 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)**, …” which, strictly speaking, doesn’t preclude <=32 ports. So this extension proposal is not OOS. | **Support/fine:** ZTE, Lenovo/MotM, IDC, Samsung (ok), Xiaomi, Nokia/NSB, NEC, Fujitsu, Intel (FFS capability), NTT DOCOMO, CATT (only Scheme-B, no scheme-A), Spreadtrum, CMCC, MediaTek (ok with bullet), **Not support:** Google (OOS),OPPO,Huawei/HiSi, vivo, HONOR, Apple, TCL, Fraunhofer IIS/HHI, Tejas,  |
|  |  |  |

Table 1B SLS results: issue 1

|  |  |
| --- | --- |
| **Company** | **SLS results** |
| **Issue #** | **Metric** | **Observation** |
| ZTE | 1.5 | UPT gain | SLS results of UPT gain for R19 Type-I(Scheme-A) codebook for RI=3-4 compared with R15 legacy: indicating that R19 Type-I(Scheme-A) codebook for rank-3/4 still offers a UPT gain (i.e., ~21.2% for cell-edge UE, ~3.8% for near-field UE, ~8.1% in average) over legacy mechanisms for ≥16 ports when PCSI-RS = 32 |

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*** **Please focus on the new issues/proposals**
* **Please also check if you change your mind on the old proposals (from previous round(s))**
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### 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/proposals** |
| 2.1.1 | **Proposal 2.A.1**: Amend the agreement on Monday online session as follows:**Agreement**: For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports, regarding priority 0 (G0)/wideband in CSI part 2, the UCI packing order is as follows:* The G0 for the 1st configured CMR among the non-reported MR CRIs;
* …
* The G0 for the last configured CMR among the non-reported MR CRIs;
* The G0 for the 1st reported CRI;
* …
* The G0 for the (M- MR)-th reported CRI;

The entire G0 is either reported or dropped entirely, following the legacy principle.**FL assessment**: This amendment is needed to capture the behaviour for wideband part in CSI part 2 |  |
| 2.2.2 | **Proposal 2.A.2**: For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports, regarding periodic wideband CQI/PMI reporting, the UCI packing order is as follows:* The wideband CQI/PMI for the 1st reported CRI;
* …
* The wideband CQI/PMI for the M-th reported CRI;

**FL assessment**: This proposal addresses only P-CSI reporting  | **Support/fine**: Huawei/HiSi, Tejas, ZTE, CATT, HONOR, Lenovo/MotM, IDC, New H3C, Google, Samsung, Qualcomm, NTT DOCOMO, Ericsson, OPPO, Xiaomi, Nokia/NSB, NEC, Fujitsu, HONOR, Sharp, Intel, Apple, Spreadtrum, CMCC, Huawei/HiSi, MediaTek, Tejas, **Not support**: |
| 2.2 | **Proposal 2.B.2**: For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports, support the following additional UE behavior: when X out of KS CSI-RS resources are received after the CSI reference resource, instead of dropping the CSI report, the UE reports the following:* CSI associated with M CRIs if M ≤ KS -X,
* CSI associated with M1 (M1<M and M1≤KS -X) CRIs if M>KS -X

**FL assessment**: This proposal facilitates reporting when only X out of KS resources are received. | **Support/fine:** IDC,**Not support:**  |
|  |  |  |

Table 2B SLS results: issue 2

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| --- | --- |
| **Company** | **SLS results** |
| **Issue #** | **Metric** | **Observation** |
| (no results) | -- | -- | -- |

Table 2C Additional inputs: issue 2

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| --- | --- |
| **Company** | **Input** |
| InterDigital | @Mod. Thanks for your comment. As you correctly, pointed out, our earlier comment had a typo (i.e., M was used instead of Ks in the sentence …”) which caused a confusion. Our understanding of Proposal 2.B is as follows. The UE reports a CSI for M CRIs only after receiving all the Ks CSI-RS resources no later than the CSI-RS reference resource. For example, the UE drops the CSI report when at least one of the Ks CSI-RS resource is received after the reference resource. In our view, this seems a bit restrictive. When X out of Ks CSI-RS resources are received after the CSI reference resource, then instead of dropping the CSI report, the UE can do the following,* Report a CSI for M CRIs if M =< Ks-X
* Report a CSI for M1 (M1<M and M1=<Ks-X) CRIs if M>Ks-X

Reporting a CSI based on a partial number of received CSI-RS resources or a CSI for a partial number of CRIs is more beneficial to the gNB than dropping the CSI report.  |
| Mod V0 | **Please share your inputs on each of the issues and, if applicable, proposals in TABLE 2A*** **Please focus on the new issues/proposals**
* **Please also check if you change your mind on the old proposals (from previous round(s))**
* **Re proposal 2.B.2, please check IDC’s comment above from round-1**
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### 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/proposals** |
| 3.1.4 | **Question 3.A.4**: For the Rel-19 aperiodic standalone CJT calibration reporting, when ReportQuanti-ty is ‘cjtc-P’ (DL/UL phase offset), regarding the selection of PSRS=1 SRS port (corresponding to the ‘reference UE antenna port’) out of the y available SRS ports (from an xTyR SRS resource for antenna switching), *in addition to* the agreed configuration per CSI reporting setting, please share your view, if any, whether an additional configuration per AP-CSI trigger state should be supported or not:* + Yes: ZTE
	+ No:
 |
| 3.1.5 | **Question 3.A.5**: For the Rel-19 aperiodic standalone CJT calibration reporting, when ReportQuantity is ‘cjtc-P’ (DL/UL phase offset), please share your views, if any, on * Whether ‘the earliest SRS transmission occasion after the NTRP CSI-RS occasions’ is also supported as an option of the SRS transmission occasion for the determining the reference UE antenna port
	+ Yes: CATT, Sony,
	+ No:
* Whether determination of SRS transmission occasion is needed for aperiodic associated SRS resource, and if so, how
	+ Yes: Google, ZTE (latest DCI),
	+ No (only 1 occasion, no ambiguity): vivo, TCL, Samsung, NTT DOCOMO,

**FL assessment**: The above two issues need some discussion. For a given issue, if there is no consensus on ‘Yes’, we will assume that the answer is ‘No’ |
| 3.3.8 | **Proposal 3.C.8**: 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 shall assume dynamic TRP selection is not enabled for eType-II CJT CSI reporting**FL assessment**: This proposal needs some discussion. | **Support/fine:** Samsung,**Not support:** |
| 3.3.9 | **Question 3.C.9**: 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, please share your views, if any, on:* Whether an additional UE procedure is needed when the reported DO value is ‘out of range’
	+ Yes: Google, NEC, HONOR,
	+ No: TCL,
* Whether the Dd report codepoints need to be reinterpreted from intervals/ranges to values when the linkage mechanism is configured
	+ Yes: NEC,
	+ No:

**FL assessment**: The above two issues need some discussion. For a given issue, if there is no consensus on ‘Yes’, we will assume that the answer is ‘No’ |
| 3.3.10 | **Question 3.C.10**: 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 views, if any, on how the timeline, CPU occupation, and/or active resource counting of the joint reporting are determined from those agreed for the CJTC Dd and the Rel-18 eType-II CJT CSI. * Alt1. Reuse the timeline, CPU occupation, and active resource counting for the Rel-18 eType-II CJT
* Alt2. Add the timeline, CPU occupation, and active resource counting for the Rel-19 CJTC to the timeline, CPU occupation, and active resource counting for the Rel-18 eType-II CJT, respectively

Alt1:* Support/fine:
* Not support:

Alt2: * Support/fine: ZTE
* Not support:

**FL assessment**: The baseline is to reuse those of the Rel-18 eType-II CJT CSI since this represents the worst of the two and the resulting report is analogous to Rel-18 eType-II CJT (i.e. Alt1).  |
| 3.3.11 | **Proposal 3.C.11**: 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, also support P/SP CSI-RS as the CMR for the Rel-18 eType-II CJT reporting (in addition to the agreed AP CSI-RS).**FL assessment**: The above two issues need some discussion. For a given issue, if there is no consensus on ‘Yes’, we will assume that the answer is ‘No’ | **Support/fine:** Ericsson, ZTE, CATT, Huawei/HiSi, CMCC, ETRI,**Not support (concern):** Apple, Samsung, Qualcomm, MediaTek, Fujitsu, IDC, TCL |
| 3.3.12 | **Question 3.C.12**: 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, please share your view, if any, on the following FFS: “Details on signalling design for the indicator including whether it is per CSI-RS resource/Dd value and the associated UE behaviour(s)”* Alt1. The indicator indicates whether the linked Dd report is successfully decoded or not (i.e. ACK/NACK)
* Alt2. The indicator indicates whether the Rel-18 eType-II CJT CSI is calculated assuming the latest linked CJTC Dd report
* …

**FL assessment**: This issue pertains to the interpretation of the indicator. Note that Alt1 and Alt2 do not exclude each other. The following issues will be discussed in later rounds: 1) detailed hypotheses for the second trigger, 2) whether to include the indicator as a part of trigger state, or elsewhere (without introducing a new DCI field), 3) whether it is per CSI-RS resource or for all resources (TRPs) |
| 3.3.13 | **Proposal 3.C.13**: 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, the *codebookMode* is assumed as ‘mode1’ if pre-compensation with CJTC Dd is not indicated, and the *codebookMode* is assumed as ‘mode2’ if pre-compensation with CJTC Dd is indicated.**FL assessment**: This proposal needs some discussion. | **Support/fine:** NEC,**Not support:** |
| 3.3.14 | **Proposal 3.C.14**: 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.**FL assessment**: This proposal needs some discussion. | **Support/fine:** HONOR,**Not support:** |
| 3.5 | **Proposal 3.E.2:** For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, when *ReportQuantity* is *‘cjtc-P’* (PO), an RRC configuration for disabling nref reporting should be supported.**FL assessment**: This issue needs some discussion. | **Support/fine:** Google, **Not support:** |
|  |  |  |
| **Issues/proposals from previous round(s)** |
| 3.3.5 | **[118] Agreement**For the Rel-19 aperiodic standalone CJT calibration (CJTC) reporting, to facilitate UE-specific delay 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 delay offset (when ReportQuantity is ‘cjtc-Dd’). * The two separately configured reports (i.e. Rel-18 eType-II CJT CSI report and the CJTC delay offset report) can be separately or jointly triggered [and carried on a same PUSCH (hence on a same slot)] following legacy joint triggering mechanism
	+ (Working Assumption) When separately triggered, the delay offset value to be compensated is the latest reported delay offset (DO) whose reporting instance’s last symbol is before the first symbol of DCI triggering of the CJT CSI reporting
		- FFS: whether some expiration time interval is needed

**Proposal 3.C.5**: 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 an expiration timer for a CJTC Dd report* The UE capability is used to inform the NW on the maximum duration for the latest CJTC Dd report, measured from the reception of the trigger for a Rel-18 eType-II CJT CSI

**FL assessment**: This issue was briefly mentioned discussed OFFLINE [2]. Its resolution may help confirming the WA for separate triggering (issue 3.3.1 proposal 3.C.1). 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, Samsung (but no timer in RAN1 spec), Qualcomm (same as SS), vivo (same as SS), Ericsson (same as SS), OPPO (same as SS), Xiaomi, Nokia/NSB, Huawei/HiSi, NEC, HONOR, Sharp, KDDI, MediaTek, **Not support**: Google, Spreadtrum, NTT DOCOMO, Intel, Apple, CATT, Sony, TCL, Spreadtrum,  |
| 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, Lenovo/MotM, Ericsson (open), TCL, **Not support**: Huawei/HiSi, MediaTek, NTT DOCOMO, NEC, Intel, Apple, TCL, Huawei/HiSi, Xiaomi, IDC, Sharp, KDDI, CMCC, ETRI, OPPO, Apple, vivo, New H3C, Nokia/NSB, Spreadtrum,  |
| 3.7.2 | **Proposal 3.G.2:** For the Rel-19 aperiodic standalone CJT calibration reporting, support reporting, in one CSI reporting instance, L1-RSRPs associated with the configured NTRP CSI-RS resources and the following CJT calibration report type:* ReportQuantity is ‘cjtc-Dd’ (delay offset), or
* ReportQuantity is ‘cjtc-F’ (frequency offset), or
* ReportQuantity is ‘cjtc-Dd-F’ (delay+frequency offset), or
* ReportQuantity is ‘cjtc-P’ (DL/UL phase offset)

Regarding the L1-RSRP:* 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
* FFS: Whether this is supported via a new ReportQuantity or a joint CSI request/triggering

**FL assessment**: This proposal (from RAN1#118) is an optimization primarily for TRP selection (which utilizes both RSRP and CJTC report) | **Support/fine:** NEC, NTT DOCOMO, Lenovo/MotM, Samsung (ok), Sony (open), TCL, **Not support**: ZTE, Xiaomi, Fujitsu, Ericsson, Apple, Huawei/HiSi, OPPO, TCL, ETRI, New H3C, Google, Nokia/NSB, vivo, Sharp, Intel, KDDI, Spreadtrum,  |
|  |  |  |

Table 3B LLS/SLS results: issue 3

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| --- | --- |
| **Company** | **LLS/SLS results** |
| **Issue #** | **Metric** | **Observation** |
| 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** |
| Lenovo/ MotM | **Re Proposal 3.C.5**: We do not believe this issue is a NW implementation since the CSI processing to derive the DL precoder at the NW is based on knowledge of this timer value. The NW side needs to know the timer value. If the delta between the two separate triggers is within the timer value, the NW assumes the UE has applied the DO in computing the CSI based on Type-2 CJT CB, whereas if the delta between the two separate triggers is larger than the timer value, the NW will have to apply the DO to the PMI coefficients to each of the corresponding TRPs in CJT based on function of the values obtained in the last CJTC report |
| Mod V0 | **Please share your inputs on each of the issues and, if applicable, proposals in TABLE 3A*** **Please focus on the new issues/proposals**
* **Please also check if you change your mind on the old proposals (from previous round(s))**
* **Re proposal 3.C.5, please check Lenovo’s argument from round-1**
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# References