**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]):

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

## Summary of companies’ proposals and views

***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 CSI-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, NTT DOCOMO, Spreadtrum, CMCC, ZTE, CATT, Nokia/NSB, Fraunhofer IIS/HHI, Ericsson, TCL, OPPO, Google, NEC, Tejas, * Not support:   Alt2:   * Support/fine: Qualcomm, LG, Xiaomi, MediaTek, Lenovo/MotM, Google, * Not support:   Pure NW implementation of configuring proper ‘*non-PMI-PortIndication*’ (no spec impact)   * Support/fine: vivo, Samsung * 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, Spreadtrum (name change), Samsung, Qualcomm, HONOR, Xiaomi, MediaTek, CATT, Nokia/NSB, Fraunhofer IIS/HHI (open), Ericsson, TCL (open), NEC, Tejas,  **Not support:** ZTE, OPPO (UE feature), Google (fine for UE feature) |
| 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, Spreadtrum, Samsung (open), HONOR (open), Fraunhofer IIS/HHI (open), Qualcomm, TCL (open), Tejas (open), * No: ZTE, CMCC, Nokia/NSB (not sure but ok to discuss), Ericsson (ok to discuss), OPPO, Google,   **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: * Alt6: * Alt7:   + if two different vectors for , for the vector with smaller scaling factor , and for the other vector configured with larger scaling factor ;   + otherwise ( or one same vector for ), for the vector   Where ri denotes the number of layers associated with the i-th SD basis vector.  The same scheme applies to both Mode-A and Mode-B.  Note: as agreed in RAN1#117  Alt1:  Alt2:  Alt3: OPPO  Alt4: Lenovo/MotM,  Alt5: Samsung | **Support/fine:** Ericsson, Qualcomm, Nokia/NSB, Huawei/HiSi, Samsung, ZTE, HONOR, Fraunhofer IIS/HHI, Lenovo/MotM, TCL, OPPO, Google, NEC, Tejas  **Not support:** [Xiaomi], |
| 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.   **Proposal 1.F.2 (legacy)**: 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,   |  |  |  | | --- | --- | --- | |  | Timeline capability 1 | Timeline capability 2 | | P-report (L subConfigs) |  |  | | AP/SP-report (N triggered) |  |  |   **Original version**:   * Support/fine: Samsung, Lenovo/MotM, IDC, Google, ZTE (open), Xiaomi, Nokia/NSB, Huawei/HiSi, Fujitsu, HONOR, Sharp, Intel, Apple, Spreadtrum, CMCC, vivo, Fraunhofer IIS/HHI, Ericsson, * Not support: NTT DOCOMO, Qualcomm,   **Revised version (function of # CMRs per legacy)**:   * Support/fine: NTT DOCOMO, Qualcomm, ZTE, Nokia/NSB, Fraunhofer IIS/HHI, Ericsson, TCL, Tejas, * Not support: New H3C, Samsung, vivo,   **Legacy version:**   * Support/fine: Samsung (2nd), Qualcomm (2nd), Google, * Not support: vivo, | |
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| **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 was discussed during Monday Offline session.  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,OPPO,HONOR, TCL, Fraunhofer IIS/HHI, Tejas,  **Concern**: Apple, vivo (ok RI=3-4 & 16, 24, 32 ports), Huawei/HiSi (same as vivo), Ericsson, Lenovo/MotM |
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Table 1B SLS results: issue 1

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| **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

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| --- | --- |
| **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))** |
| New H3C | **Proposal 1.F.2: support original version** |
| Mod V2 | **P1.E: captured Monday offline outcome** |
| Spreadtrum | **Proposal 1.B.2**: The name “*maxNumberTxPortsPerReport*” looks weird since a report doesn’t have ports, it should be the resources associated with the report which have ports. We suggest to change the name as “*maxNumberTxPortsPerActiveResource*”.  **Question 1.B.3**: Support in principle. This proposal is beneficial to relax the timeline for CSI-RS measurement and Type-II Doppler CB calculation. |
| Samsung | **Question 1.A.2**  If gNB has option to configure non-PMI-portIndication, do we need to define again a default mapping for this feature as well? It seems up to gNB implementation. I  **Proposal 1.B.2**  Fine.  **Proposal 1.B.3**  We can be open to discuss but we are not sure it also needs to be extended at this point, so wanted to see proponents’ explanation.  **Proposal 1.C.2**  We prefer Alt5 since it means power constraint per beam perspective (hence easy to understand).  **Question 1.F.2**  We prefer the original proposal.  If we have to change in a way that QC/DCM suggested, the term of ceil(Pi/32) seems not needed since we already take into account it active port counting/active resource counting in the previous agreement. So we prefer to reuse Rel-18 SD NES Type-I Ocpu legacy rule for both capabilities 1 and 2, if the original proposal can’t be aggregable. |
| Qualcomm | **Question 1.A.2**: While we agree that Alt1 can also resolve this problem by NW implementation, we still prefer Alt2 more – since legacy non-PMI report also has this default mapping b/w CSI-RS ports and hypothetical layers w/o explicit ‘*non-PMI-PortIndication*’ configured. Therefore, Alt2 can save RRC overhead, while not excluding ‘*non-PMI-PortIndication*’.  In summary, we support Alt2.  **Proposal 1.B.2**: OK  **Proposal 1.F.2**: On paper, if we follow the concept of (1) legacy NES CPU rule; (2) Scale OCPU for faster timeline capability 1, it should be the following table   |  |  |  | | --- | --- | --- | |  | Timeline capability 1 | Timeline capability 2 | | P-report (L subConfigs) |  |  | | AP/SP-report (N triggered) |  |  |   But we agree with @Samsung that, if this issue can’t be converged, we can reuse legacy w/o considering the scaling with #ports of each subConfig, which is   |  |  |  | | --- | --- | --- | |  | Timeline capability 1 | Timeline capability 2 | | P-report (L subConfigs) |  |  | | AP/SP-report (N triggered) |  |  | |
| ZTE | **Question 1.A.2:**  Support Alt1. We agree with FL’s assessment that, Alt2 causes extra spec changes but without benefits.  **Proposal 1.B.2**:  Do NOT support. The triplet capability mechanism has been used from Rel-15 to Rel-18. If this proposal is agreed, it may cause serious backward compatibility issues. Besides, it may also cause serious management issues at NW side.    **Question 1.B.3**:  Do NOT support. CSI reference resource is just a reference time point to define the usable CSI-RS occasions for channel measurement. It is NOT relevant with CSI processing time. So, we did NOT see the necessity of extending the CSI reference resource slot location.  **Proposal 1.C.2:**  Support.  **Proposal 1.F.2 (revised)**:  Fine.  **Proposal 1.E**:  Firstly, we want to point out that, one important motivation of this proposal is to have a unified codebook structure for RI = 3-4 for different number of CSI-RS ports. If Rel-19 SP codebook is NOT applicable for P < =32, then we would have different codebook structures for RI = 3-4 for P < 16, 16 <= P <= 32, and P > 32.  Secondly, we encourage companies to compare the performance of Rel-15 SP codebook and Rel-19 SP codebook for P<= 32. Since Rel-19 SP codebook provides more flexibility, it is expected that Rel-19 SP codebook also outperforms Rel-15 SP codebook for P<= 32. So, supporting Rel-19 SP codebook for P<= 32 is also beneficial from the performance perspective. |
| HONOR | **Proposal 1.B.2**: Support.  **Question 1.B.3**: Open to discuss it. However, the determination of nCSI\_ref is different for periodic/semi-persistent and aperiodic CSI report. For aperiodic CSI report, nCSI\_ref is determined according to Z’ (the unit of Z’ is symbol). Maybe it’s better to use Z’ to be multiplied by ceil(P/32).  **Proposal 1.C.2:** OK to list all the options and decide in next meeting. |
| Xiaomi | **Question 1.A.2:**  Alt2 is preferred considering it is simple and can save signalling overhead.  **Proposal 1.B.2**:  Fine  **Proposal 1.C.2:**  According to the achieved agreement on 3-bit scaling factor configuration in RAN1#117 meeting, we think per-layer power scalling factor for RI=v=1 is . This proposal should focus on discussion on per-layer power scaling factor for RI=v=2.  For Alt3, Alt4 and Alt5, it may lead the per-layer power is larger than , which results the total power is larger than one. |
| MediaTek | **Question 1.A.2**  We prefer Alt 2, which also aligns with the legacy behavior of non-PMI reporting  **Proposal 1.B.2**: OK |
| CATT | **Question 1.A.2:**  We prefer Alt1 for its simplicity.  **Proposal 1.B.2**: ok |
| NTT DOCOMO | **Question 1.A.2:** Our first preference is Alt.1.  **Proposal 1.F.2:** Following legacy rule, O\_CPU is related to the number of CMRs measured by UE. Then we can discuss whether to further scale it with ceil(Pi/32) for UE capability 1 timeline. We think the original version is not related to the number of CMRs. Thus, we prefer the revised version. |
| CMCC | **Question 1.A.2:**  Prefer Alt1, rather than making optimization for the case of RRC parameter is not configured, we prefer to directly make sure ‘*non-PMI-PortIndication*’ is always configured to the UE and the issue is resolved by gNB implementation.  **Question 1.B.3:**  CSI reference resource is just a defined reference point, and the CPU occupation, Z, Z’ have already been scaled, we think the scaling of CSI reference resource slot location is not needed. |
| Vivo | **1.A.1**  We think a simple NW configuration can address this issue. The so-call “default” is nothing other than one RRC state based on RAN2 signaling design. Hence we don’t think it is very different as other possible configurations of non-PMI port indication.  **1.B.2**  We don’t think there is any BC issue as this is Rel-19 UE capability reporting. The active resource counting is just one for the K aggregated resources, then if the first entry in the triplet is still the number of ports per resource, it cannot be large than 32. Then assuming only one report is configured, the given the total number of active resource is 1, the total number of active ports cannot be large than 32 for a certain report. There will be serious issue as gNB cannot configure a 128 port resource for such reporting at all due to the signaling design of legacy triplet. This has be to fixed otherwise the Rel-19 CSI for up to 128 ports doesn’t work. We are not strong about the detailed name of this parameter, but the number of ports per report seems a simpler one.  **1.B.3**  We are surprised to see companies’ comments on reference resource definition is not relevant with CSI processing time. gNB expects UE to use the CSI-RS occasions before the CSI reference resource. So the time between CSI reference resource and CSI report has to reserve sufficient time for UE to process this CSI report. Based on the current definition of UE timeline capability 2, and the time for capability 2 can be larger than 4 or 5 slots in the current specification for n\_CSI\_ref. It means for this type of UE, it needs more than 4 or 5 slots to process such CSI. The processing time has to be extended to give UE sufficient time for processing CSI based on periodic and/or semi-persistent CSI-RS.  **1.F.2**  We prefer a unified solution for all the cases. It seems a bit too complex to have different solutions for P and AP/SP CSI reports. |
| Nokia | **Question 1.A.2**  We prefer Alt1. Alt2 seems to be restrictive when non-PMI-PortIndication is not configured for ranks because a single CW is always associated to SRS port group 0  **Proposal 1.B.2**  Ok  **Proposal 1.B.3**  We are not sure it is needed but we are open to discuss  **Proposal 1.F.2**  We are ok with the revised proposal |
| Fraunhofer IIS/HHI | **Question 1.A.2**: Support Alt 1  **Proposal 1.B.2**: Open for discussion  **Proposal 1.B.3**: Open to discuss  **Proposal 1.C.2**: Fine  **Question 1.F.2**: Fine with both versions |
| Lenovo/ MotM | **Question 1.A.2:**  We prefer Alt2 but more discussion is needed on CSI-RS port mapping. We also believe more discussion is needed on Alt1 in the next offline session.  **Proposal 1.C.2:**  OK to discuss, prefer Alt4. |
| Qualcomm | Some more feedback on **Proposal 1.B.3**: Support  As explained by the proponent company (vivo), one rule of CSI reference resource is defining the timeline of P-report, which in our view, is also beneficial for similar reason as the extended timeline for AP-report |
| Ericsson | **Question 1.A.2**: Support Alt 1.  **Proposal 1.B.2**: Ok.  **Proposal 1.B.3** Not support at this point. Like other companies, we are not sure if this is needed. We need more discussion on this to understand the need.  **Proposal 1.C.2** Ok to list options options and make a decision in next meeting. On Xiaomi’s comment regarding whether or not certain alternatives result in total power larger than 1, this is something to take into account when we perform down-selection at the next meeting.  **Question 1.F.2**: open to discuss both versions. Would be good to understand the pros and cons of the two versions before downselection. |
| TCL | **Question 1.A.2**: We prefer Alt 1. It is more simplified.  **Proposal 1.B.2**: Open to discuss.  **Proposal 1.B.3**: We are open to discuss. According to vivo’s explanation, what confuses us is that some features before Rel-19 also extended the processing time for CSI. Why was it not considered to expand the CSI reference resources before?  **Proposal 1.C.2**: Ok  **Question 1.F.2**: We think that the revised proposal is more reasonable. |
| Mod V24 | **No revision** |
| OPPO | **Question 1.A.2:**  Support Alt.1.  **Proposal 1.B.2**:  Suggest to discuss it in UE feature section.  **Question 1.B.3**:  We have relaxed the value of Z/Z’ for Rel-18/19 enhanced codebook. However, the timeline for CSI reference resource remained unchanged. We need to understand the intention to enhance this only for Re-19 >32 ports CB.  **Proposal 1.C.2:**  Fine. Our preference is Alt.3 if the scaling is based on legacy power without scaling. |
| Google | Question 1.A.2: We are fine with both Alt1 and Alt2.  Proposal 1.B.2: OK. But such proposal can be discussed in UE feature agenda.  Question 1.B.3: Is it for AP or SP/P? The CSI reference slot for SP/P seems to be sufficient.  Proposal 1.C.2: It seems the definition of ri is and rk are missing?  Proposal 1.F.2: Support the legacy version and original version.  Proposal 1.E: We do not see the necessity. |
| NEC | **Question 1.A.2:** Alt.1 is preferred.  **Proposal 1.B.2**: OK.  **Proposal 1.C.2:**  Firstly, we think it’s better to clarify the codebook structure with power scaling for each alternative, i.e. the scaling factor applied to one SD basis vector with or without the normalization , as it seems some alternatives with the normalization (e.g. Alt 1,2,5) while some not (e.g. Alt 3,4). For example, the codebook may be for some alternatives, or for some other alternatives.  Another way is to keep the codebook structure aligned for the alternatives, taking for reference, we think another alternatives can be as . And in case of , with two different vectors, if one vector configured with smaller scaling factor , the power can be , the other vector (e.g. configured with larger scaling factor ) can be with power  So we prefer to add two alts like:   * Alt6: * Alt7:   + if two different vectors for , for the vector with smaller scaling factor , and for the other vector configured with larger scaling factor ;   + otherwise ( or one same vector for ), for the vector |
| Tejas | **Question 1.A.2**:  Support Alt 1. We think that since the option is already present in the current spec, it could be extended as a mandatory configuration, when SRS port grouping is configured. And in our view the RRC signalling overhead is only the legacy overhead for P ≤ 8 ports.  **Proposal 1.B.2**:  Support  **Proposal 1.B.3**  Open to discussion before supporting this feature.  We think that if this feature is required to relax the timeline for periodic or semi-persistent CSI reporting for Rel-19 Type-I SP and Type-II codebook refinements, should it not be extended to Rel-19 Type-I MP as well ?  Based on the following Agreement from RAN1 #118;  **Agreement**  For the Rel-19 Type-I MP codebook refinements for 48, 64, and 128 CSI-RS ports, regarding OCPU, timeline, active resource counting, and CMR restriction (FDM/TDM, EPRE offset), fully reuse those for the Rel-19 Type-I SP codebook.  **Proposal 1.C.2**  Support the proposal with suggested alternatives for study.    **Question 1.F.2**:  We are inclined towards Proposal 1.F.2 (revised), due to its alignment with the legacy spec description. However, agree with few other proponents that it is desirable to understand the pros and cons of the two alternatives. |
| Mod VFinal | **P1.C.2 revised** |

### 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/wideband for the 1st configured CMR among the non-reported MR CRIs; * … * The G0/wideband for the last configured CMR among the non-reported MR CRIs; * The G0/wideband for the 1st reported CRI; * … * The G0/wideband for the (M- MR)-th reported CRI;   The entire G0/wideband is either reported or dropped entirely, following the legacy principle.  **FL assessment**: Monday OFFLINE agreement.  This amendment is needed to capture the behaviour for G0/wideband part in CSI part 2 | **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, TCL,  **Not support**: |
| 2.2.2 | **Proposal 2.A.2**: For the Rel-19 CRI-based CSI refinement for up to 128 CSI-RS ports, regarding one-part CSI wideband CQI/PMI reporting, the UCI packing order is as follows:   * The wideband CSI for the 1st reported CRI; * … * The wideband CSI for the M-th reported CRI;   **FL assessment**: Monday OFFLINE agreement.  This proposal addresses only 1-part wideband CSI | **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, TCL,  **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,Spreadtrum,  **Not support:** Qualcomm, ZTE,HONOR, Xiaomi,MediaTek, CATT, NTT DOCOMO, CMCC, vivo, Nokia/NSB, Lenovo/MotM, Ericsson, TCL, OPPO, Google, Tejas, |
|  |  |  |

Table 2B SLS results: issue 2

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

Table 2C Additional inputs: issue 2

|  |  |
| --- | --- |
| **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** |
| Mod V2 | **P1.E: captured Monday offline outcome** |
| Spreadtrum | **Proposal 2.B.2**: Support the spirit of allowing UE to report some of the CSIs that can be updated timely. Besides, there’s another case that UE can only update some of the CSIs, i.e. when the number of un-occupied CPUs N is smaller than Ks. For the MR gNB selected CMRs, UE can calculate {PMI, RI, CQI} directly without CMR selection. Therefore, each one of the MR gNB selected CMRs can occupy one CPU independently. So we suggest to discuss the following additional proposal:  ***Proposal****: When the number of un-occupied CPUs N is smaller than Ks, if MR is configured, the min(N, MR) CSIs corresponding to gNB selected CMRs can be updated.* |
| Samsung | **Proposal 2.A.1:**  Support  **Proposal 2.A.2:**  Support. |
| Qualcomm | **Proposal 2.A.1/.2**: OK for both  **Proposal 2.B.1**: Slightly prefer no additional dropping rules than what has been agreed in Round1. |
| ZTE | **Proposal 2.B.2:**  Do NOT support. It is NOT aligned with legacy UE behaviour and seems unnecessarily complicated. |
| HONOR | **Proposal 2.B.2:** We don’t see the need to define such complicated UE behaviors. gNB should ensure all Ks resources are transmitted before the CSI reference resource. |
| Xiaomi | **Proposal 2.A.1/.2**:  Fine  **Proposal 2.B.2**:  We prefer to no additional dropping rules introduced, since the reported CSI based on M or M1 CRI may be not optimal once the dropped CSI-RS resource corresponding to the optimal CSI. |
| Samsung | Revised our previous input. |
| MediaTek | **Proposal 2.B.2** Prefer no additional dropping rules since there might be additional effort to determine the value of M1 (e.g., UE selected or gNB configured) |
| CATT | **Proposal 2.B.2**  We understand the motivation to have partial CRI reporting instead of dropping, but we think further clarification is need. One issue is when “MR resources”are configured (or not). Another issue is that in the second bullet there might be multiple possible M1 valuesthat satisfies M1<M and M1=<Ks-X, does UE freely decide M1 and associated CRI to report? It seems a bit complicated. |
| NTT DOCOMO | **Proposal 2.A.1:**  Support  **Proposal 2.A.2:**  Support.  **Proposal 2.B.2:**  We donot support additional dropping rule as such optimization may be not so useful with cost of additional complexity. |
| CMCC | **Proposal 2.B.2**:  We support the spirt of letting NW getting as much information as possible, but considering the UE behavior of CSI dropping does not happen frequently, this complicated solution is not needed. |
| Vivo | **2.B.2**  Prefer to keep the legacy rule, which is simpler for UE. |
| Nokia | **Proposal 2.B.2**  This additional UE ehavior seems to contradict the dropping rule we just agreed |
| Lenovo/ MotM | **Proposal 2.A.1/2**:  Support  **Proposal 2.B.2**:  Do not support, at least needs further discussion. This may lead to ambiguity depending on whether the CMRs dropped belong to unreported CRI |
| Ericsson | **Proposal 2.B.2** Do not support proposal. Similar view as Nokia. |
| TCL | **Proposal 2.A.1:**  Support.  **Proposal 2.A.2:**  Support.  **Proposal 2.B.2**  We not support additional dropping rules. |
| Mod V24 | **No revision** |
| OPPO | **Proposal 2.A.1/2**:  Support  **Proposal 2.B.2**:  Do not support. |
| Google | Proposal 2.A.1: Support  Proposal 2.A.2: Support  Proposal 2.B.2: We failed to see the necessity |
| NEC | **Proposal 2.A.1/2**:  Support |
| Tejas | **Proposal 2.A.1:**  Support as indicated earlier. As per existing spec description Part 2 G0/wideband CSI for Priority 0 is specified for CSI reports 1 to NRep, unlike other Priorities. We think that, capturing this in the proposal description will be good for clarity.  **Proposal 2.A.2:**  Support as indicated earlier. As per existing spec description Part 2 wideband CSI for Priority 0 is specified for CSI reports 1 to NRep, unlike other Priorities. We think that, capturing this in the proposal description will be good for clarity.  **Proposal 2.B.2:**  Our initial inclination is to not support as the additional dropping rule is largely deviated from existing implementation and due to its complexity increase.  We understand the need of allowing the NW getting as much information as possible, and is very important.  To achieve this, we suggest 2 options with nominal changes to spec;  Option 1: Where the priority rule be modified such that, each report is indexed by *y, k, c, s* and *m,* and associated with a priority value ,  Here, the additional parameter *m* is defined as,  *m =* 0 for non-*M* CRI based CSI reports (legacy CSI reports up to Rel 18) and *m =* 1 for *M* CRI based CSI reports. *M* is the maximum number of CRIs present in a specific CSI report.  Hence, it allows to maintain the same complexity if M is not configured and minimize the omission for total reported.  Option2: Prioritizing the non-reported *MR* CRIs either based on the configured order or based on a quality measure like, either a higher cri-SINR, cri-RSRP or resource specific RI and resource specific CQI. And prioritizing the reported *M*-*MR* CRIs based on a similar quality measure described as earlier.  [Mod: This can be discussed separately] |
| Mod VFinal | **No revision** |

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

Table 3A Summary: issue 3

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **#** | **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, Google,   + No: Spreadtrum, Qualcomm, HONOR, CATT, vivo, Nokia/NSB, Ericsson, OPPO, NTT DOCOMO, | | | |
| 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, Qualcomm (open), Google (optional),   + No: Samsung, ZTE, HONOR, vivo, Nokia/NSB, Lenovo/MotM, Ericsson, NTT DOCOMO, * Whether determination of SRS transmission occasion is needed for aperiodic associated SRS resource, and if so, how   + Yes: Google, ZTE (latest DCI), Qualcomm, ZTE, CATT (ok), Sony (open),   + No (only 1 occasion, no ambiguity): vivo, TCL, Samsung, NTT DOCOMO, HONOR, Nokia/NSB, Lenovo/MotM, Ericsson,   **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, Xiaomi, Lenovo/MotM,  **Not support:** Spreadtrum, ZTE, HONOR, vivo, Nokia/NSB, Ericsson, Sony, TCL, OPPO, Google, NEC, NTT DOCOMO, | | |
| 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, Lenovo/MotM, Ericsson (discuss), Samsung (discuss),   + No: TCL, ZTE, vivo, Nokia/NSB, Sony, OPPO, NTT DOCOMO, * Whether the Dd report codepoints need to be reinterpreted from intervals/ranges to values when the linkage mechanism is configured   + Yes: NEC, HONOR,   + No: ZTE, vivo, Nokia/NSB, Samsung, Lenovo/MotM, Ericsson, Sony, OPPO, 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’ | | | |
| 3.3.10 | **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 (no spec impact):   * Support/fine: Samsung, HONOR, Xiaomi, vivo, Ericsson, OPPO, NTT DOCOMO, * Not support:   Alt2:   * Support/fine: ZTE, MediaTek, Google, NEC, * 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). This implies there is no spec impact, which is the default. | | | |
| 3.3.11 | **Conclusion 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, there is no consensus in supporting 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 CONCLUSION. For a given issue, if there is no consensus on ‘Yes’, we will assume that the answer is ‘No’  **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).  **Support/fine:** Ericsson, ZTE, CATT, Huawei/HiSi, CMCC, ETRI, Nokia/NSB, Lenovo/MotM,  **Not support (concern):** Apple, Samsung, Qualcomm, MediaTek, Fujitsu, IDC, TCL, Spreadtrum, HONOR, OPPO, Google, | | | |
| 3.3.12 | **Proposal 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, increase the bit-width of the CSI request field of the DCI triggering a Rel-18 CJT eType-II CJT CSI report by 1 bit to indicate whether or not the UE should perform delay offset (DO) compensation based on the latest linked CJTC Dd report when calculating the Rel-18 Type-II CJT CSI.  **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)  **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)   + Support/fine: Sony,   + Not support: Ericsson, * Alt2. The indicator indicates whether the Rel-18 eType-II CJT CSI is calculated assuming the latest linked CJTC Dd report   + Support/fine: Samsung, Qualcomm, ZTE, Xiaomi, MediaTek, vivo, Nokia/NSB, Lenovo/MotM, Ericsson,   + Not support: * … | | | **Support/fine:** Samsung, OPPO, Google, NTT DOCOMO, …  **Not support:** |
| 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:** ZTE, HONOR, MediaTek,vivo,Nokia/NSB, Lenovo/MotM, Ericsson, OPPO, Google, NTT DOCOMO, | |
| 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.   * Based on a fixed correspondence between the set of TRS resource set IDs in ascending order and the set of CSI-RS resource IDs in ascending order   **FL assessment**: This proposal needs some discussion. | | **Support/fine:** HONOR,Samsung, Qualcomm, Xiaomi, MediaTek, CATT, Nokia/NSB (or in DCI), Lenovo/MotM, Sony, OPPO, Google, NEC, NTT DOCOMO,  **Not support:** Ericsson, | |
| 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:** Nokia/NSB,Lenovo/MotM,Ericsson, Sony, OPPO,NTT DOCOMO, | |
|  |  | |  | |
| **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 the following:   * 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 * One supported value of the UE capability is ‘Infinity’   + FFS: The other supported value(s) * Introduce an RRC parameter to enable/disable this feature * When the UE does not report this UE capability, a default value of ‘Infinity’ applies.   **FL assessment**: Wording is based on the outcome of Monday offline session.  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, Qualcom, vivo, Ericsson, OPPO, Xiaomi, Nokia/NSB, Huawei/HiSi, NEC, HONOR, Sharp, KDDI, MediaTek, NTT DOCOMO, Apple,  **Not support**: Google, Spreadtrum, Intel, CATT, TCL, | |
| 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),  **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, TCL, | |
| 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),  **Not support**: ZTE, Xiaomi, Fujitsu, Ericsson, Apple, Huawei/HiSi, OPPO, TCL, ETRI, New H3C, Google, Nokia/NSB, vivo, Sharp, Intel, KDDI, Spreadtrum, TCL, | |
|  |  | |  | |

Table 3B LLS/SLS results: issue 3

|  |  |  |  |
| --- | --- | --- | --- |
| **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 confidence  Performance comparison between PO+delay/TAE and subband phase with MRT-precoded CSI-RSs (left figure) and non-MRT-precoded CSI-RSs (right figure)  From the SLS results, the following observations can be made:   * For MRT-precoded CSI-RSs, Opt1 (wideband/initial PO + delay/TAE) outperforms Opt2 (subband PO) for the case of all 16 subbands (which is with massive UCI overhead). * For non-MRT-precoded CSI-RS), the benefit of Opt1 (wideband/initial PO + delay/TAE) over Opt2 (subband PO) is reduced. |
|  |  |  |  |

Table 3C Additional inputs: issue 3

|  |  |
| --- | --- |
| **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** |
| Mod V2 | **P1.E: captured Monday offline outcome** |
| Spreadtrum | **Question 3.A.4**: In additional to the supported per CSI reporting setting configuration, We don’t prefer to have another configuration method for the the selection of PSRS=1 SRS port.  **Proposal 3.C.8**: As FL explained earlier in another proposal, “the spec isn’t designed for invalid/bad NW or UE implementations”. We think this proposal is not needed.  **Proposal 3.C.11**: We think supporting AP CSI-RS is enough. |
| Samsung | Question 3.A.4  Since we agreed to support the Psrs=1 SRS port selection per report setting, we don’t think any additional configuration is needed.  Question 3.A.5  Re the first bullet, since the agreed one can be applicable to both implementation ways, we don’t think additional option is needed, which seems more complicated.  Question 3.C.8  This issue is about a potential duplicated usage of dynamic TRP selection in CJTC-Dd and CJT CSI reports, if dynamic TRP selection (i.e., when *restrictedCMR-selection* is not enabled) for CJT CSI reporting is configured.   * For the separate triggering case, triggering instance for each of CJTC-Dd and CJT CSI reporting is different so it is possible to select a different set of TRPs (within the selected TRPs of CJTC-Dd report) for CJT CSI reporting. Hence enabling dynamic TRP selection for CJT CSI may be useful and needed. * For the case of joint triggering, since the CJTC-Dd and CJT-CSI reports are conveyed together in the same reporting instance, there is no point to include TRP selection indicator again in CJT-CSI report given that CJT-Dd report can already include TRP selection. In other words, configuring the dynamic TRP selection for CJT CSI reporting creates redundant overhead (up to 4 bits) and is not needed in the joint-triggering case.     Question 3.C.10  We prefer Alt 1, since it should be analogous to CJT CSI mode 1.  Question 3.C.12  It seems Alt2 is a more appropriate way to describe the UE behaviour.  Proposal 3.C.14  We think this is needed. Simple rule is preferable to us (e.g., lowest index to highest index) |
| Qualcomm | **Question 3.A.4**:  **Question 3.A.5**: Open for the first bullet;  Support the second bullet (since AP-SRS can be triggered by multiple times, thus “latest SRS occasion” can still be meaningful for AP-SRS)  **Question 3.C.12**: Prefer Alt2  Alt2 is more like standard definition of UE behavior (while Alt1 is more like a motivation)  **Question 3.C.14**: We agree this is needed, and simple one-to-one mapping should be natural |
| ZTE | **Question 3.A.4**:  Support. If the selected SRS port can be indicated by the trigger state, then fewer CSI reporting settings need to be configured. For example, if one report setting is associated with one 2-port SRS resource and the selected SRS port is indicated per CSI reporting setting, then two reporting settings (and two trigger states) are needed to enable the dynamical indication of the selected SRS port. While if the selected SRS port is indicated per trigger state, then one reporting setting (and two trigger state) is needed.  **Question 3.A.5**:  Do NOT support the first bullet. This solution is only applicable for non-precoded CSI-RS.  Support the second bullet. From RRC perspective, the CSI reporting setting of the PO report is associated with one AP SRS resource (ID). However, the AP SRS resource may be triggered many times. So, the UE needs to know which SRS occasion should be used for PO measurement. The simplest solution is that, the PO report is associated with the AP SRS occasion triggered by a DCI no later than the DCI triggering the PO report.  **Proposal 3.C.8**:  Do NOT support. The reported DO may be ‘out-of-range’ and the reported ‘d’ may indicate that the average delay plus the delay spread exceeds the CP. Then dynamic TRP selection is necessary.  **Question 3.C.9**:  For both bullets, do NOT support extra optimization. These issues can be handled by NW/UE implementations.  **Question 3.C.10**:  Support Alt2. However, we only think the extension of timeline (Z/Z’) is needed for joint reporting, i.e., the timeline (Z/Z’) for joint reporting is the sum of those of CJTC report and CJT Type-II report. The intension is to give UE sufficient time to process the CJTC report firstly and process the CJT Type-II report secondly.  **Proposal 3.C.11**:  Support. In practical implementation P/SP CSI-RS is more commonly used. There is no necessity to limit the CSI-RS as AP.  **Question 3.C.12**:  Prefer Alt2. Alt2 is much clearer than Alt1, since Alt2 directly defines UE behaviours.  **Proposal 3.C.13**:  Do NOT support. DO compensation should be configurable for both mode1 and mode2, because it can provide performance gain for both modes.  **Proposal 3.C.14**:  Support the proposal in general. To make the proposal clear, the i-th CSI-RS resource set in the CSI reporting setting of CJTC Dd report should be associated with the i-th CSI-RS resource in the CSI reporting setting of the CJT Type-II report.  **Proposal 3.E.2:**  Do NOT support. We failed to understand the motivation of the proposal. |
| HIONOR | **Question 3.A.4**: What we have agreed for per CSI report setting is enough. We don’t need to have a duplicated designs for the same functionality.  **Question 3.A.5**:  First bullet: NO. The previous agreement is enough to cover both precoded CSI-RS and non-precoded CSI-RS.  Second bullet: NO.  **Proposal 3.C.8:** Don’t support. It should be discussed together with the first bullet in **Question 3.C.9**. For example, if the TRP whose delay offset is out of range in CJTC Dd report, the TRP is not expected to be selected in Rel-18 eType-II CJT CSI report. In this case, dynamic TRP selection should be enabled.  **Question 3.C.9**:  First bullet: Yes. Please see the comment in **Proposal 3.C.8.**  Second bullet: Yes. It can help network to reconstruct PMI.  **Question 3.C.10**: Alt 1. Prefer a simple solution. There is no specific design for CJT CSI mode 1 in Rel-18.  **Proposal 3.C.11**: Not support to reduce UE complexity.  **Proposal 3.C.13**: The current description is a bit ambiguous. For eType-II CJT CSI report,it may be configured with either mode 1 or mode 2 regardless whether it’s linked with Dd report. According to Monday’s agreement, the indication is configured in trigger state level rather than resource setting level. One better way forward is that eType-II CJT CSI report be configured with either mode 1 or mode 2. However, if it’s linked with Dd report, UE is not expected to report FD basis offset in the eType-II CJT CSI report as the delay offset can provide more precise information based on TRS.  **Proposal 3.C.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 two separate triggers, support to include an indicator in the trigger for a Rel-18 eType-II CJT CSI, which indicates whether the UE should perform delay offset (DO) compensation based on the linked CJTC Dd report when calculating the Rel-18 Type-II CJT CSI or not.   * This feature is a separate UE capability * No new DCI field is introduced. This does not preclude increasing the bit width for CSI request. * FFS: Details on signalling design for the indicator including whether it is per CSI-RS resource/Dd value and the associated UE behaviour(s)   In addition, the above applies to both joint triggers and separate triggers.  **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~~ UE is no expected to report FD basis offset in Rel-18 eType-II CJT CSI report ~~the~~ *~~codebookMode~~* ~~is assumed as ‘mode2’~~ if pre-compensation with CJTC Dd is indicated (i.e., the *codebookMode* is assumed as ‘mode2’).  **Proposal 3.C.14**: Support. |
| Xiaomi | **Proposal 3.C.8**  It seems reasonable  **Question 3.C.10**  Agree with FL assessment and prefer Alt 1  **Question 3.C.12**  Prefer Alt 2 to indicate the UE behavior clearly  **Proposal 3.C.13**  Does it mean RRC signaling for indicating mode 1 or mode 2 is not needed?  **Proposal 3.C.14**  It seems necessary. Implicitly linking can be assumed by the same entry in each resource set. |
| MediaTek | **Question 3.C.10** Slightly prefer Alt 2 to accommodate computation of both Dd and CSI reports  **Question 3.C.12** Prefer Alt 2  **Proposal 3.C.13** We think it is not needed, especially when pre-compensation is not indicated. In this case, either of the two configured codebook modes can be used for CJT CSI computation.  **Proposal 3.C.14** Similar view as Samsung and Qualcomm |
| CATT | **Question 3.A.4**:  We don’t think additional configuration per AP-CSI trigger state is needed.  **Question 3.A.5**:   * Whether determination of SRS transmission occasion is needed: We are open to hear the justification form the proponent   **Proposal 3.C.14**: OK |
| vivo | **3.A.4**  We prefer not to have this additional optimization. We think the current mechanism to have per report setting configuration is sufficient to make it work.  **3.A.5**  We prefer NO for the first question. We see the point as for NP CSI-RS, the order of CSI-RS and SRS does not matter. But we think a single timeline (which is the agreed one) can be used for both BF and NP CSI-RS. Hence the need to have another timeline option is not strong.  **3.C.8**  We think even for joint triggering, dynamic TRP selection can still work. For example, dynamic TRP selection can simply selects the out of range TRPs for delay offset. Hence we are not sure about the need to have such restriction.  **3.C.9**  We don’t see the need to specify anything for these two issues.   * For the first one, gNB can choose to trigger one linked CSI or not-linked CSI based on the current agreements, after decoding the DO reporting. * For the second, we are not sure about why this is an issue.   **3.C.10**  We support Alt 1.  For the linked CSI reports, these two reports are still two report configs even if there are triggered jointly. For CPU, these two report will occupy separate CPUs, which is sufficient. For timeline, if multiple CSI reports are triggered jointly, the current spec has already specified that the require time will be the maximum Z for PUSCH scheduling. So there is sufficient time for UE to process.  **3.C.11**  We also support to have AP CSI-RS only, similar as other UE vendors.  **3.C.12**  What we agreed is Alt 2 based on the following agreement on Monday:  “support to include an indicator in the trigger for a Rel-18 eType-II CJT CSI, which indicates *whether the UE should perform delay offset (DO) compensation based on the linked CJTC Dd report when calculating the Rel-18 Type-II CJT CSI or not*.”  **3.C.13**  We don’t support to have any restriction on mode 1 or mode 2. We think mode 1 can also benefit from linked DO reporting. Type II CSI CSI is limited to delays within the subband granularity. The linked DO report can help to compensate the channel to make the delays within subband granularity and then mode 1 can be used to report the FD bases and inter-TRP phases. |
| Nokia | **Question 3.A.4**  We don’t think this is needed as the same functionality can be supported with the existing solution  **Question 3.A.5**  First bullet: the benefit is not clear, and, if supported there is a need to distinguish between two different assumptions in RRC  Second bullet: it does not seem needed, but we can clarify that AP-SRS is jointly triggered with cjtc-P  **Proposal 3.C.8**  In CJTC the UE reports for all the configured NTRP NZP CSI-RS resources/resource sets and the out-of-range indication for DO indicates that DO exceeds the last quantisation range. A UE may still exclude other TRPs in the CSI calculation based on RSRP measurements. So we don’t think this restriction is useful.  **Proposal 3.C.9**  First bullet: not needed, it can be addressed by network implementation  Second bullet: not needed, this can be addressed by network implementation  **Proposal 3.C.11**  Support.  **Question 3.C.12**  We think the agreement already provides a clear interpretation of the indicator, which “indicates whether the UE should perform delay offset (DO) compensation based on the linked CJTC Dd report when calculating the Rel-18 Type-II CJT CSI or not”  **Proposal 3.C.13**  We have a concern with this proposal as it restricts certain useful gNB implementations. The gNB may still configure DO compensation for CJT CSI report with Mode1, because the range of delays for Mode 1 and DO are different and can complement each other.  **Proposal 3.C.14**  We agree this is needed, but the linkage can be done through the DCI indicator in 3.C.12, if it is per resource  **Proposal 3.E.2**  It is unclear why this is needed |
| Samsung | **Question 3.C.9**  For second bullet, we think it is up to NW implementation.  **Re details regarding Q3.C.12**  We think it would be better to discuss detail signalling since we agreed to support it.  After discussing with other companies, it was common understanding that an 1bit in the trigger is needed to indicate whether UE calculates CJT-CSI based on linkage or not. So we propose the following to start discussion:  **Proposal**  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, increase the bit-width of the CSI request field of the DCI triggering a Rel-18 CJT eType-II CJT CSI report by one bit to indicate whether the UE should perform delay offset (DO) compensation based on the linked CJTC Dd report when calculating the Rel-18 Type-II CJT CSI or not. |
| Lenovo/ MotM | **Question 3.A.5**:  No fo both questions.  **Proposal 3.C.8**:  Support, makes sense to avoid mismatch between TRPs in CJTC report and Rel-18 Type-II CJT report  **Question 3.C.9**:  For the first bullet, the case where any of the DO values is out of range is a corner point/bad vendor design under separate triggering where the NW may have already received the CJTC DO report before triggering Type-II CJT codebook. Our preference is to drop the CSI report carrying Type-II CJT for this corner case.  For the second bullet, no need. UE implementation since the UE applies the DO to the calculated PMI  **Proposal 3.C.11**:  Support  **Question 3.C.12**:  Support Alt2  **Proposal 3.C.13**:  Network implementation. Do not support  **Proposal 3.C.14**:  Needs to be discussed, whether this needs explicit signaling or can be inferred from QCL information  **Proposal 3.E.2:**  Proposal motivation is not clear, more emphasis is needed |
| Ericsson | **Question 3.A.4**: No.  **Question 3.A.5** No for both questions.  **Question 3.C.8** Not sure if this restriction is needed.  **Question 3.C.9** Second bullet is not needed. Need some more discussion in the first bullet. For instance, if a reported DO value is ‘out of range’, we don’t think the UE will pre-compensate an ‘out of range’ DO.  **Question 3.C.10** Alt 1  **Question 3.C.12** Prefer Alt 2. In our understanding, Alt 1 is an attempt to specify gNB behavior (i.e., whether gNB successfully decoded the DO report or not). Hence, we don’t support Alt 1.  **Proposal 3.C.13** Not support. We don’t see the need for such restrictions in the specs.  **Proposal 3.C.14** Not support. Unclear about the need to define such linking.  **Proposal 3.E.2** Not support. Nref needs to be reported anyway. Don’t see the need to define turning off Nref reporting. |
| Ericsson 2 | On Proposal 3.C.5, a couple of additional views from us.   1. What is the default value if the UE does not report this capability? One natural solution is to assume infitity (as that corresponds to no restriction). 2. To reduce risk of network scheduling flexibility, we prefer to introduce an RRC parameter to enable/disable this feature.   Please see a suggested revisions below:  **Proposal 3.C.5 (revised)**: 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 for the latest CJTC Dd report, measured from the reception of the trigger for a Rel-18 eType-II CJT CSI * One supported value of the UE capability is ‘Infinity’   + FFS: The other supported value(s) * Introduce an RRC parameter to enable/disable this feature * When the UE does not report this UE capability, a default value of ‘Infinity’ applies. |
| Sony | **Question 3.A.5:**  We are supportive of the first bullet. In our understanding, the SRS closest to the ‘cjtc-P’ report might occur after the report. Channel coherence can better maintained if this option is allowed, enabling better performance, at least for NP CSI-RS.  For the second bullet, we are open to discuss whether determination of the latest AP-SRS occasion it is needed.  **Question 3.C.8:**  We don’t see a strong need for this. Also, if the UE assumes dynamic TRP selection is not enabled for eType-II CJT CSI reporting, it assumes the configured NZP CSI-RS resources/resource sets are to be used for eType-II CJT CSI reporting, unless the behavior of eType-II CJT CSI reporting is modified.  **Question 3.C.9**:  We do not support these bullets, as the network implementation can take care of it.  **Question 3.C.12:**  We prefer Alt1. When the indicator indicates that the linked Dd report was not successfully decoded, the UE applies the latest successfully decoded linked Dd report. This ensures a continuity of the applied DO values. Otherwise, i.e., if not DO compensation is applied by the UE at all, there is a “jump” in the applied DOs that can deteriorate the performance of the PDSCHs.  **Question 3.C.14:**  Support. A simple rule is preferred, e.g., as suggested by Qualcomm or ZTE.  **Question 3.E.2:**  We don’t understand the benefit of this proposal.  **Question 3.C.5:**  We also support Ericsson’s addition that if the UE does not report the corresponding UE capability, ‘Infinity’ applies. |
| TCL | **Proposal 3.C.8**  Not support. For joint trigger reporting, we think ‘out of range’ can also be a criterion for dynamic TRP selection.  **Proposal 3.G.1/2**  We do not support it, please remove us from the support list, thank you! |
| Mod V24 | **Revised proposal 3.C.14 per inputs**  **Added conclusion 3.C.11 and proposal 3.C.12** |
| OPPO | **Question 3.A.4**  Not needed.  **Proposal 3.C.8**  We think it can be up to gNB implementation without restriction.  **Question 3.C.9**  Not needed. In our understanding, if out of range is reported, the Dd report would not be used for CSI calculation for CJT.  **Question 3.C.10**  Though they are jointly triggered, different CSI report config is still needed which means different CSI report. There are clear timeline, CPU and ARC for this case.  **Conclusion 3.C.11**  Fine.  **Proposal 3.C.12**  Fine.  **Proposal 3.C.13**  Not needed.  **Proposal 3.C.14**  Implicit link seems sufficient for this case.  **Proposal 3.E.2**  The motivation should be clarified. |
| Google | Question 3.A.4: Support. This can provide better performance compared to fixed port selection  Question 3.A.5: For the first question, if this is supported, we would like to make it optional. For the second question, we think the association transmission occasion for AP-SRS should also be defined, since AP-SRS is not only triggered once.  Proposal 3.C.8: We do not see the issue if TRP selection is eanbled.  Question 3.C.9: We need to at least clarify UE does not need to perform DO compensation if the reported one is out of range.  Question 3.C.10: Support Alt2.  Conclusion 3.C.11: OK  Proposal 3.C.12: OK  Proposal 3.C.13: We failed to see the necessity. We already have a constraints that the CMRs are not based on the same QCL assumption.  Proposal 3.C.14: Support  Proposal 3.E.2: We would like to clarify that reporting nref would result in unnecessary overhead. This is a simply way to reduce the overhead. |
| NEC | **Proposal 3.C.8:** We haven’t discussed the FFS on how to handle “out of range” for DO report (Question 3.C.9), so we think this issue should be postponed, in addition, we prefer the opposite way, TRP selection should be enabled for linked CJTC and CJT CSI, then UE can have flexibility to remove the TRP corresponding to “out of range” DO value.  **Question 3.C.9:** Support both, “out of range” means the TRP is not suitable for CJT transmission, it’s better to not include the TRP in CJT CSI.  **Question 3.C.10:** Alt 2 is preferred. For jointly triggered CJTC and CJT CSI, actually CJTC should be performed firstly, then CJT CSI can be processed, there should be some new behaviour for CPU, CSI processing timeline.  **Proposal 3.C.14:** Support. |
| NTT DOCOMO | **Question 3.A.4:** Not support.  **Question 3.A.5:** No for the first bullet.  **Question 3.C.8:** Not sure the need for the restriction.  **Question 3.C.9:**  For 1st bullet, seems the only interpretation at NW is no DO precompensation for “out-of-range” TRP. It is achieved by NW implementation, and thus not sure the need for additional UE procedure.  For 2nd bullet, no.  **Question 3.C.10:** Alt1  **Proposal/question 3.C.12:** Open to consider Alt 1  **Proposal 3.C.13:** Not support  **Proposal 3.C.14:** Support  **Proposal 3.E.2:** Not support |
| Mod VFinal | **No revision** |

# References