**3GPP TSG RAN WG1 #118 R1-2407190**

**Maastricht, NL, August 19th – 23th, 2024**

**Source: Moderator (OPPO)**

**Title: Summary #2 on Rel-19 asymmetric DL sTRP/UL mTRP**

**Agenda Item: 9.2.4**

**Document for: Discussion and Decision**

# Introduction

This document summarizes remaining issues proposed in company contributions of AI 9.2.4 for the following objective in Rel-19 WI of NR MIMO Phase 5:

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| 1. Specify enhancement for asymmetric DL sTRP/UL mTRP deployment scenarios, assuming intra-band intra-DU non-co-located mTRP scenarios, without changing existing cell definition or defining a new cell (e.g. UL-only cell), assuming the Rel-17/18 unified TCI framework and fully reusing the legacy QCL/UL spatial relation rules, targeting FR1 and FR2    1. Two closed-loop PC adjustment states for SRS, both separate from PUSCH; and pathloss offset configurations for pathloss calculation to UL TRP(s), when the pathloss RS is from DL sTRP. |

# Issues for Discussions

## Pathloss Offset

**Proposal 1.3B:**

Study whether to support Type 3 PHR reporting in a serving cell/BWP where the UE is configured with two separate SRS CLPC adjustment states.

* Continue to study whether to support including PL offset in the calculation of Type 3 PHR.

Mod: Quite a few companies (ZTE/MTK/China Telecom/Ericsson/CATT, Google) proposes/ok to study the scenario of transmitting Type 3 PHR in asymmetric DL sTRP/UL mTRP scenario. However, Huawei/HiSilicon seems to have concern on it. My understanding is that it seems to be a valid issue, worthwhile for study.

* Support: ZTE, Spreadtrum, Lenovo, DCM, Tejas,
* Concern: Samsung, ETRI

**Proposal 1.5:**

Study whether/how to facilitate gNB’s determination of the value of PL offset from specification point of view for FR2.

Mod: This has been discussed for quite a few meetings. I think we need to make a conclusion on that. The views diverged a lot. If we still cannot converge to study, we should conclude no discussion on that.

* Support: Samsung, ZTE, Ericsson, OPPO, Spreadtrum, ASUSTeK, NTT DOCOMO, Xiaomi, vivo, QC, CATT, NEC, ETRI, Fujitsu, TCL, Sharp, Sony, Tejas, Transsion
* Concern: MTK, China Telecom, Huawei/HiSilicon, IDC, Lenovo, Google, LG, CMCC,

Table 1-2: Company input for Issues 1.x

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| **Company** | **Comments** |
| Mod00 | Please share your views/inputs on the issues 1.x |
| ZTE | **Proposal 1.3B:** As we elaborated in round-1, Type 3 PHR should be supported for SRS transmitted towards DL TRP (e.g., AS SRS for DL CSI acquisition) that associated with the second separated CLPC adjustment state, which is the main and practical use case for introducing two separated CLPC adjustment states for SRS in Rel-19 asymmetric DL/UL mTRP. Consequently, PL offset of Type 3 PHR calculation seems not needed as per the above use case.  **Proposal 1.5:** We think the spec impact of this issue is zero, we are also wondering what is the extra spec impact, if deemed existed. |
| Samsung | **Proposal 1.3B**: Given current condition for Type 3 PHR, we are not supportive.  **Proposal 1.5**:We are fine with this proposal. |
| Spreadtrum | **Proposal 1.3B**: Fine to have the study.  **Proposal 1.5**: Fine to have the study. |
| Lenovo | **Proposal 1.3B:** Ok to have the study.  **Proposal 1.5**: We still think it is up to implementation and failed to see the potential spec impact. |
| Docomo | **Proposal 1.3B:** Support. If Type 3 PHR is supported, gNB can use it for calculation of PL-offset in FR2. Hence, we think this is beneficial.  **Proposal 1.5:** Support. But, if Proposal 1.3B is agreed, we don’t see anything other to specify. |
| MediaTek | **Proposal 1.5**:We prefer to conclude it, as suggested by FL. |
| Tejas | **Proposal 1.3B:** Fine to study further. |
| ETRI | **Proposal 1.3B** Not support.  **Proposal 1.5** Support. |
| CATT | **Proposal 1.3B:** Fine to study..  **Proposal 1.5:** Support. |
| Panasonic | **Proposal 1.3B:** Okay to study  **Proposal 1.5:** okay to study |
| Nokia | **Proposal 1.3B:** we believe that Type 3 PHR needs to be supported. We are ok with studying  **Proposal 1.5** We support the study |
| Sony | **Proposal 1.3B:** We are fine to study.  **Proposal 1.5:** Support |

## Two Separate CLPC adjustment states for SRS

**Proposal 2.1**: Support DCI format 1\_1 to indicate TPC command for SRS CLPC adjustment states separate from PUSCH:

* This is subject to UE capability
* Introduce a 1-bit SRS CLPC indicator to indicate one of the separate SRS CLPC adjustment states, and a 2-bit TPC command indicator to indicate TPC command for one of the separate SRS CLPC adjustment states where:
  + The 2-bit TPC command indicator are present for scheduled CC/BWP if UE reports supporting this UE capability, and a corresponding RRC parameter is configured.
  + The 1-bit SRS CLPC indicator is present for the scheduled CC/BWP if the 2-bit TPC command indicator is present and two separate SRS CLPC adjustment states are configured

Mod: the views collected from round-1 discussion is as follows. The views diverged a lot and I guess the supporting companies need to explain more on the motivation and why it is needed.

* Support: Samsung, ZTE, MTK, CMCC, Ericsson, NTT DOCOMO, Nokia, Google, ETRI, Fujitsu, Sharp, Sony, Apple, Tejas,
* Concerns: OPPO, HW, Spreatrum, Lenovo, LG, Xiaomi, vivo, QC, CATT, Panasonic, TCL, Transsion

**Proposal 2.2**: About the extended value range 1~X of starting bit of blocks in DCI format 2\_3 in Rel-19 assuming intra-band intra-DU non-co-located mTRP scenarios, down-select one from the following Alts in RAN1#118bis:

* Alt1: X = 45 for operations in FR1 in shared spectrum or FR2-2 and X = 43 otherwise
  + This feature is a separate UE capability and is appliable to any rel-19 UE who supports this UE capability, regardless this UE supports two separate SRS CLPC adjustment states or not.
* Alt2: X = 44 for operations in FR1 in shared spectrum for FR2-2 and X = 42 otherwise
  + This feature is only applicable to UE who is configured with two separate SRS CLPC adjustment states.

Mod: My suggestion is to list both Alt1 and Alt2, and we do down-selection in RAN1#118bis. The views on Alt1 and Alt2 diverged a lot now. And the views input during round-1 discussion are:

* Alt1: Samsung, MTK, HW, Spreadtrum, NTT DOCOMO, Nokia, QC, Intel, TCL, Sony, Apple, Transsion, ETRI,
* Alt2: ZTE, CMCC, OPPO, Lenovo, Google, Fujitsu, Panasonic,

**Proposal 2.3:** RAN1 to study whether/how to use DCI format 2\_3 to trigger the transmission of SRS resource configured with multiple entries in *availableSlotOffsetList*

* For example, define one default slot offset for this case without adding new field for this; add one SRS offset indicator field in DCI format 2\_3.

Mod: Majority companies support 2.3 based on the inputs in round-1:

* Support: Samsung, ZTE, MTK, CMCC, Ericsson, OPPO, Spreadtrum, Lenovo, NTT DOCOMO, Nokia, Google, LG, Xiaomi, ETRI, Fujitsu, Intel, Sharp, Sony, Tejas, Transsion
* Concern: HW, vivo, QC, CATT, TCL,

**Proposal 2.4:**

* Study how to apply PL offset for SRS resource set when the SRS resource set is not configured with TCI state
* Study how to apply one of the two separate SRS CLPC adjustment states on the SRS resource set when the SRS resource set is not configured with TCI state
  + E.g., defining i0 as the default CLPC for SRS resource set in this case. e.g,, configure one of the separate SRS CLPC adjustment states to the SRS resource set.

Mod: Majority companies support 2.4 based on the inputs in round-1:

* Support: Samsung, ZTE, MTK, CMCC, Ericsson, HW, NTT DOCOMO, Nokia, Google, LG, Xiaomi, CATT, NEC, ETRI, Fujitsu, Intel, TCL, Sharp, Sony, Apple, Tejas, Transsion
* Concern: OPPO, Spreadtrum, Lenovo, QC,

**Proposal 2.5:**

The IE *SRS-CarrierSwitching* can be configured when separate SRS CLPC(s) is configured regardless PUSCH is configured or not.

Mod: The motivation for proposal 2.5 is that in current 38.331, the description on the IE *SRS-CarrierSwitching* restricts that this IE can be configured only when PUSCH is not configured and separate SRS CLPC is configured. That is not true at least for the asymmetric DL sTRP/UL mTRP scenarios. CATT suggested to correct it.



Table 2-2: Company input for Issues 2.x

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| **Company** | **Comments** |
| Mod00 | Please share your views/inputs on the issues 2.x |
| ZTE | **Proposal 2.1:** Support the updated version for progress.  **Proposal 2.2:** Fine to further down-select between Alt1 and Alt 2. Besides, given that two RRC parameters are dedicated to the starting bit position of block in DCI format 2\_3 (i.e., *startingBitOfFormat2-3* for NUL carrier, *startingBitOfFormat2-3SUL* for SUL carrier), we think the case of SUL is out of scope and should be precluded due to:   * As stated in WID, Rel-19 asymmetric DL sTRP/UL mTRP assumes intra-band and non-co-located mTRP scenarios, in which SUL is precluded. * Given that Rel-19 asymmetric DL sTRP/UL mTRP can facilitate coverage enhancement of UL transmission, the necessity of supporting SUL is marginal and redundant.   In light of this, we suggest to capture the assumption in WID as follows.  **Proposal 2.2**: About the extended value range 1~X of starting bit of blocks in DCI format 2\_3 in Rel-19 that assuming intra-band intra-DU non-co-located mTRP scenarios, down-select one from the following Alts in RAN1#118bis:   * Alt1: X = maximum payload size of DCI format 1\_0 - 1   + This feature is a separate UE capability and is appliable to any rel-19 UE who supports this UE capability, regardless this UE supports two separate SRS CLPC adjustment states or not. * Alt2: X = maximum payload size of DCI format 1\_0 - 2   + This feature is only applicable to UE who is configured with two separate SRS CLPC adjustment states.   Mod: implemented  **Proposal 2.3:** Support.  **Proposal 2.4:** Support.  **Proposal 2.5:** Basically, we think this discussion is good for clarification. Nevertheless, there is no such misunderstanding in RAN1 specs as per the discussion in previous meetings. Instead, we think it is proper and also sufficient to send an LS to RAN2 to fix this discrepancy. |
| Samsung | **Proposal 2.1**:  Actually our comment was that we need to introduce different condition for two new fields.   * For 1-bit SRS CLPC indicator, we think that it is based on the case when RRC parameter supporting two separate SRS CLPC adjustment states is configured. * For 2-bit SRS TPC command indicator, we think that it is based on separate parameters (e.g., UE capability and/or RRC parameter) from the parameters for 1-bit SRS CLPC indicator above.   So, 2-bit SRS TPC command indicator can be used for the case when a UE has a single SRS CLPC separate from PUSCH, especially for SRS antenna switching.  Hence, we would like to suggest one more time as we mentioned in the previous round.  **(Updated) Proposal 2.1**: Support DCI format 1\_1 to indicate TPC command for SRS CLPC adjustment state(s)separate from PUSCH:   * Introduce a 1-bit SRS CLPC indicator to indicate one of the separate SRS CLPC adjustment states, and a 2-bit TPC command indicator to indicate TPC command for one of the separate SRS CLPC adjustment states, where   + 1-bit SRS CLPC indicator is present for scheduled CC/BWP where two separate SRS CLPC adjustment states are configured.   + 2-bit TPC command indicator is present for scheduled CC/BWP if the UE reports a separate UE capability (independent from UE capability of supporting rel-19 two separate SRS CLPC adjustment states) and the corresponding RRC parameter (which is different with an RRC parameter for two separate SRS CLPC adjustment states) is configured.   Mod: I understand your intention here is to use this new feature of DCI format 1\_1 for all the rel-19 UEs who is configured with either single separate SRS CLPC or two separate SRS CLPC adjustment states. Similarly to 2.2, I guess here we also need to discuss the applicable case of this new feature (if agreed)  Mod2: @Samsung, your suggestion is implemented in the proposal 2.2. Re the 1-bit SRS CLPC indicator, I think it is present if two separate SRS CLPCs are configured and also the new 2-bit TPC command field is present ( the reason is the SRS CLPC shall be present only when the UE has two separate SRS CLPCs and also the system enable this new UE feature)  **Proposal 2.2.** Support Alt1. It can be beneficial for all UEs supporting this feature regardless of supporting two separate SRS CLPC adjustment states. Hence, it is good to introduce this feature by subject to a separate UE capability.  **Proposal 2.3.** We are fine to study.  **Proposal 2.4.** We are fine to study.  **Proposal 2.5.** We are fine with ZTE’s suggestion. |
| Spreadtrum | **Proposal 2.1**: Not support. It would change the original intention since Rel-15 where only DCI 2\_3 can indicate TPC command for SRS. We have not seen strong motivation to do the enhancement specially for asymmetric DL/UL scenario in Rel-19. We have agreed to the enhancement on DCI 2\_3 and introduce PL offset, which are enough for asymmetric DL/UL scenario.  **Proposal 2.2**: Support, and prefer Alt1.  **Proposal 2.3**: Not support. The conclusion in Rel-17 is still valid. Even for Rel-18 UL M-TRP, there is also no enhancement on DCI 2\_3 for this issue. We have not seen the necessity to do the special enhancement for asymmetric DL/UL scenario.  **Proposal 2.4**: Ok to study.  **Proposal 2.5**: Ok |
| Mod | Re 2.5, my understanding is:   1. If we want RAN2 to correct that for all the releases, then this shall be discussed in section 7 and then a LS is sent to RAN2 2. If we make the decision in our session, we can only ask RAN2 to fix that in spec of release 19 and an agreement based on proposal 2.5 would be sufficient. |
| Lenovo | **Proposal 2.1**: Not support. Support only DCI 2\_3 to indicate TPC command for SRS as explained in the first-round discussion.  **Proposal 2.2**: Support. We prefer Alt2 since it is caused by the increased bits of a block for a UE configured with two separate SRS CLPC adjustment states.  **Proposal 2.3**: Support.  **Proposal 2.4**: Not support. We understand that an SRS resource should either be configured with a TCI state or be indicated to follow the indicated unified TCI state according to the current specification.  **Proposal 2.5**: Support in principle. |
| Docomo | **Proposal 2.1:** Support the updated version  **Proposal 2.2:** OK except for “assuming intra-band intra-DU non-co-located mTRP scenarios”. We don’t think the limitation is necessary. At least, A-HetNet scenario can includes sTRP scenario.  **Proposal 2.3:** Support. We see a value of the proposal. Re Spreadtrum’s comment, Rel.17 conclusion does not preclude possibility for Rel.19.  **Proposal 2.4:** OK.  **Proposal 2.5:** Support. |
| Tejas | **Proposal 2.2:** Support. Our preference is Alt 1 that provisions the extension to be applicable to any rel-19 UE, including UL mTRP UE.  **Proposal 2.5**: Support in principle. |
| ETRI | **Proposal 2.1** Support.  **Proposal 2.2** Support. We prefer Alt1.  **Proposal 2.3** Support.  **Proposal 2.4** Support.  **Proposal 2.5** Support. |
| Mod | Revise the wording in 2.2 by including the particular values for X:   * Per the current spec, the size of DCI 1\_0 could be up to 46 bits for the operations in FR1 in shared spectrum or FR2-2 and 44 otherwise. * Alt1 is the size of DCI 1\_0 – 1 while Alt2 is the size of DCI 1\_0 -2.   Also revise the wording in 2.1 to implement Samsung’s comments. |
| CATT | **Proposal 2.1:** Not support. Same comment as in round1.  **Proposal 2.2:** Fine to further down-select between Alt1 and Alt 2 and prefer to Alt2.  **Proposal 2.3:** Not support. Same comment as in round1.  **Proposal 2.4:** Support.  **Proposal 2.5:** Support and we would like to clarify that we do not have to change anything in RAN1 spec, the same as ZTE mentioned. We also agree to send an LS asking RAN2 to fix this issue. |
| Nokia | **Proposal 2.1** we support  **Proposal 2.2** We support Alt1. We are ok with the moderator’s latest text proposal  **Proposal 2.3** we support  **Proposal 2.4** we support  **Proposal 2.5** we are fine with ZTE’s suggestion as well |

## SLS evaluation Results for the asymmetric DL sTRP/UL mTRP scenarios

Companies provided evaluation results to study the time difference between UL TRP and macro TRP in the asymmetric DL sTRP/UL mTRP deployment scenarios. The results are captured here for your reference.

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| **#** | **Evaluation results** |
| 3.1 | ZTE/Sanechips and China Telecom provided SLS results of uplink propagation delay difference between macro and micro TRPs:    And they provided the following observation:  ***Observation 2:*** *In asymmetric UL sTRP/ DL mTRP scenarios applied with one single TAG, uplink propagation delay difference between macro and micro nodes of ~70% UE cannot meet the timing error limit Te in both FR1 and FR2. As a result, it will negatively lead to that the performance of the vast majority of uplink transmissions cannot be guaranteed or the network has to deploy more dense micro nodes.* |
| 3.2 | Samsung provided the following SLS evaluation results:      Figure 3. Empirical CDF of uplink propagation delay differences for all scheduled UEs  Samsung explained that for x=4 micro cells distributed in each of the macro cells, more than 50% of the scheduled UEs would have their uplink propagation delay differences between their scheduling micro cells and the corresponding macro cells greater than the timing error limit Te of 114.0 ns (at FR2). This number becomes to more than 60% for x=2.    Figure 4. Normalized UPT performances for x=2 and x=4 with 2 TA values  Samsung explained that for both x=2 (i.e., 2 micro cells distributed per macro cell) and x=4 (i.e., 4 micro cells distributed per macro cell), with appropriate UL timing adjustments/alignments towards the scheduling cells, the average UPT performance can be significantly improved. |
| 3.3 | NTT DOCOMO also provided system level evaluation results on the timing difference between macro TRP and UL TRP:    Figure 3 CDF of time differences for all UEs between DL macro-UE and UL TRP-UE.  Observation 1:   * When only one TA is used in asymmetric DL sTRP/UL mTRP scenario, for FR1@30KHz with ISD=500m, more than 76% UEs could not meet the requirement on Timing Error Limit; for FR2@120KHz with ISD=200m, more than 54% UEs could not meet the requirement on Time Error Limit. |

Mod: All these evaluation results generally suggests that the uplink time difference between Macro TRP and UL TRP for many UEs could be pretty large in the asymmetric DL sTRP/UL mTRP deployment scenarios.

# Proposals for Online Discussion

# Contributions in RAN1#118

1. R1-2405873 Enhancements for asymmetric DL sTRP/UL mTRP scenarios Huawei, HiSilicon
2. R1-2405878 On Rel-19 Asymmetric mTRP Operation InterDigital, Inc.
3. R1-2405890 Enhancement for asymmetric DL sTRP/UL mTRP scenarios MediaTek Inc.
4. R1-2405906 Enhancements for asymmetric DL sTRP/UL mTRP scenarios Spreadtrum Communications
5. R1-2405937 Enhancement for asymmetric DL sTRP/UL mTRP scenarios Tejas Networks Limited
6. R1-2405983 Discussion on enhancement for asymmetric DL sTRP/UL mTRP scenarios CMCC
7. R1-2406026 Enhancements for asymmetric DL/UL scenarios Intel Corporation
8. R1-2406031 Discussion on enhancements for asymmetric DL sTRP/UL mTRP scenarios ZTE Corporation, Sanechips, China Telecom
9. R1-2406086 Discussion on enhancements for asymmetric DL sTRP/UL mTRP scenarios China Telecom, ZTE
10. R1-2406180 Discussion on asymmetric DL sTRP/UL mTRP scenarios vivo
11. R1-2406263 Enhancements on asymmetric DL sTRP/UL mTRP scenarios OPPO
12. R1-2406265 Discussion on asymmetric DL sTRP/UL mTRP scenarios TCL
13. R1-2406282 Discussion on enhancement for asymmetric DL sTRP/UL mTRP scenarios Xiaomi
14. R1-2406313 Discussion on UL-only mTRP operation Fujitsu
15. R1-2406366 On asymmetric DL sTRP/UL mTRP scenarios CATT
16. R1-2406455 "Enhancement for Asymmetric DL sTRP/UL mTRP Scenarios " Panasonic
17. R1-2406469 Enhancement for asymmetric DL sTRP/UL mTRP scenarios Sony
18. R1-2406524 Enhancement for asymmetric DL sTRP/UL mTRP scenarios Lenovo
19. R1-2406544 Discussion on enhancements for asymmetric DL sTRP and UL mTRP scenarios NEC
20. R1-2406647 Views on Rel-19 asymmetric DL sTRP/UL mTRP scenarios Samsung
21. R1-2406701 Discussion on enhancements for asymmetric DL sTRP/UL mTRP scenarios Transsion Holdings
22. R1-2406724 Discussion on UL enhancement through asymmetric DL and UL ETRI
23. R1-2406748 Enhancement for asymmetric DL sTRP/UL mTRP scenarios Nokia
24. R1-2406803 Enhancement for asymmetric DL sTRP UL mTRP scenarios Ericsson
25. R1-2406834 Enhancements for asymmetric DL sTRP/UL mTRP Apple
26. R1-2406928 Discussion on enhancement for asymmetric DL sTRP/UL mTRP scenarios NTT DOCOMO, INC.
27. R1-2407005 Enhancement for asymmetric DL sTRP/UL mTRP scenarios Sharp
28. R1-2407027 Enhancement for asymmetric DL sTRP and UL mTRP deployment scenarios Qualcomm Incorporated
29. R1-2407112 Discussion on enhancement for asymmetric DL sTRP and UL mTRP scenarios Google
30. R1-2407123 Discussion on asymmetric DL sTRP and UL mTRP ASUSTeK