**3GPP TSG RAN WG1 #117 R1-2405347**

**Fukuoka City, Fukuoka, Japan, May 20th – 24th, 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.
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# Issues for Discussions

## Pathloss Offset

**Proposal 1.3:**

* When a joint/UL TCI state associated with a PL offset with value $G\_{b,f,c}$is applied on a PUSCH transmission, the UE determines the PUSCH transmit power as:

$P\_{PUSCH,b,f,c,k}\left(i,j,q\_{d},l\right)=min\left\{\begin{matrix}P\_{CMAX,f,c,k}\left(i\right)\\P\_{O\\_PUSCH,b,f,c}\left(j\right)+10log\_{10}\left(2^{μ}∙M\_{RB,b,f,c}^{PUSCH}\left(i\right)\right)+α\_{b,f,c}\left(j\right)∙(PL\_{b,f,c}\left(q\_{d}\right)-G\_{b,f,c})+∆\_{TF,b,f,c}\left(i\right)+f\_{b,f,c}\left(i,l\right) \end{matrix}\right\}$

* When a joint/UL TCI state associated with a PL offset with value $G\_{b,f,c}\left(i\right)$ is applied on a PUCCH transmission, the UE determines the PUCCH transmit power as:

$$P\_{PUCCH,b,f,c,k}\left(i,q\_{u},q\_{d},l\right)=min\left\{\begin{matrix}P\_{CMAX,f,c,k}\left(i\right)\\P\_{O\\_PUCCH,b,f,c}\left(j\right)+10log\_{10}\left(2^{μ}∙M\_{RB,b,f,c}^{PUCCH}\left(i\right)\right)+PL\_{b,f,c}\left(q\_{d}\right)-G\_{b,f,c}+∆\_{F\\_PUCCH}\left(F\right)+∆\_{TF,b,f,c}\left(i\right)+g\_{b,f,c}\left(i,l\right) \end{matrix}\right\}$$

* When power control parameters contained in one joint/UL TCI state associated with a PL offset with value $G\_{b,f,c}\left(i\right)$ are applied on a SRS transmission, the UE determines the SRS transmit power as:

$$P\_{SRS,b,f,c}\left(i,q,l\right)=\min\_{}\left\{\begin{matrix}P\_{CMAX,f,c}\left(i\right),\\P\_{O\_{SRS},b,f,c}\left(q\_{s}\right)+10log\_{10}\left(2^{μ}∙M\_{SRS,b,f,c}\left(i\right)\right)+α\_{SRS,b,f,c}\left(q\_{s}\right)∙(PL\_{b,f,c}\left(q\_{d}\right)-G\_{b,f,c})+h\_{b,f,c}\left(i,l\right)\end{matrix}\right.$$

Note: How to capture that is up to the editor.

FFS: the value range and candidate values of PL offset value

**Proposal 1.4a:** To calculate a Type 1 PHR based on an actual PUSCH transmission,if a joint/UL TCI state associated with a PL offset with value $G\_{b,f,c}$ is applied on this PUSCH transmission, the UE determines the Type 1 PHR as:

$$PH\_{type1,b,f,c}\left(i,j,q\_{d},l\right)= P\_{CMAX,f,c}\left(i\right)-\left\{P\_{O\\_PUSCH,b,f,c}\left(j\right)+10log\_{10}\left(2^{μ}⋅M\_{RB,b,f,c}^{PUSCH}(i)\right)+α\_{b,f,c}\left(j\right)⋅(PL\_{b,f,c}\left(q\_{d}\right)-G\_{b,f,c})+∆\_{TF,b,f,c}\left(i\right)+f\_{b,f,c}\left(i,l\right)\right\}$$

* Note: How to capture that is up to the editor.
* FFS Type 1 PHR calculation based on reference PUSCH when including PL offset.
* FFS: Whether or not PHR triggering conditions in 38.321 need to be modified to account for PL offset.

**Proposal 1.4b:** To calculate a Type 3 PHR based on an actual SRS transmission,if a joint/UL TCI state associated with a PL offset with value $G\_{b,f,c}$ is applied on this SRS transmission, the UE determines the Type 3 PHR as:

$$PH\_{type3,b,f,c}\left(i,q\_{s}\right)= P\_{CMAX,f,c}\left(i\right)-\left\{P\_{O\\_SRS,b,f,c}\left(j\right)+10log\_{10}\left(2^{μ}⋅M\_{SRS,b,f,c}^{}(i)\right)+α\_{SRS, b,f,c}\left(j\right)⋅(PL\_{b,f,c}\left(q\_{s}\right)-G\_{b,f,c})+f\_{b,f,c}\left(i\right)\right\}$$

* Note: How to capture that is up to the editor.
* FFS Type 3 PHR calculation based on reference SRS when including PL offset.
* FFS: Whether or not PHR triggering conditions in 38.321 need to be modified to account for PL offset.

**Proposal 1.5:**

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

**Updated Conclusion 1.7a**: For the asymmetric DL sTRP/UL mTRP deployment scenario,

* When rel-17 unified TCI/ICBM is configured:
	+ For FR1: one joint TCI state or one DL TCI state + one UL TCI state can be applied to the system
	+ For FR2: one DL TCI state + one UL TCI state can be applied to the system.
* When rel-18 unified TCI is configured:
	+ For FR1: up to two joint TCI states or one DL TCI state + up to two UL TCI state can be applied to the system.
		- Note: When two joint TCI states are applied, the 1st joint TCI state is applied on DL transmission and both joint TCI states can be applied on UL transmissions
	+ For FR2: one DL TCI state + up to two UL TCI states can be applied to the system.

**Updated Proposal 1.7b**: To facilitate the asymmetric DL sTRP/UL mTRP deployment scenario, study whether/how to support a mixed TCI mode of joint TCI state + UL TCI state for FR1 and FR2 additionally:

* In the mixed TCI mode: a joint TCI state + a UL TCI state can be mapped to a TCI field codepoint, and the indicated UL TCI state is applied on UL transmission towards the UL TRP.

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| **Company**  | **Comments** |
| Mod00 | Please share your views/inputs on the issues 1.xRe 1.4b: Samsung commented that 1.4b needs more discussion because they think Type 3 PHR is reported for CC without PUSCH-config and the case of CC without PUSCH-Config is not valid for this UL TRP scenario. I would like to hear your views on this.Re 1.7a: slightly wording. I guess no one comments that the proposal 7.1a is wrong technically and the only concern is whether this conclusion is needed. Some companies did propose to make it clear.Re 1.7b: the views diverged. I think we can conclude to first study this mixed TCI mode for the current moment.  |
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## Closed-loop PC for SRS

**Proposal 2.1**: Support to use DCI format 1\_1 and 0\_1 to indicate TPC command for SRS CLPC adjustment states of Rel19:

* FFS the detailed DCI field design, e.g., introduce 1-bit state indicator and 2-bit TPC command, DCI format 1\_1 without DL assignment.

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| **Company**  | **Comments** |
| Mod00 | Please share your views/inputs on the issues 2.1 |
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## Others

**Proposal 3.1**: To fulfil the asymmetric DL sTRP/UL mTRP deployment scenarios, support two TAs for single DCI based multi-TRP/panel and single TRP.

* Reuse Rel-18 specification of two TA for multi-DCI based multi-TRP/panel and remove the restriction that *coresetPoolIndex* needs to be configured.

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| **Company**  | **Comments** |
| Mod00 | Please share your views/inputs on the issues 3.1 |
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# Proposals for Online Discussion

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# Contributions in RAN1#117

1. R1-2403849 Discussion on Rel-19 Asymmetric mTRP Operation InterDigital, Inc.
2. R1-2403903 Enhancement for asymmetric DL sTRP/UL mTRP scenarios MediaTek Inc.
3. R1-2403947 Enhancements for asymmetric DL sTRP/UL mTRP scenarios Huawei, HiSilicon
4. R1-2403984 Enhancements for asymmetric DL/UL scenarios Intel Corporation
5. R1-2404022 Enhancements for asymmetric DL sTRP/UL mTRP scenarios Spreadtrum Communications
6. R1-2404111 Views on Rel-19 asymmetric DL sTRP/UL mTRP scenarios Samsung
7. R1-2404173 Discussion on asymmetric DL sTRP/UL mTRP scenarios vivo
8. R1-2404242 Discussion on enhancements for asymmetric DL sTRP/UL mTRP scenarios ZTE, China Telecom
9. R1-2404280 Enhancements for asymmetric DL sTRP/UL mTRP Apple
10. R1-2404339 Enhancement for asymmetric DL sTRP/UL mTRP scenarios Lenovo
11. R1-2404397 Views on asymmetric DL sTRP/UL mTRP scenarios CATT
12. R1-2404424 Discussion on enhancements for asymmetric DL sTRP/UL mTRP scenarios China Telecom, ZTE
13. R1-2404452 Discussion on enhancement for asymmetric DL sTRP/UL mTRP scenarios CMCC
14. R1-2404476 "Enhancement for Asymmetric DL sTRP/UL mTRP Scenarios " Panasonic
15. R1-2404496 Enhancement for asymmetric DL sTRP/UL mTRP scenarios Sony
16. R1-2404532 Enhancement for asymmetric DL sTRP UL mTRP scenarios Ericsson
17. R1-2404553 Discussions on asymmetric DL sTRP/UL mTRP scenarios LG Electronics
18. R1-2404568 Discussion on asymmetric DL sTRP/UL mTRP scenarios TCL
19. R1-2404590 Discussion on UL-only mTRP operation Fujitsu
20. R1-2404614 Discussion on enhancement for asymmetric DL sTRP/UL mTRP scenarios Xiaomi
21. R1-2404658 Discussion on enhancements for asymmetric DL sTRP and UL mTRP scenarios NEC
22. R1-2404771 Discussion on asymmetric DL sTRP and UL mTRP operation ETRI
23. R1-2404815 Discussion on enhancements for asymmetric DL sTRP/UL mTRP scenarios Transsion Holdings
24. R1-2404885 Enhancements on asymmetric DL sTRP/UL mTRP scenarios OPPO
25. R1-2404921 Enhancement for asymmetric DL sTRP/UL mTRP scenarios Nokia
26. R1-2404973 Enhancement for asymmetric DL sTRP/UL mTRP scenarios Sharp
27. R1-2405038 Discussion on enhancement for asymmetric DL sTRP/UL mTRP scenarios NTT DOCOMO, INC.
28. R1-2405151 Enhancement for asymmetric DL sTRP and UL mTRP deployment scenarios Qualcomm Incorporated
29. R1-2405188 Discussion on asymmetric DL sTRP and UL mTRP ASUSTeK
30. R1-2405272 Discussion on enhancement for asymmetric DL sTRP and UL mTRP scenarios Google