**3GPP TSG RAN WG1 #117 DRAFT R1-** **2405450**

**Fukuoka, Japan, May 20th – 24th, 2024**

**Agenda item:** 5

**Source:** Moderator (MediaTek Inc.)

**Title:** Moderator summary of reply RAN2 LS on type 3 PH value for the serving cell configured with mTRP

**Document for:** Discussion and Decision

# Introduction

This summary discusses the LS (R1-2403828) from RAN2, where the content of the LS is copied below:

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| **1. Overall Description:****Rel-17 PHR for mTRP PUSCH Repetition**In Rel-17, it is confirmed by RAN1 that UE can provide either one type 3 PH value or two type 1 PH values for a serving cell configured with mTRP PUSCH repetition in the Enhanced Multiple Entry PHR for multiple TRP MAC CE according to the LS (R1-2208224) as shown in below.

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| **Answer to question 5:**There is no consensus in RAN1 if the current specification is sufficient for UL power control and if further flexibility, such as case c, is needed.**Question 6**1. Does RAN2 have correct understanding for PH report, i.e.:
	1. the UE provides two Type 1 PH value for the serving cell if there is actual or reference PUSCH transmission on both TRP for slot n.
	2. the UE provides one Type 3 PH value for the serving cell if there is actual or reference SRS transmission for slot n.
2. If a) is correct, in which case will the UE report type 3 PH value for this serving cell?

**Answer to question 6:**(a). Yes, RAN2 understanding is correct.(b). For type 3 PH value determination, **legacy procedure** applies. |

However, regarding the answer (b), RAN2 still has not any clues about the ‘legacy procedure’ by which UE shall report one type 3 PH value instead of two type 1 PH values for a serving cell that is configured with mTRP PUSCH repetition. In this sense, RAN2 kindly ask RAN1 to reconsider and answer the below questions about Enhanced Multiple Entry PHR for multiple TRP MAC CE for Rel-17 mTRP PUSCH repetition:1. Whether UE can provide one type 3 PH value instead of two type 1 PH values for a serving cell that is configured with mTRP PUSCH repetition?
2. If answer to a) is yes, in which case will the UE report the type 3 PH value for this serving cell, and in which case will the UE report two Type 1 PH values for this serving cell.

**R18 PHR for STx2P**Besides, RAN2 is also working on the Enhanced Multiple Entry PHR for multiple TRP STx2P MAC CE for R18 STx2P, according to the agreements from RAN 1, only Type 1 PH values are mentioned in the agreement:

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| **Agreement in RAN1#114**On unified TCI framework extension for S-DCI based MTRP, if *twoPHRMode* is configured, and two SRS resource sets for CB/NCB and *multipanelScheme* for SDM/SFN are configured:* If the UE determines that **one or both Type 1 PHRs** are based on an actual PUSCH transmission
	+ If the actual PUSCH transmission applies both first and second indicated joint/UL TCI states, the UE provides the first {power headroom, configured maximum output power} associated with the first indicated joint/UL TCI state for the actual PUSCH transmission, and the second {power headroom, configured maximum output power} associated with the second indicated joint/UL TCI state for the actual PUSCH transmission
	+ If the actual PUSCH transmission applies only the first indicated joint/UL TCI state, the UE provides the first {power headroom, configured maximum output power} associated with the first indicated joint/UL TCI state for the actual PUSCH transmission
		- FFS: How to provide the second report for a reference PUSCH transmission?
	+ If the actual PUSCH transmission applies only the second indicated joint/UL TCI state, the UE provides the second {power headroom, configured maximum output power} associated with the second indicated joint/UL TCI state for the actual PUSCH transmission
		- FFS: How to provide the first report for a reference PUSCH transmission?
* FFS: If the UE determines that both Type 1 PHRs are based on reference PUSCH transmissions, how to provide the first and second reports for reference PUSCH transmissions, respectively?

 **Agreement** (RAN1 #114bis)On unified TCI framework extension for S-DCI based MTRP, if *twoPHRMode* is configured, and two SRS resource sets for CB/NCB and *multipanelScheme* for SDM/SFN are configured:* If the UE determines that only one Type 1 PHR is based on an actual PUSCH transmission
	+ If the actual PUSCH transmission applies only the first indicated joint/UL TCI state, the UE provides the second {power headroom, configured max output power} associated with the second indicated joint/UL TCI state for a reference PUSCH transmission
	+ If the actual PUSCH transmission applies only the second indicated joint/UL TCI state, the UE provides the first {power headroom, configured max output power} associated with the first indicated joint/UL TCI state for a reference PUSCH transmission
* If the UE determines that both Type 1 PHRs are based on reference PUSCH transmissions, the UE provides the first {power headroom, configured max output power} associated with the first indicated joint/UL TCI state for a reference PUSCH transmission, and the second {power headroom, configured max output power} associated with the second indicated joint/UL TCI state for another reference PUSCH transmission
* FFS: Whether the configured max output power reported in above cases is per UE or per panel or both

 **RAN1#115 Conclusion**There is no consensus in RAN1 to support the report of P-MPR for unified TCI framework extension for S-DCI based MTRP, if *twoPHRMode* is configured, and two SRS resource sets for CB/NCB and *multipanelScheme* for SDM/SFN are configured. |

As a result, the same type 3 PH value issue is also encountered in RAN2 for Rel-18 STx2P as same as Rel-17 mTRP PUSCH Repetition. RAN2 would like to ask the questions about the Enhanced Multiple Entry PHR for multiple TRP STx2P MAC CE for Rel-18 STx2P:1. Whether UE can provide one type 3 PH value with one Pcmax instead of two type 1 PH values with two Pcmax for a serving cell that is configured with *multipanelSchemeSDM* or *multipanelSchemeSFN*?
2. If answer to c) is yes, in which case will the UE provide type 3 PH value with one Pcmax for this serving cell, in which case will the UE provides two type 1 PH values with two Pcmax for this serving cell.

**2. Actions:****To RAN WG1****ACTION:** RAN2 respectfully asks RAN1 to answer above questions in order to give RAN2 a clear guidance about the PHR/PHR MAC CE design for both R17 mTRP PUSCH repetition and R18 STx2P.  |

# Discussion

RAN2 ask two questions about Enhanced Multiple Entry PHR for multiple TRP MAC CE for Rel-17 mTRP PUSCH repetition:

**Question a:** Whether UE can provide one type 3 PH value instead of two type 1 PH values for a serving cell that is configured with mTRP PUSCH repetition?

**Question b:** If answer to **Question a** is yes, in which case will the UE report the type 3 PH value for this serving cell, and in which case will the UE report two Type 1 PH values for this serving cell.

Based on offline discussion [1] and contributions [2]-[16], two cases for a serving cell configured with single UL carrier and two UL carriers need to be considered for Question a.

**Case 1**: For a serving cell configured with single UL carrier, according to current RAN1 specification, Type3 PHR is provided to a carrier of a serving cell if PUSCH transmissions are not configured, but it is not reasonable to configure Rel-17 mTRP PUSCH repetition on the serving cell w/o PUSCH transmissions. Even there is no RAN1 agreement on RAN1 doesn’t have corresponding agreement, it should be fine to clarify the RAN1 understanding to specification to RAN2. In summary, the answers is “No” for this case.

In summary, my recommendation to the draft answers to **Question a** and **Question b** would be:

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| RAN2 ask RAN1 questions about Enhanced Multiple Entry PHR for multiple TRP MAC CE for Rel-17 mTRP PUSCH repetition:**Question a:** Whether UE can provide one type 3 PH value instead of two type 1 PH values for a serving cell that is configured with mTRP PUSCH repetition?**Draft Answer on Question a:** According to current RAN1 specification, for a serving cell configured with mTRP PUSCH repetition and configured with a single UL carrier, the UE cannot provide one type 3 PH value instead of two type 1 PH values for the serving cell. For a serving cell configured with mTRP PUSCH repetition and configured with two UL carriers, TBD.**Question b:** If answer to **Question a** is yes, in which case will the UE report the type 3 PH value for this serving cell, and in which case will the UE report two Type 1 PH values for this serving cell. |

**Case 2**: For a serving cell configured with two UL carriers, based on offline discussion [1], companies have different understanding to current RAN1 specification as follows:

* Option 1: Current RAN1 specification doesn’t support Case 2
	+ Support/fine: MTK, Google, Huawei, ZTE, OPPO, Nokia, Xiaomi
* Option 2: Agree with that current RAN1 specification doesn’t support Case 2, but RAN1 can discuss this issue and provide a solution to RAN2 (this may cause specification change)
	+ Support/fine: Docomo, vivo, CATT
* Option 3: Current RAN1 specification already supports Case 2
	+ Support/fine: Ericsson, Apple

Note that Option 2 will cause impact to current RAN1 specification for this case. If we go with Option 2, introduction of CR would be necessary, e.g., based on R1-2404365.

I’d like to check on companies’ views on the following alternatives for Case 2 to response to **Question a**. Please provide your preference on the following alternatives:

* Alt1: Clarify that current RAN1 specification doesn’t support Case 2
* Alt2: Introduce a CR for Case 2, and provide the answer to RAN2 based on the agreed CR.

In current TS 38.213, the UE shall provide two Type1 power headroom reports (i.e., two Type1 power headroom values) when *twoPHRmode* is configured. However, current TS 38.213 for handling Type1 and Type3 power headroom reports is conditioned on only one Type1 power headroom report.

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| **7.7.1 Type 1 PH report**…If a UE is provided *twoPHRMode*, and is provided two SRS resource sets in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with *usage* set to 'codebook' or 'nonCodebook' on active UL BWP$b$ of carrier $f$ of serving cell $c$, the UE provides two Type 1 power headroom reports in a slot $n$, where… |

Potential CR could be:

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| 7.7 Power headroom report-------------------------------------------Unchanged parts are omitted-----------------------------------------If a UE - is configured with two UL carriers for a serving cell, and - determines at least a Type 1 power headroom report and a Type 3 power headroom report for the serving cell the UE- provides the Type 1 power headroom report(s) if all the Type 1 and Type 3 power headroom reports are based on respective actual transmissions or on respective reference transmissions - provides the Type 1 power headroom report(s) if any of the Type 1 power headroom report(s) is based on respective actual transmission- provides the Type 3 power headroom report if the Type 3 report is based on a respective actual transmission and all the Type 1 power headroom report(s) is based on respective reference transmission-------------------------------------------Unchanged parts are omitted-------------------------------- |

* Alt3: Clarify that current RAN1 specification already supports Case 2

Table 1-1 Company inputs to Question a and b and corresponding draft answers

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| **Company** | **Input** |
| Samsung | We are fine with the draft answer for case 1 (i.e., a single UL carrier in a serving cell). Regarding case 2, our view is Alt1, since it clearly describes current RAN1 specification. Regarding Alt2, we don’t see any necessity on introducing a new rule for switching either two Type 1 PHRs or one Type 3 PHR. |
| QC | We are fine with the answer for Case 1. For Case 2, our view is Alt.3, i.e., current spec already support case 2 based on the following:

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| If a UE - is configured with two UL carriers for a serving cell, and - determines a Type 1 power headroom report and a Type 3 power headroom report for the serving cell the UE - provides the Type 1 power headroom report if both the Type 1 and Type 3 power headroom reports are based on respective actual transmissions or on respective reference transmissions - provides the power headroom report that is based on a respective actual transmission if either the Type 1 report or the Type 3 report is based on a respective reference transmission |

In this case, the UE provides Type-3 PHR when both Type-1 PHRs are based on reference transmissions and Type-3 PHR is based on actual transmission. Otherwise, the UE provides Type-1 PHR. |
| vivo | Support the draft answer for case 1. For Case 2, we prefer Alt2. Current specification cannot support case 2. |
| Ericsson | We are fine with the reply to case 1. We also reviewed the paragraph that Qualcomm quotes and came to the conclusion that the UE in general supports the case where it provides one Type 3 report instead of one Type 1 report. Also, the RAN1 discussion never meant to exclude the case where the UE sends a Type 3 PHR, which is indicated by the response to R1-2208224:(b). For type 3 PH value determination, **legacy procedure** applies.Legacy procedures describe that the a Type3 PHR can be sent, so the answer indicates that it is possible.The only possible issue with the quoted text is that is discussed “a” Type 1 PHR, whereas other parts of the RAN1 specification talks about two PHR: If a UE is provided *twoPHRMode*, and is provided two SRS resource sets in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with *usage* set to 'codebook' or 'nonCodebook' on active UL BWP$b$ of carrier $f$ of serving cell $c$, the UE provides two Type 1 power headroom reports in a slot $n$, where …However, in reality the UE never provides two Type1 headroom reports in a slot, as described in 38.321:Thus, 38.321 describes one report, which include two PH values. With the understanding that the UE always provide one report, which may contain multiple PH values, there is no issue with the paragraph that Qualcomm quoted. If we also align 38.213 with the description in 38.321, we remove any uncertainty. Such alignment would be to change “two PHR reports” to “one PHR report with two PH values”, for example: If a UE is provided *twoPHRMode*, and is provided two SRS resource sets in *srs-ResourceSetToAddModList* or *srs-ResourceSetToAddModListDCI-0-2* with *usage* set to 'codebook' or 'nonCodebook' on active UL BWP$b$ of carrier $f$ of serving cell $c$, the UE provides one Type 1 power headroom report with two power headrooms in a slot $n$, where…In addition, we need to make the following changes in 7.7.1:* first Type 1 power headroom report -> first Type 1 power headroom (6 places)
* second Type 1 power headroom report -> second Type 1 power headroom (10 places)

With these changes, there should not be any unclarity that the specification supports the case that the UE provides a Type 3 PHR in some cases, also for mTRP PUSCH repetition. |
| OPPO | After reviewing the description in 38.213, we intend to agree with QC that the current spec. can already cover the case. Since the PUSCH repetitions are scheduled by the same DCI, there is no the case that one type 1 PH is based actual transmission and the other based on reference transmission. In this case, the UE provides Type-3 PH value only when both Type-1 PH values are based on reference transmissions and Type-3 PH value is based on actual transmission (That is what we have in the spec. ). |
| Huawei, Hisilicon | For Case 1, support the draft answer.For Case 2, fine with alt 1. |
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RAN2 also ask two questions about the Enhanced Multiple Entry PHR for multiple TRP STx2P MAC CE for Rel-18 STx2P:

**Question c:** Whether UE can provide one type 3 PH value with one Pcmax instead of two type 1 PH values with two Pcmax for a serving cell that is configured with *multipanelSchemeSDM* or *multipanelSchemeSFN*?

**Question d:** If answer to **Question c** is yes, in which case will the UE provide type 3 PH value with one Pcmax for this serving cell, in which case will the UE provides two type 1 PH values with two Pcmax for this serving cell.

Based on offline discussion [1] and contributions [2]-[16], it seems there is common understanding that there is no need to report Type3 PHR for a serving cell configured with *multipanelSchemeSDM* or *multipanelSchemeSFN.* Thus, the answers to Question c is “No”.

In summary, my recommendation to the draft answers to **Question c** and **Question d** would be:

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| RAN2 ask questions about the Enhanced Multiple Entry PHR for multiple TRP STx2P MAC CE for Rel-18 STx2P:**Question c:** Whether UE can provide one type 3 PH value with one Pcmax instead of two type 1 PH values with two Pcmax for a serving cell that is configured with *multipanelSchemeSDM* or *multipanelSchemeSFN*?**Draft Answer on Question c:** No**Question d:** If answer to **Question c** is yes, in which case will the UE provide type 3 PH value with one Pcmax for this serving cell, in which case will the UE provides two type 1 PH values with two Pcmax for this serving cell. |

Table 1-2 Company inputs to Question c and d and corresponding draft answers

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| **Company** | **Input** |
| Samsung | We are fine with the draft LS response. |
| QC | We are fine with the answer to Question c and Question d. |
| vivo | OK with the draft answer. |
| OPPO | Fine with the answer |
| Huawei, Hisilicon | Support the Draft answer. |
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# Conclusion

TBD

# References

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| 1 | R1- 2405400 | Summary of offline discussion on reply RAN2 LS on type 3 PH value for the serving cell configured with mTRP | Moderator (MediaTek Inc.) |
| 2 | R1-2404012 | Discussion on LS on type 3 PH value for the serving cell configured with mTRP | Spreadtrum Communications |
| 3 | R1-2404063 | Draft reply LS on type 3 PH value for the serving cell configured with mTRP | Samsung |
| 4 | R1-2404144 | Discussion on LS on type 3 PH value for the serving cell configured with mTRP | vivo |
| 5 | R1-2404243 | Discussion on type 3 PH value for the serving cell configured with mTRP | ZTE |
| 6 | R1-2404244 | Draft reply LS on type 3 PH value for the serving cell configured with mTRP | ZTE |
| 7 | R1-2404268 | Draft Reply LS type 3 PH value for the serving cell configured with mTRP | Apple |
| 8 | R1-2404341 | Reply LS on Type 3 PH Value for the Serving Cell Configured with mTRP | Lenovo |
| 9 | R1-2404350 | Draft reply LS on Type3 PH value for the serving cell configured with mTRP | MediaTek Inc. |
| 10 | R1-2404354 | Discussion on reply RAN2 LS on type 3 PH value for the serving cell configured with mTRP | CATT |
| 11 | R1-2404355 | Draft reply LS on type 3 PH value for the serving cell configured with mTRP | CATT |
| 12 | R1-2404679 | Draft Reply LS on type 3 PH value for the serving cell configured with mTRP | Google |
| 13 | R1-2404755 | Discussion of LS on type 3 PH value for the serving cell configured with mTRP | Ericsson |
| 14 | R1-2404826 | Discussion on LS on type 3 PH value for the serving cell configured with mTRP | OPPO |
| 15 | R1-2405330 | Discussion on type 3 PH value for the serving cell configured with mTRP | Huawei, HiSilicon |
| 16 | R1-2405186 | Discussion on RAN2 LS regarding type 3 PHR | ASUSTeK |