**3GPP TSG RAN WG1 #100b R1-200xxxx**

**e-Meeting, April 20th – 30th, 2020**

**Agenda item:** 7.2.6.3.

**Source:** Moderator (LG Electronics)

**Title:** Summary of email thread [100b-e-NR-eMIMO-MB1-01]

**Document for:** Discussion and Decision

# Introduction

This contribution summaries discussion in email thread [100b-e-NR-eMIMO-MB1-01]

# Background and Summary of Proposal

In RAN1#100-e, there were agreements that could not be captured in specification yet.

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| **Outcome of email thread [100e-NR-eMIMO-MB-01]****Agreement**The application timing for the newly activated PL RSs is the next slot that is 2ms after the N-th measurement sample, where the 1st measurement sample corresponds to be the 1st instance, 3ms after sending ACK for the MAC CE.* Note: The value of N can be discussed in UE feature session. If there is no consensus on introducing UE capability for the value of N, N is fixed to 5.
* The application timing is applied to PUSCH, AP/SP-SRS and PUCCH.
* Note: Whether/how to capture above in RAN1 specification or send an LS to other WGs to suggest them to update their specifications accordingly will be decided in the next meeting.

**Agreement**The following WA is confirmed with modifications (changes are marked by red):Pathloss reference RS for PUSCH can be activated/updated via a MAC CE* The MAC CE message can activate/update the value of*PUSCH-PathlossReferenceRS-Id* corresponding to *sri-PUSCH-PowerControlId*.
* Further signaling details are up to RAN2.
* Reuse higher layer filtered RSRP for pathloss measurement, with defining the applicable timing after the MAC CE.
	+ Filtered RSRP value for previous pathloss RS will be used before the application time, which is the next slot that is 2ms after theN~~5~~th measurement sample, where the 1st measurement sample corresponds to be the 1st instance, 3ms after sending ACK for the MAC CE.
		- This is only applicable for UEs supporting the number of RRC-configurable pathloss RSs larger than 4, and this is only for the case that the activated PL RS by the MAC CE is not tracked.
		- UE is only required to track the activated PL RS(s) if the configured PL RSs by RRC is greater than 4.
		- It is up to UE whether to update the filtered RSRP value for previous PL RS 3ms after sending ACK for the MAC CE.
		- Note: The value of N can be discussed in UE feature session. If there is no consensus on introducing UE capability for the value of N, N is fixed to 5.
* ~~Send an LS to RAN4 asking opinion on this working assumption.~~ Note: Whether/how to capture above in RAN1 specification or send an LS to other WGs to suggest them to update their specifications accordingly will be decided in the next meeting.

**Agreement**The following WA is confirmed with modifications (changes are marked by red):Pathloss reference RS for AP-SRS/SP-SRS can be activated/updated via a MAC CE.* A UE can be configured with multiple pathloss RSs by RRC and one of them can be activated/updated via the MAC CE for a SRS resource set.
* Further signaling details are up to RAN2.
* Reuse higher layer filtered RSRP for pathloss measurement, with defining the applicable timing after the MAC CE.
	+ Filtered RSRP value for previous pathloss RS will be used before the application time, which is the next slot that is 2ms after theN~~5~~th measurement sample, where the 1st measurement sample corresponds to be the 1st instance, 3ms after sending ACK for the MAC CE.
		- This is only applicable for UEs supporting the number of RRC-configurable pathloss RSs larger than 4, and this is only for the case that the activated PL RS by the MAC CE is not tracked.
		- UE is only required to track the activated PL RS(s) if the configured PL RSs by RRC is greater than 4.
		- It is up to UE whether to update the filtered RSRP value for previous PL RS 3ms after sending ACK for the MAC CE.
		- Note: The value of N can be discussed in UE feature session. If there is no consensus on introducing UE capability for the value of N, N is fixed to 5.
* ~~Send an LS to RAN4 asking opinion on this working assumption.~~ Note: Whether/how to capture above in RAN1 specification or send an LS to other WGs to suggest them to update their specifications accordingly will be decided in the next meeting.

**Outcome of email thread [100e-NR-eMIMO-MB-02]****Agreement:**When the number of RRC configured PL RSs for pathloss estimates for PUCCH, PUSCH and SRS is greater than 4, UE is not required to track the RSs which are not activated by MAC-CE.* Note: How to capture above into the spec will be discussed at RAN1#100bis.
* Note: Further consider the configuration cases when the default PL RS is not enabled or enabled.

**Conclusion:**If MAC-CE based PL RS activation/update is not enabled, UE is not expected to be configured with more than 4 PL RS. |

For the agreements related to the application timing of the newly activated PL RSs, 8 tdocs proposed to capture them in RAN1 specification while 2 tdocs proposed not to capture them in RAN1 specification. For this issue, further discussion seem to be needed.

* Alt1. Capture the agreements in RAN1 specification
	+ Huawei/HiSilicon(Proposal1), ZTE(Proposal1), vivo(Proposal3), OPPO(Proposal1), LGE(Proposal1/2), CMCC(Proposal6), Apple(Proposal2), Qualcomm(Proposal9)
* Alt2. Do not capture the agreements in RAN1 specification
	+ Ericsson/Nokia(Proposal1), Nokia/NSB(Proposal1~3)

Main concern for Alt1 is summarized as below:

* The motivation for the delay related to measurement samples is to improve accuracy of the RSRP measurement used for power control, and properties related to measurement accuracy are belong to RAN4’s scope, not RAN1’s scope.

Main concern for Alt2 is summarized as below:

* Capturing the application timing is important to align timing between gNB and UE, and RAN4 already sent an LS to RAN1 to capture the application timing in RAN1 specification, therefore, going to Alt2 will only delay the progress.

For Alt1, a converged TP were discussed before the meeting based on RAN1 chairman’s guidance, captured below:

TP#1:

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| 7 Uplink Power controlUplink power control determines a power for PUSCH, PUCCH, SRS, and PRACH transmissions. A UE does not expect to simultaneously maintain more than four pathloss estimates per serving cell for all PUSCH/PUCCH/SRS transmissions as described in Clauses 7.1.1, 7.2.1, and 7.3.1, except for SRS transmissions configured by IE *SRS-Positioning-Config* as described in Clause 7.3.1.If the RS resource for pathloss estimation for PUSCH, PUCCH or SRS is updated by MAC CE as described in Clause 7.1.1, 7.2.1 and 7.3.1, respectively,- if the updated RS resource is one of the RS resources being tracked for pathloss estimation for PUSCH/PUCCH/SRS, UE shall apply the RS resource for pathloss estimation starting from the first slot that is after slot where is the slot where the UE would transmit a PUCCH or PUSCH with HARQ-ACK information for the PDSCH providing the MAC CE and is the SCS configuration for the PUCCH or PUSCH*.*- Otherwise, UE shall apply the RS resource for pathloss estimate starting from the first slot that is 2ms after slot, where is the time for [N]th measurement sample of the RS resource, as described in [10, TS 38.133].--------------- Unchanged parts omitted ------------- |

For the agreement related to the PL RS tracking when the number of RRC configured PL RSs is greater than 4, 5 tdocs were submitted with corresponding TPs:

- Huawei/HiSilicon(Proposal2), ZTE(TP2), vivo(Proposal1), OPPO(Proposal1), LGE(Proposal3)

A converged TP were discussed before the meeting based on RAN1 chairman’s guidance, captured below:

TP#2:

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| 7 Uplink Power controlUplink power control determines a power for PUSCH, PUCCH, SRS, and PRACH transmissions. A UE does not expect to simultaneously maintain more than four pathloss estimates per serving cell for all PUSCH/PUCCH/SRS transmissions as described in Clauses 7.1.1, 7.2.1, and 7.3.1, except for SRS transmissions configured by IE *SRS-Positioning-Config* as described in Clause 7.3.1. If the number of RS resources configured by RRC for pathloss estimation for PUCCH, PUSCH and SRS is greater than 4, UE is not required to track the RS resources which are not activated by MAC-CE for the uplink channels and signals where the MAC-CE based activation of the RS resources for pathloss estimation is applicable as described in Clause 7.1.1, 7.2.1 and 7.3.1.--------------- Unchanged parts omitted ------------- |

# Discussion

Based on the identified issues/alternatives summarized in section 2, companies are encouraged to provide their views on the following questions (TP#1 and TP#2 are in Section2).

Q1: For the agreement on the application timing of the newly activated PL RSs,

* Alt1: Endorse TP#1
* Alt2: Do not endorse TP#1 and send an LS to RAN4 to inform the outcome of RAN1.

Q2: For the agreement on the PL RS tracking when the number of RRC configured PL RSs is greater than four, do you agree to endorse TP#2?

**Companies’ view (to be updated)**

|  |  |
| --- | --- |
| Company name | View |
| CATT | Q1: No strong view whether to capture in RAN1 spec, however we have a comment on TP1. “UE shall apply the RS resource for pathloss estimation staring from…” is not entirely accurate in our view and our understanding is that the *pathloss estimation result* is to be applied for uplink starting from slot n+3+k. Pathloss estimation itself starts earlier, otherwise the N symbol delay is not necessary. Therefore a suggested rewording is that “UE shall apply the pathloss estimation on the RS resources starting from …”Q2: Fine.  |
| ZTE | Q1: Alt1: Endorse TP#1. We are fine with CATT’s update.Q2: Endorse TP#2.Besides, considering that we have received the clear message of specifying the timing of applying new PL estimate in RAN1 spec according to RAN4 LS, we do NOT support to resend any further LS that this timing should be specified in RAN4 rather than RAN1. The ping-pong LS(s) should be avoided herein. |
| Ericsson | Q1: Alt 2. Do not capture TP#1.Q2: Endorse TP#2 |
| Apple | Q1: In the first sub-bullet, we think the “being tracked” should be “configured”. We think currently it is premature to capture the second sub-bullet since it is incomplete.Q2: We think there may be some problems for the sentence. The gNB may configure some pathloss RS by MAC CE, and configure some other pathloss RS by RRC. Besides, there should be some default pathloss RS to be tracked.  |
| Samsung | Q1: Alt 2 but no need to send reply LS to RAN4.Q2: OK. |
| CMCC | Q1: Endorse TP#1.Q2: Endorse TP#2. |
| MediaTek | Q1: Endorse TP#1.Q2: Endorse TP#2. |
| Nokia/NSB | Q1: Alt. 2. Do not capture TP#1, but neither send LS to RAN4. For the companies supporting Alt 1, we would kindly ask to check the status with RAN4. In our perspective, RAN1’s agreement is not actually aligned with RAN4’s current specification.Q2: Not support TP #2 as it as. AS we discussed in 100-e, UE operation is not clesar if default PL-RS is enabled. Endorse of TP#2 should rely on the decision of MB1-02, which handles the UE operation with default PL-RS. |
| Intel | Q1: Slight preference to Alt 2 to make RAN1 spec more future proof for possible enhancements / changes in RAN4.Q2: Consider capturing this in UE feature specification similar to tracking requirements for active TCI and spatial relation.  |
| OPPO | Q1: slightly prefer to endorse TP1Q2: TP#2 shall include the default pathloss RS too, i.e., the number of the pathloss RS the UE track simultaneously shall be bounded, for example, 4.  |
| DOCOMO | Q1: Alt 2. We don’t support to capture TP#1 in RAN1 spec. We think it is RAN4’s responsibility to capture the application timing, if RAN4 thinks needed. Also, RAN1 didn’t consider every aspect of RAN4 spec. (e.g. known/unknown TCI-state, which is different from RAN4’s understanding). Q2: Agree to endorse TP#2 |
| vivo | Q2: Agree to endorse TP#2. |
| Sony | Q1: we are fine to endorse TP#1, assuming RAN4 already sent clear message for RAN1 to capture it.Q2: Not good time to endorse TP#2 by now. When more than 4 PL RS configured but not activated by MAC CE yet, the UE behavior may be impacted by default PL RS as well. Current TP#2 seems to exclude the case when default PL RS applies.  |
| LGE | Q1: Support Alt1 to endorse TP#1.Q2: Agree to endorse TP#2 |
| Fraunhofer | Q1: Alt1 – Endorse TP#1Q2: TP#2 may require input from MB1-02 thread as default pathloss RS tracking is not discussed. |
| Lenovo/MOT | Q1: Support Alt.1Q2: Agree to endorse TP#2 |
| Huawei, HiSilicon | Q1: Support Alt1/TP#1 and refined wording from CATT. Given that the previous reply LS from RAN4 clearly indicated to capture this timing in RAN1 specs, we do not think Alt2 is a valid alternative. We think the proposal of not capturing the agreements and not sending LS to RAN4 is not being constructive. Q2: Support TP#2. In our view, the existing agreements should be captured first, while further considerations if agreed can be incorporated later.  |
| Qualcomm | Q1: Support TP1 except that it should remove or at least have a bracket on “, as described in [10, TS 38.133]”, since the N samples for the T\_pathloss may be described in UE capability spec or even RAN1 spec, while RAN4 already has an agreement for no RAN4 spec impact for MAC-CE based PL RS. Q2: Support to extend TP2 also in case of configured PL RS # < 4, i.e. UE only tracks activated PL RS regardless the configured PL RS # to simplify the behavior. Prefer to remove “If the number of RS resources configured by RRC for pathloss estimation for PUCCH, PUSCH and SRS is greater than 4” in TP2 |

Companies’ views are summarized as below.

For Q1,

* Alt1 is supported by 10 companies (ZTE, CMCC, MediaTek, OPPO, Sony, LGE, Fraunhofer, Lenovo/MOT, Huawei/HiSilicon, Qualcomm)
* Alt2 is supported by 5 companies (Ericsson, Samsung, Nokia/NSB, Intel, DOCOMO)
* Other views: CATT(no strong view), Apple(capture the first sub-bullet only)

Although Alt1 gathers more support than Alt2, further discussion might be helpful on how to address concerns from proponents of Alt2, e.g. by simplifying the texts and referring to other specification. There were proposals for Alt2 not to send an LS to RAN4, but that approach is not aligned with previous RAN1 agreement so I suggest not discussing that approach. Concerns on endorsing TP#1 is summarized below:

* Capturing the application timing is RAN4’s area (from DOCOMO)
* To avoid (potential) mis-alignment between RAN1 spec and RAN4 spec (from Nokia/NSB, Intel)

Regarding suggestions for changing wording of TP#1, CATT’s suggestion seems fine to proponents of Alt1 but Apple’s suggestion may not as it could change the meaning.

For Q2, 11 companies (CATT, ZTE, Ericsson, Samsung, CMCC, MediaTek, DOCOMO, vivo, LGE, Lenovo/MOT, Huawei/HiSilicon) support endorsing TP#2, meanwhile 5 companies (Apple, Nokia/NSB, OPPO, Sony, Fraunhofer) suggested modifying TP#2 to consider the case when default PL RS is enabled. 1 company (Qualcomm) proposed to extend TP#2 to the case when the number of configured PL RSs is equal to or smaller than 4. From procedural perspective, it will not be good if we add other issues here unless they are simple clarification or editorial issues. So, as Huawei proposed, I suggest to endorse TP#2 first, then we may update the text according to further decision of [100b-e-NR-eMIMO-MB1-02] or others.

FL’s suggestion:

* Endorse TP#2
	+ Note: the text can be updated later according to decision of [100b-e-NR-eMIMO-MB1-02] or others.
* For Q1, discuss further on how to address concerns from proponents of Alt2.
	+ Concern#1: Capturing the application timing is RAN4’s responsibility
	+ Concern#2: To avoid (potential) mis-alignment between RAN1 spec and RAN4 spec
	+ Note: TP#1 is slightly revised and captured below.

TP#1(revised by CATT’s suggestion, highlighted by yellow):

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| --- |
| 7 Uplink Power controlUplink power control determines a power for PUSCH, PUCCH, SRS, and PRACH transmissions. A UE does not expect to simultaneously maintain more than four pathloss estimates per serving cell for all PUSCH/PUCCH/SRS transmissions as described in Clauses 7.1.1, 7.2.1, and 7.3.1, except for SRS transmissions configured by IE *SRS-Positioning-Config* as described in Clause 7.3.1.If the RS resource for pathloss estimation for PUSCH, PUCCH or SRS is updated by MAC CE as described in Clause 7.1.1, 7.2.1 and 7.3.1, respectively,- if the updated RS resource is one of the RS resources being tracked for pathloss estimation for PUSCH/PUCCH/SRS, UE shall apply the pathloss estimation on the RS resources starting from the first slot that is after slot where is the slot where the UE would transmit a PUCCH or PUSCH with HARQ-ACK information for the PDSCH providing the MAC CE and is the SCS configuration for the PUCCH or PUSCH*.*- Otherwise, UE shall apply the RS resource for pathloss estimate starting from the first slot that is 2ms after slot, where is the time for [N]th measurement sample of the RS resource, as described in [10, TS 38.133].--------------- Unchanged parts omitted ------------- |

# Conclusion (to be updated)

From the email discussion [100b-e-NR-eMIMO-MB1-01], xxx

# References

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| --- | --- | --- |
| **TDoc** | **Title** | **Source** |
| [**R1-2001564**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2001564.zip) | Remaining issues on multi-beam enhancements in R16 | Huawei, HiSilicon |
| [**R1-2001597**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2001597.zip) | Maintenance of multi-beam operation | ZTE |
| [**R1-2001679**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2001679.zip) | Discussion on remaining issues on multi beam operation | vivo |
| [**R1-2001727**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2001727.zip) | Remaining issues on Multi-beam Operation Enhancement | OPPO |
| [**R1-2001914**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2001914.zip) | Remaining issues on multi beam operation | LG Electronics |
| [**R1-2002213**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002213.zip) | Remaining issues on multi-beam operation | CMCC |
| [**R1-2002295**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002295.zip) | Maintenance of Rel-16 Beam Management | Nokia, Nokia Shanghai Bell |
| [**R1-2002338**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002338.zip) | Remaining issues on beam management enhancement | Apple |
| [**R1-2002498**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002498.zip) | On the timing for pathloss RS activation | Ericsson, Nokia |
| [**R1-2002552**](http://www.3gpp.org/ftp/TSG_RAN/WG1_RL1/TSGR1_100b_e/Docs/R1-2002552.zip) | Enhancements on Multi-beam Operation | Qualcomm Incorporated |