**3GPP TSG-RAN WG2 Meeting #113-eR2-201xxxx**

**Online, 25th Jan – 5th Feb 2021**

**Agenda item:** 8.13.4

**Source:** vivo (Rapporteur)

**Title:** Report of [Post112-e][852][NR R17 SONMDT] R17 L2M enhancement (vivo)

**Document for:** Discussion and Agreement

# 1 Introduction

This is to report the result of the following email discussion after RAN2#112-e meeting [1].

* [Post112-e][852][NR R17 SON/MDT] R17 L2M enhancement (vivo)

Scope: Based on R2-2010985, figure out the majority interest on the proposals and progress on the details if possible.

Intended outcome: Report to next meeting.

Deadline: Long

According to the chair’s guidance, this report will be based on the summary R2-2010985 [2] and try to figure out the majority interest on the proposals. The document consists of phase-1 and phase-2, the deadline of each phase is outlined as follow:

* Phase-1: collecting views on the detailed proposals, deadline: Friday Dec. 11, 2020.
* Phase-2: collecting views on summary proposals, deadline: Friday Jan. 8, 2021

# 2 Contact Information

To make it easier to find the correct contact delegate in each company for potential follow-up questions, the rapporteur encourages the delegates who provide input to provide their contact information in this table:

|  |  |
| --- | --- |
| Company | Contact: Name (E-mail) |
| vivo | Kimba Dit Adamou, Boubacar (kimba@vivo.com) |
| Qualcomm | Rajeev Kumar (rkum@qti.qualcomm.com) |
| OPPO | Xue Lin (linxue@oppo.com) |
| Ericsson | Pradeepa Ramachandra (Pradeepa.ramachandra@ericsson.com) |
| Huawei | Jun Chen (jun.chen@huawei.com) |
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| KDDI | Hiroki TAKEDA(ho-takeda@kddi.com) |
| Nokia | malgorzata.tomala@nokia.com |
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# 4 Phase-2: collecting views on solutions proposed

In this section, we will go through the proposals summaried in Section 3 (Phase-1), and collect companies’ views on the proposed way forwards. **Companies are encouraged to review the summaries in Section 3 (Phase-1) before providing comments below.**

The intention of this section is to find some consensus on the issues and distinguish the agreeable proposals from the ones which may require further discussions.

Proposal 1: Support counting the number of received random access preamble per cell/per SSB separately for 2step RA and 4step RA type.

*Please provide your company’s view on this proposal. In case you are not fine with the proposal, please propose a rewording which moves the discussion forward and promises broad consensus.*

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| --- | --- | --- |
| Company | Agree/Disagree | Detailed Comments |
| vivo | Agree |  |
| Ericsson | Agree |  |
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Proposal 2: L2 measurements for IAB will NOT be introduced in Rel-17 SON/MDT WI, later release can be considered.

*Please provide your company’s view on this proposal. In case you are not fine with the proposal, please propose a rewording which moves the discussion forward and promises broad consensus.*

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| --- | --- | --- |
| Company | Agree/Disagree | Detailed Comments |
| vivo | Agree |  |
| Ericsson | Agree but see comments | We should to remove the part ‘later release can be considered’. Looking into new aspects that are not yet addressed in one release will be discussed in future releases if many companies agree on such a WI and this is just the normal way of working in 3gpp.  So, we should remove that part (‘later release can be considered’).  **Proposal 2: L2 measurements for IAB will NOT be introduced in Rel-17 SON/MDT WI** |
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Proposal 3: RAN2 will NOT enhance the current delay measurement mechanism unless new requirements are proposed.

*Please provide your company’s view on this proposal. In case you are not fine with the proposal, please propose a rewording which moves the discussion forward and promises broad consensus.*

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| --- | --- | --- |
| Company | Agree/Disagree | Detailed Comments |
| vivo | Agree |  |
| Ericsson | Agree in principle but see comments | We should to remove the part ‘unless new requirements are proposed. That is also something we do naturally in each working group i.e., if someone says that the current measurements are not good enough, then one looks into the short coming of such a measurement and if required, we introduce new measurements.  So, we should remove that part (‘unless new requirements are proposed’).  **Proposal 3: RAN2 will NOT enhance the current delay measurement mechanism** |
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Proposal 4: In case split bearer data goes through Xn/X2 interface, the delay over Xn/X2 interface should be taken into account in M6 for split bearers.

*Please provide your company’s view on this proposal. In case you are not fine with the proposal, please propose a rewording which moves the discussion forward and promises broad consensus.*

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| --- | --- | --- |
| Company | Agree/Disagree | Detailed Comments |
| vivo | Agree |  |
| Ericsson | Agree |  |
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Proposal 5: D3 is re-used to reflect the DL delay on F1-U/X2/Xn, D2.3 is re-used to reflect the UL delay on F1-U/X2/Xn, LS to RAN3 for further confirmation.

*Please provide your company’s view on this proposal. In case you are not fine with the proposal, please propose a rewording which moves the discussion forward and promises broad consensus.*

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| --- | --- | --- |
| Company | Agree/Disagree | Detailed Comments |
| vivo | Agree |  |
| Ericsson | Agree |  |
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Proposal 6: The delay over Xn/X2 interface should be taken into account in M6 for MN terminated SCG bearers and SN terminated MCG bearers.

*Please provide your company’s view on this proposal. In case you are not fine with the proposal, please propose a rewording which moves the discussion forward and promises broad consensus.*

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| --- | --- | --- |
| Company | Agree/Disagree | Detailed Comments |
| vivo | Agree |  |
| Ericsson | Agree but see comments | This is applicable only when X2/Xn us used instead of F1-U. So, we propose to include F1-U in the proposal alongwith X2/Xn.  Proposal 6: The delay over Xn/X2/F1-U interface should be taken into account in M6 for MN terminated SCG bearers and SN terminated MCG bearers. |
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Proposal 7: The minimum value between two legs is defined as the total delay measurement M6 over MCG/SCG for split bearers WITH PDCP duplication.

*Please provide your company’s view on this proposal. In case you are not fine with the proposal, please propose a rewording which moves the discussion forward and promises broad consensus.*

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Detailed Comments |
| vivo | Agree |  |
| Ericsson | Agree but see comments | The need for merging all the delays is required only for QoS related reporting to core network. For the immediate MDT, this is not applicable as there is no single node where all the sub delay measurements are aggregated.  Therefore, we propose to change as follows.  Proposal 7: For QoS monitoring related delay reporting to CN, the minimum value between two legs is defined as the total delay measurement M6 over MCG/SCG for split bearers WITH PDCP duplication. |
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Proposal 8: RAN2 to choose one of the following options for the total delay measurement M6 over MCG/SCG for split bearers WITHOUT PDCP duplication.

* Option a: the maximum value between two legs;
* Option b: weighte average (consider the number of packets) over MN and SN;
* Option c: simply by average the values of M6 from MN and M6 from SN;
* Option d: raw data (separate delay in MN and SN);
* Option e: no differentiation.

*Please provide your company’s view on this proposal. In case you are not fine with the proposal, please propose a rewording which moves the discussion forward and promises broad consensus.*

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| --- | --- | --- |
| Company | Agree/Disagree | Detailed Comments |
| vivo | Agree |  |
| Ericsson | Agree but see comments | The need for merging all the delays is required only for QoS related reporting to core network. For the immediate MDT, this is not applicable as there is no single node where all the sub delay measurements are aggregated.  Therefore, we propose to change as follows.  Proposal 8: For QoS monitoring related delay reporting to CN , RAN2 to choose one of the following options for the total delay measurement M6 over MCG/SCG for split bearers WITHOUT PDCP duplication.   * Option a: the maximum value between two legs; * Option b: weighte average (consider the number of packets) over MN and SN; * Option c: simply by average the values of M6 from MN and M6 from SN; * Option d: raw data (separate delay in MN and SN); * Option e: no differentiation. |
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Proposal 9: The delay estimation coordination between MN and SN is needed for split bearers.

*Please provide your company’s view on this proposal. In case you are not fine with the proposal, please propose a rewording which moves the discussion forward and promises broad consensus.*

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| --- | --- | --- |
| Company | Agree/Disagree | Detailed Comments |
| vivo | Agree |  |
| Ericsson | Agree but see comments | The need for merging all the delays is required only for QoS related reporting to core network. For the immediate MDT, this is not applicable as there is no single node where all the sub delay measurements are aggregated.  Therefore, we propose to change as follows.  Proposal 9: For QoS monitoring related delay reporting to CN, the delay estimation coordination between MN and SN is needed for split bearers. |
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Proposal 10: The delay estimation coordination between MN and SN is needed for MN terminated SCG bearers and SN terminated MCG bearers.

*Please provide your company’s view on this proposal. In case you are not fine with the proposal, please propose a rewording which moves the discussion forward and promises broad consensus.*

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| --- | --- | --- |
| Company | Agree/Disagree | Detailed Comments |
| vivo | Agree |  |
| Ericsson | Agree but see comments | The need for merging all the delays is required only for QoS related reporting to core network. For the immediate MDT, this is not applicable as there is no single node where all the sub delay measurements are aggregated.  Therefore, we propose to change as follows.  Proposal 10: For QoS monitoring related delay reporting to CN, the delay estimation coordination between MN and SN is needed for MN terminated SCG bearers and SN terminated MCG bearers. |
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# 5 Conclusion

**TBD**

# Annex

# 3 Phase-1: collecting views on the detailed proposals

In this section, we will prioritize the issues brought up in [2] as per the degree of the agreeability of the proposals (i.e., the cat-a/cat-x proposals in [2] will be discussed with high priority, which are addressed by questions Q1-Q4 in this report), so that we may easily reach a consensus on some of the issues and make progress.

## 3.1 Received random access preamble per cell/per SSB for 2-step RACH

The paper R2-2010326 in [2] states that it is beneficial to record the number of preambles received separately for 2step RA type and 4step RA type. By this means, the network can understand the RA request for different RA type, then decide the RA resource configuration appropriately, e.g. how to divide the preamble between 2 RA type or whether to configure separate RO for 2step. As a consequence, the following proposal is made: **support counting the number of received random access preamble per cell/per SSB separately for 2step RA and 4step RA type.**

**Q1: Do you agree to** **support counting the number of received random access preamble per cell/per SSB separately for 2step RA and 4step RA type?**

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| --- | --- | --- |
| Company | Agree/Disagree | Detailed Comments |
| vivo | Agree | We tend to believe the separate parameters for 2-step RA are beneficial for network to pinpoint the specific issues caused by improper configuration. |
| Qualcomm | May be |  |
| OPPO | Agree | It is beneficial for network to analyse the number of users with each type and optimize the RACH configuration correspondingly. |
| Ericsson | Agree |  |
| Huawei, HiSilicon | Agree |  |
| ZTE | Agree | As opponent, we think it is necessary to introduce the RA preamble measurement separately for different RA type otherwise NW cannot decide whether the mismatch between RACH resource and RA attempts is due to improper 4step RA configuration or 2step configuration or both. |
| KDDI | Agree |  |
| Nokia, Nokia Shanghai Bell | Not sure | We were wondering if the existing measurement limits applicability to different RA procedures. In our understanding it may be feasible to apply the metric separately per RA type in an implementation specific way. Not sure if any standard changes to the metric formula are needed |
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**Summary on Q1**

Clearly there is a majority view on supporting the proposal (6 out of 8), so Rapporteur proposes:

1. Support counting the number of received random access preamble per cell/per SSB separately for 2step RA and 4step RA type.

## 3.2 L2 measurements for IAB

As discussed by R2-2009435 in [2], only the number of UEs directly connected to the gNB should be counted, regardless of the number of UE that are served by the IAB-node which connects to the same gNB. Since IAB-node is considered as a network node and can provide service for downstream IAB-nodes and UEs, the rapporteur believes it would be usefull to define a new way of counting the number of active UEs in the case of IAB. Therefore the clarification in TS 38.314 for the exclusion of active UEs connected to IAB-node may be needed. Similar to the measurement for the number of active UEs discussed above, the proposal regarding inactive UEs is also agreeable, therefore we have:

* *TS38.314 clarifies that, for a gNB serving as an IAB-donor, the measurement refers to the number of active/inactive UEs connected directly to the gNB, excluding IAB Nodes (and the UEs connected as child to IAB Nodes).*

**Q2: Do you agree that TS38.314 to** **clarify for a gNB serving as an IAB-donor, the measurement refers to the number of active/inactive UEs connected directly to the gNB, excluding IAB Nodes (and the UEs connected as child to IAB Nodes)?**

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| --- | --- | --- |
| Company | Agree/Disagree | Detailed Comments |
| vivo | Agree |  |
| Qualcomm | May be |  |
| OPPO | Maybe |  |
| Ericson | See comments | We believe that a generic statement can be added in TS 38.314 that states that the measurements captured in this specification is not applicable for scenarios wherein IAB child nodes are involved.  This is not only applicable for active/inactive UEs but also for RA premables, delay measurements etc.  We can discuss the solutions related to the IAB in Rel-18 or in the enhanced IAB WI, if required but not in Rel-17 SON-MDT WI. |
| Huawei, HiSilicon | May be |  |
| ZTE | Maybe not | We understand current specs leave the measurement in IAB scenarios to NW’s implementation, therefore it is preferred to keep the specs as it is now. Unless there are clearly requirement indicating necessity to support IAB measurement in this release, we may postpone the discussion to next release for the consideration on time budget, or as Ericsson suggested to leave it to enhanced IAB WI instead of SON/MDT WI. |
| KDDI | See comments | Basically, we are supportive to have some SON features related to IAB, but we are wondering if RAN2 can work on this area under this WI, since the WID doesn’t mention to IAB. So, before starting detailed discussion, we may want to discuss whether we work on this under this WI, or work under another new WI. |
| Nokia, Nokia Shangai Bell | Agree | As explained in R2-2009435. There could be specific counters for IAB nodes |
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If the answer to Q2 is ‘**Agree**’, then RAN2 might need to discuss whether a new measurement is required for number of IAB-MTs in RRC\_CONNECTED states.

**Q3: Do you agree that RAN2 to discuss if a separate measurement for number of IAB\_MTs RRC\_Connected to serving gNB is needed?**

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| Company | Agree/Disagree | Detailed Comments |
| vivo | Agree | A new measurement for the number of CONNECTED IAB\_MTs is useful. |
| Qualcomm | Disagree | IAB not part of Rel-17 WI, I think we should focus on rel-17 WIs. |
| OPPO | Maybe | The intention is not clear. |
| Ericsson | Disagree | If we start with one measurement, then we have to address all the other measurements as well. So, we do not want to address any IAB specific measurement in Rel-17. |
| Huawei, HiSilicon | Disagree | For this Rel-17 WI, IAB is not included, so the relevant discussions should be low priority. |
| ZTE | Disagree | Please refer to answers in Q2. |
| Nokia, Nokia Shanghai Bell | Agree | As explained in R2-2009435 |
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Further, the following two proposals regarding the inactive state of IAB-nodes are proposed:

* *RAN2 should clarify if IAB MT can be in RRC Inactive mode.*
* *RAN2 can discuss if a separate measurement for number of IAB\_MTs in Inactive\_RRC state is needed.*

As far as the rapporteur is concerned, whether IAB\_MTs can be in Inactive\_RRC state was already discussed in the IAB WI and the following was agreed that:

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| **Agreement from RAN2#110-e meeting [3]**   * R2 think no effort should be spent to standardize extensions to RRC Inactive for IAB. If RRC Inactive is supported by an IAB MT, the operation (beyond what is currently specified) is completely up to implementation. |

Therefore, the rapporteur tends to believe that there is no need to discuss the RRC\_INACTIVE state for IAB further, as a consequence, the number of inactive IAB-nodes need not to be specified in TS 38.314 accordingly.

**Q4: Do you agree that the number of inactive IAB-nodes will NOT be specified in TS 38.314?**

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| --- | --- | --- |
| Company | Agree/Disagree | Detailed Comments |
| vivo | Agree | No need to discuss the inactive state for IAB-MTs as IAB WI already made the agreement. |
| Qualcomm | Disagree | IAB not part of Rel-17 WI, I think we should focus on rel-17 WIs. |
| OPPO | Agree | Since inactive IAB-MT is not clearly defined in IAB WI |
| Ericsson | Disagree | If we start with one measurement, then we have to address all the other measurements as well. So, we do not want to address any IAB specific measurement in Rel-17. |
| Huawei, HiSilicon | Disagree | For this Rel-17 WI, IAB is not included, so the relevant discussions should be low priority. |
| ZTE | Agree | Since IAB WI has already decided that they won’t standardize the support of inactive UE in IAB, it is unnecessary to discuss inactive IAB-nodes in L2 measurement. |
| Nokia, Nokia Shanghai Bell | Agree |  |
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Also, R2-2009435 proposes specific solutions of how to measure the F1-U delay, considering the multi-hop network deployment in IAB scenario thus F1-U delay should be the sum of multiple delays from multiple transmission between IAB-nodes. The following solution is proposed by the paper:

* *RAN2 defines the DL/UL IAB F1-U delay as the sum of delays along the packet path.*

**Q5: Do you agree that RAN2 to define the DL/UL IAB F1-U delay as the sum of delays along the packet path?**

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| --- | --- | --- |
| Company | Agree/Disagree | Detailed Comments |
| vivo | Agree | The IAB topological structure is absolutely different from the traditional Uu, therefore the definitions for some measurements shall be different. |
| Qualcomm | Disagree | IAB not part of Rel-17 WI, I think we should focus on rel-17 WIs. Furthermore, this needs extra study, thus should be postponed to the next release. |
| OPPO | Agree | The F1-U delay needs to be re-defined in IAB scenario since the data would experience multiple IAB-nodes before it is routed from IAB-DU to IAB-donor CU. Agree to consider the IAB F1-U delay as a sum of the delays generated by each node |
| Ericsson | Disagree | Same views as Qualcomm. |
| Huawei, HiSilicon | Disagree | For this Rel-17 WI, IAB is not included, so the relevant discussions should be low priority. |
| ZTE | Disagree | Delay measurement in IAB is quite different, and it is clearly needs extra study before we agree on anything. But as commented in Q2, it is not an urgent issue now. |
| Nokia, Nokia Shanghai Bell | Agree | The timing of the introduction can be discussed |
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Additionally, R2-2009435 proposes that:

* *TS38.314 clarifies for Packet Loss Rate that, if there is an IAB Node served in a cell, for that cell the gNB performs each measurement separately for packets transmitted between the gNB and UE and for packets transmitted between the gNB and IAB Nodes.*

**Q6: Do you agree that TS38.314 to clarify** **for Packet Loss Rate that, if there is an IAB Node served in a cell, for that cell the gNB performs each measurement separately for packets transmitted between the gNB and UE and for packets transmitted between the gNB and IAB Nodes?**

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| --- | --- | --- |
| Company | Agree/Disagree | Detailed Comments |
| vivo | Agree |  |
| Qualcomm | Disagree | IAB not part of Rel-17 WI, I think we should focus on rel-17 WIs. |
| OPPO | Agree | It might be beneficial to consider the packet loss rate in between difference nodes, in which way, the OAM can optimize the configuration properly. |
| Ericsson | Disagree | Same views as Qualcomm. |
| Huawei, HiSilicon | Disagree | For this Rel-17 WI, IAB is not included, so the relevant discussions should be low priority. |
| ZTE | Disagree | Please refer to our comments in Q2. |
| Nokia, Nokia Shanghai Bell | Agree | The timing of the introduction can be discussed |
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Lastly, R2-2009435 proposes:

* *The delay information is first collected by donor CU via F1AP / RRC signalling before being sent to OAM.*
* *Donor-CU computes the total F1-U delay for IAB architecture.*

**Q7: Do you agree that the delay information is first collected by donor-CU via F1AP / RRC signalling before being sent to OAM?**

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| --- | --- | --- |
| Company | Agree/Disagree | Detailed Comments |
| vivo | See comments | We are not sure which node is most suitable for performing the collection, maybe this requires further discussions. |
| Qualcomm | Disagree | IAB not part of Rel-17 WI, I think we should focus on rel-17 WIs. |
| OPPO | Maybe | Further discussion is needed. |
| Ericsson | Disagree | Same views as Qualcomm. |
| Huawei, HiSilicon | Disagree | For this Rel-17 WI, IAB is not included, so the relevant discussions should be low priority. |
| ZTE | Disagree | Please refer to our comments in Q2. |
| Nokia, Nokia Shanghai Bell | Agree | The timing of the introduction can be discussed |
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**Q8: Do you agree that the Donor-CU to compute the total F1-U delay for IAB architecture?**

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| --- | --- | --- |
| Company | Agree/Disagree | Detailed Comments |
| vivo | See comments | We are not sure which node is most suitable for performing the calculation, maybe this requires further discussions. |
| Qualcomm | Disagree | IAB not part of Rel-17 WI, I think we should focus on rel-17 WIs. |
| OPPO | Maybe | Further discussion is needed. |
| Ericsson | Disagree | Same views as Qualcomm. |
| Huawei, HiSilicon | Disagree | For this Rel-17 WI, IAB is not included, so the relevant discussions should be low priority. |
| ZTE | Disagree | Please refer to our comments in Q2. |
| Nokia, Nokia Shanghai Bell | Agree | The timing of the introduction can be discussed |
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**Summary on Q2 to Q8**

As pointed out by serval companies, the WID for Rel-17 SON/MDT does not include any IAB-related issues. Due to the limited time budget, the Rapporteur tends to agree that the IAB-related enhancements for MDT/SON can be left to Rel-18 SON/MDT WI or simply be solved by enhanced IAB WI. So we propose:

1. L2 measurements for IAB will NOT be introduced in Rel-17 SON/MDT WI, later release can be considered.

## 3.3 Enhancements on UE-RAN delay measurement

A more accurate measurement approach, as requested by SA2, is discussed in R2-2009435 to achieve the requirements on URLLC QoS monitoring. The paper states that the proposed C-plane based delay measurements in RAN2 (in TR37.816) can serve a generic purpose but suffer from the fact they are no real end-to-end measurements. Deviations come from the need to sum up the end-to-end delay from several independent delay measurements, e.g. for the UL the scheduling delay in the UE, the delay for transmission to the DU, the delay over F1-U and delays in the re-ordering buffer. Besides, each of these measurements may already be averaged to introduce great deviations.

The contribution proposes that the NG-RAN node can decide about what packets are used for the measurement and informs the UE (and the CU-UP, if necessary) about the concerned PDCP SNs. In result, the UE (and CU-UP) inform the gNB (or CU-CP) about the point in time when the corresponding packet passed by at the measurement point. The rapporteur believes the URLLC use case has a relatively sensitive delay-awareness and such an accurate approach may be desired to some extent. The proposals are given as below:

* *The delay measurements are obtained by measuring the total delay of single packet(s) without summing averaged delay.*
* *For the uplink/downlink delay measurement, the gNB indicates to the UE which PDCP PDU SN(s) needs to be measured.*
* *For the uplink delay measurement, the UE records the send time T1 of the indicated packet(s) and transmits it to the gNB. For the downlink delay measurement, the UE records the receive time T2 for the corresponding SN(s) and transmits it to the gNB.*

So firstly we can try to discuss whether ‘*The delay measurements are obtained by measuring the total delay of single packet(s) without summing averaged delay’* is agreeable, and then focus on the specific solutions.

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**Q9: Do you agree that the delay measurements should be obtained by measuring the total delay of single packet(s) without summing averaged delay?**

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| Company | Agree/Disagree | Detailed Comments |
| vivo | See comments | We do see the benefits of measuring the delay more accurately in the case of URLLC scenarios, but we also wonder if this discussion should be triggered by IIOT WI first and afterwards we can take the responsibility to work on this issue. |
| Qualcomm | Disagree | In our understanding, different bearers are provided for a different class of the packet, and packet within a bearer should be treated equally. Thus, in our point of view, this measurement has not much significance. As different classes of applications and services have different bearer total delay obtained using summing average delay is an appropriate metric. We do not see any use case for this. A URLLC packet will anyways be assigned a high priority bearer based on the class of services. |
| OPPO | Disagree | The usage of real-time delay measurement result has been extensively discussed back to R16 Xi’an meeting and was disagreed. In our opinion, the averaged delay measurement result could be much more useful, as it is much more stable than the one-shot delay measurement result. In addition, the signalling overhead of already specified averaged delay measurement result is much less than the real-time delay measurement result, as UE needs to send the network a series of timing stamp information for each network targeted PDCP PDU |
| Ericsson | Disagree | This was discussed in Rel-16 extensively and not agreed. This was mainly discussed as part of URLLC QoS monitoring work in SA2 and currently SA2 has agreed to use the current RAN solutions in their work. There are multiple technical issues related to the per-packet delay measurements as we had stated in Rel-16, just listing them again here.   1. Modifying the per packet for an URLLC application would add a very large overhead both on the PDCP layer on the network side and the UE side as time stamp encoding and decoding will add to the latency. 2. If the proponents of the method say that the per-packet measurement need not be performed for every packet, then we believe that the measurement is of not much use as the delay as experienced by the monitored packet might be totally different from the very next packet which experiences a re-transmission for example. In such a scenario, only the average packet delay provides a good expected delay measurement within RAN. 3. CU-UP and UE are not tightly sycnchronized. It is just the DU and the UE that is tightly synchronized. So, the proposed time stamping solutions do not work directly and additional synchronization work needs to be done. |
| Huawei, HiSilicon | N/A | On one hand, we do see some benefits for proposals, and on the other hand, we share some concerns mentioned above. |
| ZTE | Disagree | In our understanding, current delay measurement is designed to fulfill the URLLC services as requested by SA2 which is also the solution SA2 adopts for R16. And there is no new requirement on delay measurement has been agreed in SA2 for this release. At this stage we don’t consider new delay measurement is needed, and prefer not to re-open the discussion. |
| KDDI | See comments | We see some benefits for the proposals, but at the same time we also share some concern with the opponents. So, as vivo comments above, we may want to discuss under which WI (SON or IIoT) this topic should be discussed, first. |
| Nokia, Nokia Shanghai Bell | Agree in some cases | This would allow more accurate delay measurement, in some specific cases. Legacy measurement can still be done. |
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**Summary on Q9**

* 4 companies strongly disagree with the proposal, stated that this issue had been extensively discussed in Rel-16 and was NOT agreed, besides, the current mechanism can also meet the requirements proposed by SA2.
* 3 companies tend to agree the intention of the proposal, but also share the concerns with the above comments.
* 1 company (the Proponent) claims that this enhancement could be useful in some specific cases.

Since 7 out of 8 companies expressed concerns on this issue, the rapporteur proposes:

1. RAN2 will NOT enhance the current delay measurement mechanism unless new requirements are proposed.

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If your answer to Q9 is ‘**Agree**’, then please further provide your comments on Q10 and Q11.

**Q10: Do you agree that ‘*For the uplink/downlink delay measurement, the gNB indicates to the UE which PDCP PDU SN(s) needs to be measured*’?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Detailed Comments |
| Qualcomm | Disagree | In our understanding, different bearers are provided for a different class of the packet, and packet within a bearer should be treated equally. Thus, in our point of view, this measurement has not much significance. As different classes of applications and services have different bearer total delay obtained using summing average delay is an appropriate metric. We do not see any use case for this. A URLLC packet will anyways be assigned a high priority bearer based on the class of services. |
| Nokia, Nokia Shanghai Bell | Agree | Main motivation is URLLC use case that require sensitive delay-awareness. |
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**Q11: Do you agree that ‘*For the uplink delay measurement, the UE records the send time T1 of the indicated packet(s) and transmits it to the gNB. For the downlink delay measurement, the UE records the receive time T2 for the corresponding SN(s) and transmits it to the gNB*’?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Detailed Comments |
| Qualcomm | Disagree | In our understanding, different bearers are provided for a different class of the packet, and packet within a bearer should be treated equally. Thus, in our point of view, this measurement has not much significance. As different classes of applications and services have different bearer total delay obtained using summing average delay is an appropriate metric. We do not see any use case for this. A URLLC packet will anyways be assigned a high priority bearer based on the class of services. |
| Nokia, Nokia Shanghai Bell | Agree | With main motivation is URLLC use case that require sensitive delay-awareness. |
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**Summary on Q10 to Q11**

As we do not receive enough support, no proposal is proposed for these two questions.

## 3.4 L2 measurements for split bearers

Part of the topic (on M6) was already discussed in the summary of MDT enhancements R2-2010897, the discussions principally focus on the reporting of D1 measurement (merely an element of M6) and the configuration of M6, however, no agreeable proposal was made due to the controversy and complexity of the issues.

To avoid going back-and-forth on the same issues, and given that most of the papers discussing M5~M7 were submitted to the agenda item ‘Immediate MDT’ so we can hardly find the majority view based on few papers in L2, we would rather like to have some high-level discussions based on the overlapping issues brought up by the papers submitted in this agenda item and, trying to achieve a consensus on some basic principles before we have every detail of each proposal under scrutiny.

Both contributions in R2-2009021 (OPPO) and R2-2010045 (Ericsson) investigated how to make M6 applicable to split bearers, where, from the rapporteur’s understanding, that three basic issues should be solved firstly:

* **Issue 1: Whether the delay over Xn/X2 interface (Figure 1) should be taken into account in M6 for split bearers?**
* **Issue 2: Whether the total delay measurement M6 over MCG/SCG should be differentiated for split bearers with PDCP duplication?**
* **Issue 3: Whether the delay estimation coordination between MN and SN is needed for split bearers?**



**Figure 1: SN terminated MCG/split bearers and MN terminated SCG/split bearers**

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For Issue 1, rapporteur believes it is quite straight-forward to include the delay over X2/Xn interface, in addition to the legacy definition of M6 where, taking DL for an example, only D4 (DL delay in CU-UP), D3 (DL delay on F1-U), D2 (DL delay in gNB-DU) and D1 (DL delay in over-the-air interface) are comprised of.

**Q12.1: Do you agree that the delay over Xn/X2 interface should be taken into account in M6 for split bearers?**

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| --- | --- | --- |
| Company | Agree/Disagree | Detailed Comments |
| vivo | Agree | The delay over Xn/X2 interface is not negligible and should be considered. |
| Qualcomm | Agree | In my understanding, the D3 delay should contain the DL delay on F1-U/X2/Xn. This avoids creating a new delay measurement. |
| OPPO | Agree | The dalay over Xn/X2 interface should be defined |
| Ericsson | See comments | We have to rephrase the question in our opinion. In the figure above, the connection between the PDCP entity in one node (MN/SN) to the RLC of another node (SN/MN) is shown to be X2/Xn. In our understanding, this can be F1-U or X2 or Xn. This is basically just a GTP tunnel between the corresponding two nodes. With that in mind, we are fine with the proposal. |
| Huawei, HiSilicon | Agree |  |
| ZTE |  | Agree with Qualcomm and Ercisson, the interface can be F1-U or Xn or X2 interface, and D3 can be reused for Xn/X2 delay calculation. But this shall be confirmed by RAN3.  According to the definition of D3 in 28.552(as shown below), D3 is used to calculate the packet delay between CU-UP and DU regardless it is in MN or SN. In case there is F1-U, D3 is used for F1-U delay calculation, for such case Xn/X2 delay is no needed. And for other DC case, D3 can be considered to compute X2 or Xn delay.  ------------------------------------- From 28552 -------------------------------------  According to 28.552, D3 is obtained as: the time when receiving a GTP packet delivery status message from the gNB-DU at the egress GTP termination, minus time when sending the same packet to gNB-DU at the GTP ingress termination, minus feedback delay time in gNB-DU, obtained result is divided by two. Separate counters are optionally maintained for each mapped 5QI (or QCI for option 3) and for each S-NSSAI.  ------------------------------------- From 28552 ------------------------------------- |
| KDDI | Agree | If the delay over Xn/X2 interface is enough small to be neglectable, we are fine with not taking into account it. |
| Nokia, Nokia Shanghai Bell | Agree |  |
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**Summary on Q12.1**

The Rapporteur would like to clarify the intention of the proposal, that is to first discuss whether the delay over Xn/X2 interface should be considered regardless of how to include the delay. And if this proposal is agreeable, we can further discuss whether a new measurement should be introduced or simply the current D3 delay can be re-used to include the delay (which should be confirmed by RAN3).

Based on the comments received above, all companies agree that the delay over Xn/X2 interface should be considered. The rapporteur also agrees with Ericsson and ZTE that there could be the case that only F1-U delay is included in the M6, and for other cases there could be X2 or Xn delay optionally. Overall, the delay over X2/Xn is a new factor and we should therefore take them into account.

**So the Rapporteur proposes:**

1. In case split bearer data goes through Xn/X2 interface, the delay over Xn/X2 interface should be taken into account in M6 for split bearers.

To take one step further, also as commented by several companies, that D3 could be re-used to contain the DL delay on F1-U/X2/Xn, the Rapporteur believes this is a good way forward to keep the simplicity and consistency of M6. Consequently the Rapoorteur proposes:

1. D3 is re-used to reflect the DL delay on F1-U/X2/Xn, D2.3 is re-used to reflect the UL delay on F1-U/X2/Xn, LS to RAN3 for further confirmation.

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If the answer to Q12.1 is ‘**Agree**’, then do you think this principle is also applicable to MN terminated SCG bearers and SN terminated MCG bearers?

**Q12.2: Do you agree that the delay over Xn/X2 interface should be taken into account in M6 for MN terminated SCG bearers and SN terminated MCG bearers?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Detailed Comments |
| vivo | Agree |  |
| Qualcomm | Agree | In my understanding, the D3 delay should contain the DL delay on F1-U/X2/Xn. This avoids creating a new delay measurement. |
| OPPO | Agree | With no doubt, the delay over Xn/X2 interface should be taken into account, as the packets needs to forward between two nodes in such two scenarios. |
| Ericsson | See comments | We have to rephrase the question in our opinion. In the figure above, the connection between the PDCP entity in one node (MN/SN) to the RLC of another node (SN/MN) is shown to be X2/Xn. In our understanding, this can be F1-U or X2 or Xn. This is basically just a GTP tunnel between the corresponding two nodes. With that in mind, we are fine with the proposal. |
| Huawei, HiSilicon | Agree |  |
| ZTE | Agree, and | We agree delay over X2/Xn delay shall be considered. As commented in Q12.1, we think current D3 is sufficient to cover the X2/Xn delay, which needs to be further confirmed by RAN3. |
| KDDI | Agree |  |
| Nokia, Nokia Shanghai Bell | Agree |  |
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**Summary on Q12.2**

As summarized in Q12.1, the Rapporteur made a clarification on the intention of the proposals, which should be sufficient to address the concerns brought up by 2 companies. Given that the majority support of the proposal, the Rapporteur proposes:

1. The delay over Xn/X2 interface should be taken into account in M6 for MN terminated SCG bearers and SN terminated MCG bearers.

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For issue 2, rapporteur understands that companies have different views on whether D1 should be differentiated between MCG and SCG, however, issue 2 focuses on the overall value of M6 where D1 is only a part of the value. As a consequence, the answer to issue 2 might be different from the overall view.

**Q13.1: Which option do you support for the total delay measurement M6 over MCG/SCG for split bearers with PDCP duplication?**

**Option 1: the maximum value between two legs;**

**Option 2: the minimum value between two legs;**

**Option 3: no differentiation;**

**Option 4: other (please specify).**

|  |  |  |
| --- | --- | --- |
| Company | Option 1/option 2/ Option 3 | Detailed Comments |
| vivo | Option 2 | For split bearers with PDCP duplication, the same packet will be transmitted over MCG and SCG legs. In this case, the delay for this packet should be the minimum delay over MCG and SCG legs, this is more understandable from the perspective of the receiving equipment as the receiving node only needs to receive one packet (out of the pair of duplicated packets) to obtain the data transmitted. |
| Qualcomm | Option2 | In our understanding, a packet should be considered received when the packet is received through MN or SN. Thus, in the case of duplication, the minimum is an appropriate metric. |
| OPPO | Option2 | For packet duplication, when the packet arrives at a particular node in the first place, the duplicated packet forwarded in another route might be discarded and therefore is considered as meaningless. So the performance criteria is the minimum value between two legs. |
| Ericsson | Option 2 |  |
| Huawei, HiSilicon | Option 2 |  |
| ZTE | Option 2 | In duplicate case, UE will discard the received packet if it is duplicated with a previous received one, therefore use minimum value is more appropriate. |
| KDDI | Option2 |  |
| Nokia, Nokia Shanghai Bell | Option 2 | What is relevant for NW is to know that the delay is kept under a value thus, minimum is the good choice. |
|  |  |  |

**Summary on Q13.1**

All companies are supportive of Option 2, so we have:

1. The minimum value between two legs is defined as the total delay measurement M6 over MCG/SCG for split bearers WITH PDCP duplication

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Finally, in the case that PDCP duplication is disabled:

**Q13.2: Which option do you support for the total delay measurement M6 over MCG/SCG for split bearers without PDCP duplication?**

**Option 1: the maximum value between two legs;**

**Option 2: the minimum value between two legs;**

**Option 3: no differentiation;**

**Option 4: other (please specify).**

|  |  |  |
| --- | --- | --- |
| Company | Option 1/option 2 | Detailed Comments |
| vivo | Option 1 | For split bearers without PDCP duplication, different packets associated to the DRB are sent over the MCG and the SCG. In our understanding, not until the last packet of the concerned DRB is received will the UE be able to obtain the complete information of the bearer. That being said, the overall delay should be the maximum of the delay experienced (until the last packet is received). |
| Qualcomm | Option4  (Weighted Average) | In the case of packet aggregation, I think the delay should be considered using the weighted average over MN and SN. For example, let us assume the M and N number of packets are received from MN and SN, respectively. Furthermore, let us assume and are the delay of packets received over MN and SN then packet delay should be computed as the weighted average. Note that although ul-PDCP delay D1 will be the same, the difference in the delay can come from F1-U/X2/Xn delay in the split bearer. |
| OPPO | Option4 | Agree with Qualcomm |
| Ericsson | Option 4 | As we have proposed in our contribution to RAN2#112 meeting, we need to have the weighted average depending on the #packets sent over MN and #packets sent over SN. See the excerpts from the proposal in R2-2010045.  In MN/SN terminated split bearer scenarios without PDCP duplication in the DL, the total RAN delay is the sum of the following components:  a. CU-UP delay (D4)  b. Weighted average of [MCG associated (D1+D2+D3), SCG associated(D1+D2+D3)] wherein the weightage depends on the number of DL packets sent over MCG and SCG during the measurement period. |
| Huawei, HiSilicon | Option 4 | We think that one simple way is to just get the average values of M6 from MN and M6 from SN. For weighted average, we are not clear on how to set the weightage, e.g. for suggestion from Ericsson, whether the number of packets is from MAC/RLC/PDCP or others. In addition, the weighted average method may lead to some complexity to network. |
| ZTE | Option 4 | The solution depends on how we want to use the delay measurement. In our point of view, raw date (separate delay in MN and SN) can provide more information to TCE, where TCE can identify the problem path easily, which also leaves the flexibility for TCE to calculate the results based on its need. For example both data volume and delay measurement of each path can be provided to TCE separately, and TCE can based on its requirement to either calculate weighted average delay, or aggregate the delay per QoS. |
| KDDI | Option3 | Simple way (just getting the average values of M6 from MN and M6 from SN) is fine, since the network can have some knowledge with regard to the numbers of paclets coming from MN/SN. |
| Nokia, Nokia Shanghai Bell | Option 1 | Network wants to check if there are delay issues. Thus Maximum is the right choice for this. |
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**Summary on Q13.2**

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| **Method** | **Couting** |
| Option 1 | 2 companies (vivo, Nokia) |
| Option 3 | 1 company (KDDI) |
| Option 4a (weighted average) | 3 companies (QC,E///,OPPO) |
| Option 4b (simply by average) | 1 companies (HW) |
| Option 4c (raw data) | 1 company (ZTE) |

No consensus is achieved on this issue, further discussions are definitely needed, but at least we can exclude option 2. So we modify the proposal to:

1. RAN2 to choose one of the following options for the total delay measurement M6 over MCG/SCG for split bearers WITHOUT PDCP duplication.

* Option a: the maximum value between two legs;
* Option b: weighte average (consider the number of packets) over MN and SN;
* Option c: simply by average the values of M6 from MN and M6 from SN;
* Option d: raw data (separate delay in MN and SN);
* Option e: no differentiation.

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For Issue 3, according to the Figure 1, the delay elements of M6 are estimated in different nodes for split bearers, but the final result of M6 can only be calculated at either MN or SN. Consequently, rapporteur tends to agree that some coordination between MN and SN is required so that the node performs the final calculation is able to take into account the delay value measured by another node.

**Q14.1: Do you agree that the delay estimation coordination between MN and SN is needed for split bearers?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Detailed Comments |
| vivo | Agree | Otherwise the delay estimation cannot be exchanged between MN and SN. |
| Qualcomm | Agree | In our understanding, it may be required, in particular, in the scenario of packet duplication. |
| OPPO | Agree | Coordination is needed for split bearers since the performance is impacted by two nodes |
| Ericsson | Term coordination needs clarification | The term coordination can be in reference to both measurement configuration and measurement reporting. We would like to discuss them individually.  We agree that the delay measuerment reporting to the CN shall happen from the PDCP terminating node and there is need to ensure that this node is aware of all the individual edlay measurements. This feature is already available for MN terminated MCG bearer and SN terminated SCG bearer.  When it comes to configuration, we would like to have further discussions for measurements like D1. |
| Huawei, HiSilicon | Agree |  |
| ZTE | Depends | First, we agree with Ericsson separated discussion on reporting and configuration is needed.  For reporting, coordination might be needed if terminated node needs to combine the delay measurement. But if the measurement is separately reported as we suggested in Q13.2, then the coordination is unnecessary.  For configuration of D1, since we think UE only needs to report one D1 (without differentiate MN/SN packets), UE only based on the terminated node’s configuration to perform D1 measurement, and report the same D1 to both MN/SN, no coordination on configuration is needed. |
| KDDI | Agree |  |
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**Summary on Q14.1**

A simple clarification from the Rapporteur’s side: the question 14.1 only refers to the coordination on reporting, in which is stated as “the delay estimation coordination” and is irrelevant to the configuration coordination. As majority view tends to support the intention of the proposal, we have

1. The delay estimation coordination between MN and SN is needed for split bearers

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If the answer to Q14.1 is ‘**Agree**’, then do you think this principle is also applicable to MN terminated SCG bearers and SN terminated MCG bearers?

**Q14.2: Do you agree that the delay estimation coordination between MN and SN is needed for MN terminated SCG bearers and SN terminated MCG bearers?**

|  |  |  |
| --- | --- | --- |
| Company | Agree/Disagree | Detailed Comments |
| vivo | Agree |  |
| Qualcomm | Disagree | In our understanding, coordination between MN and SN is not required for MN terminated SCG bearer and SN terminated MCG bearer. |
| OPPO | Agree | Same principle should be applied to MN terminated SCG bearers and SN terminated MCG bearers, since both MN and SN are involved in data processing. |
| Ericsson | Not clear | The question is too vague. It would be good to first confirm the answers of question 12 and 13. We also need to discuss the D1 measuement before talking of coordination. Therefore, we propose to postpone this coordination topic. |
| Huawei, HiSilicon | Agree |  |
| ZTE | Depends | This question relates to how delay measurement is configured and reported in case of MN/SN terminated SCG/MCG bearer, it is better to comeback to this question after we made decision on the measurement configuration and reporting. |
| KDDI | Agree |  |
| Nokia, Nokia Shanghai Bell | Agree |  |
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**Summary on Q14.2**

5 out of 8 companies agree that the same coordination principle can be applied for MN/SN terminated SCG/MCG bearer, 2 companies think this should be dependent to other related issues and thus be postponed, 1 company belives the coordination is not needed in this case.

As clarified in the summary on Q14.1, the coordination here simply refers to the reporting part, and it is quite straight-forward, from the rapporteur’s perspective, that the coordination is needed between MN and SN, as either 【D4+D3 (assume include the X2/Xn delay)】 or 【D2+D1】 should be exchanged so that the other node is able to calculate the final result. So we propose the following based on the majority view:

1. The delay estimation coordination between MN and SN is needed for MN terminated SCG bearers and SN terminated MCG bearers.

# 6 References

[1] RAN2-112-e SONMDT Notes HuNan 2020-11-13-1400 UTC.docx

[2] R2-2010985, Summary on 8.13.4 L2 Measurements, vivo, 3GPP TSG-RAN WG2 Meeting #112 electronic, November 2nd - 13th, 2020

[3] R2-2006501, Report of 3GPP TSG RAN WG2 meeting #110-e Online, MCC, 1 - 12 June, 2020