**3GPP TSG-RAN WG2 Meeting #109bis-e R2-200**

**Electronic, 20 April – 30 April 2020**

**Agenda Item: 6.12.3 L2 measurements**

**Source: CMCC**

**Title: Open issues for AI 6.12.3 L2 measurements**

**Document for: Discussion and decision**

# 1 Introduction

This is an email discussion for L2M to capture companies’ views on L2M contributions based on the summary Tdoc R2-2003486.

* [109bis-e][803] Open issues on L2M (CMCC)

Scope: Continue the discussion on L2M open issues based on R2-2003486

 Intended outcome: Summary with the following sets which should be identified

 §  Set of proposals with full consensus, if any (agreeable over email)

 §  Set of proposals with almost full consensus to discuss in the follow up conference call

 §  Set of open issues and proposals to postpone to next meeting

 Deadline: 28/04/2019 22:00 UTC

# 2 Summary for L2M contributions

## 2.1 General texts

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| **Tdoc** | **Proposals** | **Corresponding TP** | **Comments** |
| CMCC[2]R2-2003489 | The correction is for chapter 1. The word ‘NR’ need to be changed to ‘network’, in order to indicate the L2M is performed by network or UE, as shown in following text:**[a]Proposal 2: Wording correction for the sentence in draft TS 38.314:** **“The present document contains the description and definition of the measurements performed by network or the UE”** | *1 Scope**The present document contains the description and definition of the measurements performed by network or the UE that are transferred over the standardised interfaces in order to support NR radio link operations, radio resource management (RRM), network operations and maintenance (OAM), minimization of drive tests (MDT) and self-organising networks (SON).* *Only the differences relative to TS 28.552 v16.2.0 [2] are specified in this specification.* | QC: it should be consistent with the definition/scope provided in 36.314. According to correlation of name and scope of document, NG-RAN maybe most suited word.CMCC: Response to QC’s comments. This spec is applicable for both SA gNB and NSA gNB, but if we use ‘NG-RAN’, it means NSA gNB is excluded. That’s why I think ‘network’ term would be better. Intel: we are ok with the change.DOCOMO: term “network” is OK.Nokia: OKEricsson: Agree with CMCC. We are fine with the change. Since the title of the specification itself mentions NR, we do not need to mention NR RAN.Huawei, HiSilicon: OKZTE2: Ok.CATT: ok |

## 2.2 Delay measurement

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| **Tdoc** | **Proposals** | **Corresponding TP** | **Comments** |
| Nokia, Nokia Shanghai Bell[5]R2-2003165 | Nokia [5] thought that the calculation for D1/D2/D3 in 28.552 and 38.314 omits the time packet spend in RLC sublayer of gNB-DU. **Figure 1: Packet Delay DL****[b]Proposal 1: Add DL RLC delay in the summary of DL packet delay in 38.314 with a reference to 5.1.3.3.3 in 28.552****[b]Proposal 2: The reference for D1 is changed from “DL delay on gNB-DU” to “over-the-air interface****TP for above proposals:** | 4.1.1.2 Packet delayPacket delay includes RAN part of delay and CN part of delay. The RAN part of DL packet delay measurement comprises:- D1 (DL delay in over-the-air interface), referring to Average delay DL air-interface in TS 28.552 [2] 5.1.1.1.1.- D2 (DL delay on gNB-DU), referring to Average delay in RLC sublayer of gNB-DU in TS 28.552 [2] 5.1.3.3.3.- D3 (DL delay on F1-U), referring to Average delay on F1-U in TS 28.552 [2] 5.1.3.3.2.- D4 (DL delay in CU-UP), referring to Average delay DL in CU-UP in TS 28.552 [2] 5.1.3.3.1.The DL packet delay measurements, i.e. D1 (the DL delay in over-the-air interface ), D2 (the DL delay in gNB-DU), D3 (the DL delay on F1-U) and D4 (the DL delay in CU-UP), should be measured per DRB per UE.**Text proposal from ZTE:**4.1.1.2 Packet delayPacket delay includes RAN part of delay and CN part of delay. The RAN part of DL packet delay measurement comprises:- D1.1 (DL average over-the-air interface packet delay, including RLC retransmission delay), referring to Average delay DL air-interface in TS 28.552 [2] 5.1.1.1.1.-D1.2 (DL average RLC delay for initial transmission of all RLC packets), referring to Average delay DL in gNB-DU in TS 28.552[2] 5.1.3.3.3.- D2 (DL delay on F1-U), referring to Average delay on F1-U in TS 28.552 [2] 5.1.3.3.2.- D3 (DL delay in CU-UP), referring to Average delay DL in CU-UP in TS 28.552 [2] 5.1.3.3.1.The DL packet delay measurements, i.e. D1 (the DL delay in gNB-DU), D2 (the DL delay on F1-U) and D3 (the DL delay in CU-UP), should be measured per DRB per UE. | ZTE: We agree with the intention. In our understanding, the delay defined in 5.1.3.3.3 of TS 28.552 only includes initial transmission delay in RLC entity (i.e., excluding the retransmission delay), therefore we suggest another text proposal as given in the table.QC: OK, D2 is actually the queuing time in DU.CMCC: Agree. The definition for DL over-the-air delay include both initial transmission and re-transmission for RLC AM mode. So I think Nokia’s proposal is fine.vivo: OkIntel: We slightly prefer ZTE version. We should also update Figure 1.DOCOMO: Nokia’s proposal is OK.Ericsson: Agree with the proposal from Nokia as the definition of the over-the-air delay in 28.552 includes the RLC AM related delay. See below excerpts from 28.5525.1.1.1.1 Average delay DL air-interfacea) This measurement provides the average (arithmetic mean) time it takes to get a reponse back on a HARQ transmission in the downlink direction. The measurement is optionally split into subcounters per QoS level (mapped 5QI or QCI in NR option 3) and subcounters per S-NSSAI.b) DER (n=1)c) This measurement is obtained as: sum of (time when the last part of an RLC SDU packet was received by the UE according to received HARQ feedback information for UM mode or time when the last part of an RLC SDU packet was received by the UE according to received RLC ACK for AM mode, minus time when corresponding RLC SDUs arriving at MAC lower SAP) divided by total number of RLC SDUs transmitted to UE successfully. Separate counters are optionally maintained for each mapped 5QI (or QCI for option 3) and for each S-NSSAI.MediaTek: Agree with ZTE and IntelHuawei: OK. Regarding the comments from ZTE, we think the average delay DL air-interface in 28.552 includes the retransmission delay.ZTE2: Per Huawei’ and Ericssion’ comments, I think what we proposed is align with TS 28552, and our comments is that RLC average delay defined in TS 28552 only includes initial RLC transmission delay, as for retransmission delay it is included in over-the-air delay. As a reference, I copy paste the definition of RLC average delay from TS 28552 in the following:5.1.3.3.3 Average delay DL in gNB-DUa) This measurement provides the average (arithmetic mean) RLC SDU delay on the downlink within the gNB-DU, for initial transmission of all RLC packets. The measurement is optionally split into subcounters per QoS level (mapped 5QI or QCI in NR option 3) and subcounters per S-NSSAI.b) DER (n=1)c) This measurement is obtained as: sum of (time when the last part of an RLC SDU was scheduled and sent to the MAC layer for transmission over the air, minus time of arrival of the same packet at the RLC ingress F1-U termination) divided by total number of RLC SDUs arriving at the RLC ingress F1-U termination. If the RLC SDU needs retransmission (for Acknowledged Mode) the delay will still include only one contribution (the original one) to this measurement. Separate counters are optionally maintained for each mapped 5QI (or QCI for option 3) and for each S-NSSAI. Each measurement is an integer representing the mean delay in microseconds. CATT: ok, slightly prefer Nokia version of brief description in 38.314. |
| Huawei, HiSilicon[7]R2-2003575 | Huawei think UE capability on UL delay measurement needs to be introduced in LTE.**[b]Proposal 1: It is proposed to also introduce UE capability on UL delay measurement in LTE TS 36.306 and TS 36.331.** | **N/A** | QC: OKCMCC: agreevivo: fineIntel: okDOCOMO: OKNokia: AgreeEricsson: Agree.MediaTek: AgreeHuawei, HiSilicon: OKCATT: ok |
| Huawei, HiSilicon[7]R2-2003575 | Huawei think RAN2 need add the objective of SA2 requirement, i.e. QoS monitoring. Otherwise, it may lead to some ambiguities for these delay measurements. For example, one may think that delay measurements are only used for MDT purpose and delay measurements shall not be sent from RAN to CN.**[b]Proposal 2: Clarify TS 38.314 that the delay measurements can be also used for QoS monitoring.** | 2 ReferencesThe following documents contain provisions which, through reference in this text, constitute provisions of the present document.- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.- For a specific reference, subsequent revisions do not apply.- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".[2] 3GPP TS 28.552: "5G performance measurements".[3] 3GPP TS 38.331: "Radio Resource Control (RRC) protocol specification".[X] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".------------------------------------------------------------NEXT CHANGE--------------------------------------4.1.1.2 Packet delayPacket delay includes RAN part of delay and CN part of delay. The RAN part of DL packet delay measurement comprises:- D1 (DL delay in gNB-DU), referring to Average delay DL air-interface in TS 28.552 [2] 5.1.1.1.1.- D2 (DL delay on F1-U), referring to Average delay on F1-U in TS 28.552 [2] 5.1.3.3.2.- D3 (DL delay in CU-UP), referring to Average delay DL in CU-UP in TS 28.552 [2] 5.1.3.3.1.The DL packet delay measurements, i.e. D1 (the DL delay in gNB-DU), D2 (the DL delay on F1-U) and D3 (the DL delay in CU-UP), should be measured per DRB per UE.The RAN part (including UE) of UL packet delay measurement comprises: - D1 (UL PDCP packet average delay, as defined in section 4.2.1.1). - D2.1 (average over-the-air interface packet delay, as defined in 4.1.1.2.1). - D2.2 (average RLC packet delay, as defined in 4.1.1.2.2).- D2.3 (average delay UL on F1-U, it is measured using the same metric as the average delay DL on F1-U defined in TS 28.552 [2] section 5.1.3.3.2). - D2.4 (average PDCP re-ordering delay, as defined in 4.1.1.2.3).The UL packet delay measurements, i.e. D1(UL PDCP packet average delay), D2.1(average over-the-air interface packet delay), D2.2(average RLC packet delay), D2.3(average delay UL on F1-U) and D2.4(average PDCP re-ordering delay), should be measured per DRB per UE. The unit of D1, D2.1, D2.2, D2.3 and D2.4 is 0.1ms.For the QoS monitoring in [X], RAN informs the RAN part of UL packet delay measurement or/and the RAN part of DL packet delay measurement to the CN.4.1.1.2.1 Average over-the-air interface packet delay in the UL per DRB per UEThe objective of this measurement is to measure air interface UL packet delay for OAM performance observability or for QoS verification of MDT or for the QoS monitoring as defined in [X].4.1.1.2.2 Average RLC packet delay in the UL per DRB per UEThe objective of this measurement is to measure RLC delay in the UL for OAM performance observability or for QoS verification of MDT or for the QoS monitoring as defined in [X].4.1.1.2.3 Average PDCP re-ordering delay in the UL per DRB per UEThe objective of this measurement is to measure PDCP re-ordering delay in the UL for OAM performance observability or for QoS verification of MDT or for the QoS monitoring as defined in [X].------------------------------------------------------------NEXT CHANGE------------------------------------------------------------4.2.1.1 UL PDCP Packet Average Delay per DRB per UEThe objective of this measurement performed by UE is to measure Packet Delay in Layer PDCP for QoS verification of MDT or for the QoS monitoring as defined in [X].------------------------------------------------------------END CHANGE------------------------------------------------------------ | QC: OKZTE: OK to add for QoS monitoring case. But one thing needed be clarified here is what’s the intended behavior for reporting the SN results to CN, e.g., MN will need to collect and combine the results from SN to CN or MN just simply forward the SN results without looking into the content? Also we think the granularity of reporting results to CN shall be per QoS level instead of per DRB.CMCC: OKvivo: okIntel: okDOCOMO:OKNokia: We agree, this use was intendedEricsson: Agree. MediaTek: AgreeHuawei, HiSilicon: OKCATT: ok |
| Huawei, HiSilicon[7]R2-2003575 | **[b]Proposal 3: For D2.1 definition:*** **Remove “per DRB” from D2.1**
* **Change “UL RLC SDU” to “MAC SDU”**
* **For tSched(i, drbid), add a clarification that i.e. when the network send a DCI with including the UL grant**
 | About D2.1 measurement Based on TS 38.314 v0.0.5 as below, Huawei’s comments and suggestions are made below (highlighted in green).

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| **Definition** | Average over-the-air packet delay in the UL per DRB per UE. This measurement is applicable for EN-DC and SA. This measurement refers to packet delay for DRBs. This measurement provides the average (arithmetic mean) time it takes to successfully receive a transport block from the time of UL transmission indicated in scheduling grant. [Huawei] For “per DRB” definition, we see there may be some problems for network implementation, because “per DRB” handling seems to be difficult for PHY and MAC layers for the network side. One option is to remove “per DRB” from the measurement.Detailed Definition:$M(T,drbid)=\left⌊\frac{\sum\_{∀i}^{}tSucc(i,drbid)-tSched(i,drbid)}{I(T)}\right⌋$$M(T,drbid)=\left⌊\frac{\sum\_{∀i}^{}tSucc(i,drbid)-tSched(i,drbid)}{I(T)}\right⌋$,whereexplanations can be found in the table 4.1.1.2.1-1 below. |

**Table 4.1.1.2.1-1**

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| $$M(T,drbid)$$ | Over-the-air packet delay in the UL per DRB per UE, averaged during time period $T$. Unit: 0.1 ms. |
| $$tSched(i,drbid)$$ | The point in time when the UL RLC SDU i is scheduled as per the scheduling grant provided. [Huawei] For the “UL RLC SDU i”, we think it should be MAC SDU as the measurement should be up to MAC layer. In addition, this measurement is to be jointly used with D1, D2.2, D2.3 and D2.4 measurements. For D2.2, it is clearly about RLC packet delay, so it is good to limit the D2.1 measurements to up to MAC layer.In addition, regarding “the scheduling grant provided.”, it seems not very clear. In our understanding, it should be aligned with D1 measurement. D1 definition is as below, so we think “the scheduling grant provided.” should be the time when the network sends a DCI with including the UL grant. *This measurement refers to PDCP queuing delay for DRBs in the UE, which captures the delay from packet arrival at PDCP upper SAP until the UL grant to transmit the packet is available, which has included the delay the UE gets resources granted (from sending SR/RACH to get the first grant).* |
| $$tSucc(i,drbid)$$ | The point in time when the RLC SDU i was received successfully by the network. [Huawei] Suggest to change “RLC SDU i” to “MAC SDU i”.  |
| $$i$$ | A MAC SDU that arrives at the RLC during time period $T$.  |
| $$I(T)$$ | Total number of RLC SDUs $i$.[Huawei] Suggest to change “RLC SDU i” to “MAC SDU i”. |
| $$T$$ | Time Period during which the measurement is performed |
| $$drbid$$ | The identity of the measured DRB. |

 | QC: Don’t think the proposals are valid. The measurement should be performed per DRB, as discussed in the last meeting. Others are oaky.ZTE: We suggest a different definition for D2.2 in next proposal, and if it is adopted there is no need to change D 2.1 in such case.vivo: no strong viewIntel: we also agree with QC removing per drb seems to be incorrect.DOCOMO: over-air delay measurement should start from NW sent the DCI including UL grant, end in MAC SDU or we can say RLC PDU is receivedper drb is PDCP level, which is in radioBearConfig, while the over air delay measurement is conducted in MAC/RLC in cellGroupConfig, where drb identity cannot be recognized. Thus, we agree to remove per DRB.Nokia: We believe the measurement should be per DRB, Ericsson: On issue-1) There is a similar measurement in the DL direction as well. We wonder why only UL related over-the-air measurement has per-DRB issue and not the DL one. On Issues-2) We are fine with changing from UL RLC SDU to UL MAC SDU.On issue-3) Okay to rephrase the scheduling grant related text.MediaTek: Agree with QualcommHuawei, HiSilicon: We agree with the principle of having per DRB delay measurements.Here our main concern is that:If a delay measurement is involving with PHY layer, e.g. D2.1, how the network knows DRB ID in its PHY layer? If it is a new requirement, it is quite challenging to the network side.For other delay measurements, it is feasible to do per DRB measurements because PDCP/RLC can be aware of DRB id.Regarding Ericsson comment on issue-1), the similar measurement in the DL direction is in RLC layer, so it should be reasonble to do per DRB measurements.CATT: agree with QC for “per DRB” definition. If remove “per DRB”, what’s the real action the UE performs? It will make the definition more confusion. We prefer to keep RLC layer involved for D2.1, so “per DRB” definition here can be kept as DRB is visible for RLC layer.Since D2.2 is the average from “first part of RLC SDU i received” to “the RLC SDU i is sent to PDCP”, D2.1 should align with D2.2 definition, to use “the first part of UL RLC SDU i is scheduled” for *tSched*, and to use “the first part of UL RLC SDU i was received” for *tSucc* , and the definition of *I(T)* should be number of RLC SDUs which should not be changed..And the Protocol Layer should be MAC, RLC.If we change from UL RLC SDU i to UL MAC SDU i, the consequence is that the definition of D2.1 is not packet delay, because multiple MAC SDU may belong to the same RLC SDU considering RLC segmentation. D1/ D2.2/D2.3/D2.4 are all packet delay, RAN2 is better to make the D2.1 align with others. |
| Huawei, HiSilicon[7]R2-2003575 | **[b]Proposal 4: For D2.2 definition:*** **In the definition, change “from the first part of an RLC PDU is received to the RLC SDU is sent to PDCP” to “from the first part of an RLC SDU is received to the RLC SDU is sent to PDCP”**
* **For the definition of tReceiv (i, drbid), change “The point in time when the first part of RLC PDU i is received.” to “The point in time when the first part of RLC SDU i is received.”**
 | About D2.2 measurement Based on TS 38.314 v0.0.5 as below, our comments and sugguestions are made below (highlighted in green).**4.1.1.2.2 Average RLC packet delay in the UL per DRB per UE**The objective of this measurement is to measure RLC delay in the UL for OAM performance observability or for QoS verification of MDT.Protocol Layer: RLC

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| **Definition** | Average RLC delay in the UL per DRB per UE. This measurement is applicable for EN-DC and SA. This measurement refers to packet delay for DRBs. For CU-DU split scenario or DC scenario, this measurement refers to the RLC delay on each DU or RAN node. This measurement provides the average (arithmetic mean) time it takes from the first part of an RLC PDU is received to the RLC SDU is sent to PDCP or CU for split gNB. [Huawei] in the above highlighted part, the “an RLC PDU” should be “an RLC SDU” beucase the measurement is to target RLC SDUs.Detailed Definition:$M(T,drbid)=\left⌊\frac{\sum\_{∀i}^{}tSent(i,drbid)-tReceiv(i,drbid)}{I(T)}\right⌋$,whereexplanations can be found in the table 4.1.1.2.1-1 below. |

NOTE: Per DRB refers to per mapped 5QI for NR SA or per QCI for EN-DC.**Table 4.1.1.2.1-1**

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| $$M(T,drbid)$$ | RLC delay in the UL per DRB per UE, averaged during time period $T$. Unit: 0.1 ms. |
| $$tReceiv(i,drbid)$$ | The point in time when the first part of RLC PDU i is received.[Huawei] Same as the above comment, the “RLC PDU i” should be “RLC SDU i”. |
| $$tSent(i)$$ | The point in time when the RLC SDU i is sent to PDCP or CU for split gNB. |
| $$i$$ | A RLC SDU that is received by the RLC during time period $T$.  |
| $$I(T)$$ | Total number of RLC SDUs $i$. |
| $$T$$ | Time Period during which the measurement is performed |
| $$drbid$$ | The identity of the measured DRB. |

**Text proposal from ZTE:**4.1.1.2.2 Average RLC packet delay in the UL per DRB per UEThe objective of this measurement is to measure RLC delay in the UL for OAM performance observability or for QoS verification of MDT.Protocol Layer: RLC

|  |  |
| --- | --- |
| **Definition** | Average RLC delay in the UL per DRB per UE. This measurement is applicable for EN-DC and SA. This measurement refers to packet delay for DRBs. For CU-DU split scenario or DC scenario, this measurement refers to the RLC delay on each DU or RAN node. This measurement provides the average (arithmetic mean) RLC SDU delay on the uplink within the gNB-DU, for initial transmission of all RLC packets. If the RLC SDU needs retransmission (for Acknowledged Mode) the delay will still include only one contribution (the original one) to this measurement.Detailed Definition:$M(T,drbid)=\left⌊\frac{\sum\_{∀i}^{}tSent(i,drbid)-tReceiv(i,drbid)}{I(T)}\right⌋$,whereexplanations can be found in the table 4.1.1.2.1-1 below. |

NOTE: Per DRB refers to per mapped 5QI for NR SA or per QCI for EN-DC.**Table 4.1.1.2.1-1**

|  |  |
| --- | --- |
| $$M(T,drbid)$$ | RLC delay in the UL per DRB per UE, averaged during time period $T$. Unit: 0.1 ms. |
| $$tReceiv(i,drbid)$$ | The point in time when the first part of RLC PDU i is received. |
| $$tSent(i)$$ | The point in time when the RLC SDU i is sent to PDCP or CU for split gNB. |
| $$i$$ | A RLC SDU that is received by the RLC during time period $T$.  |
| $$I(T)$$ | Total number of RLC SDUs $i$. |
| $$T$$ | Time Period during which the measurement is performed |
| $$drbid$$ | The identity of the measured DRB. |

 | QC: OKZTE: We have a different proposals for D2.2 definition in TS 38.214. In our understanding, current way of handling the definition of UL delay is a bit different from the way DL delay is defined in TS 28.552, and it is simpler to have a consistent solution between DL/UL delay definition,therefore we suggest TP as given in the table. And with this change there is no need to change the definition on D2.1.vivo: okIntel: okDOCOMO: from RLC receiver point of view, it should be RLC PDU. The process delay of RLC PDU=>RLC SDU cannot be ignored. The original text is OK.Nokia: Not OK, UL RLC cannot be ignored Ericsson: We believe this measurement was introduced to capture the RLC processing delay. So, the existing text states that the measurement is the time between when the RLC PDU is received, RLC header removal and then when the associated RLC SDU is transmitted to PDCP. So, we believe the existing text captures the measurement’s intention correctly.MediaTek: OKHuawei, HiSilicon: OK. Regarding the proposal from ZTE, we think the definition of DL RLC delay in TS 28.552 also include the retransmission.ZTE2: Regarding to Huawei’s comments, please refer to our comments above. We also think the processing delay in RLC layer shall be counted and we are ok to keep the original text.CATT: ok |
| Huawei, HiSilicon[7]R2-200f | **[b]Proposal 5: For D2.4 definition:*** **In the definition, change “the point a PDCP SDU is received to the PDCP SDU is sent to upper SAP” to “the point a PDCP PDU is received to the PDCP SDU is sent to upper SAP”**
* **For the definition of tReceiv(i, drbid), change “The point in time when the first part of PDCP SDU i is received” to “The point in time when the PDCP PDU including the PDCP SDU i is received”**
 | About D2.4 measurementBased on TS 38.314 v0.0.5 as below, our comments and sugguestions are made below (highlighted in green).**4.1.1.2.3 Average PDCP re-ordering delay in the UL per DRB per UE**The objective of this measurement is to measure PDCP re-ordering delay in the UL for OAM performance observability or for QoS verification of MDT.Protocol Layer: PDCP

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| **Definition** | Average PDCP re-ordering delay in the UL per DRB per UE. This measurement is applicable for EN-DC and SA. This measurement refers to packet delay for DRBs. This measurement provides the average (arithmetic mean) time it takes from the point a PDCP SDU is received to the PDCP SDU is sent to upper SAP. [Huawei] for the above highlighted part, the start time is “the point a PDCP SDU is received” but it is incorrect as it does not match with 4.1.1.2.2 (i.e. D2.2.). So the start time should be “the point a PDCP PDU is received”.Detailed Definition:$M(T,drbid)=\left⌊\frac{\sum\_{∀i}^{}tSent(i,drbid)-tReceiv(i,drbid)}{I(T)}\right⌋$,whereexplanations can be found in the table 4.1.1.2.3-1 below. |

**Table 4.1.1.2.3-1**

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| $$M(T,drbid)$$ | PDCP re-ordering delay in the UL per DRB per UE, averaged during time period $T$. Unit: 0.1 ms. |
| $$tReceiv(i, drbid)$$ | The point in time when the first part of PDCP SDU i is received.[Huawei] In order to be aligned with 4.1.2.2 (i.e. D2.2), the definition suggested to be:The point in time when the PDCP PDU including the PDCP SDU i is received. |
| $$tSent(i,drbid)$$ | The point in time when the PDCP SDU i is sent to upper SAP. |
| $$i$$ | A PDCP SDU that is received by the PDCP during time period $T$.  |
| $$I(T)$$ | Total number of PDCP SDUs $i$. |
| $$T$$ | Time Period during which the measurement is performed |
| $$drbid$$ | The identity of the measured DRB. |

 | QC: OKvivo: okIntel: okDOCOMO: AgreeNokia: AgreeEricsson: AgreeMediaTek: AgreeHuawei, HiSilicon: OKZTE2:ok.CATT: ok |

## 2.3 Number of UE

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| **Tdoc** | **Proposals** | **Corresponding TP** | **Comments** |
| CMCC[6] R2-2003489 | In RAN2#109e meeting, it was agreed to adopt the following equation for number of UE.$$M(T,drbid,p)=\frac{\left⌊\frac{\sum\_{∀i}^{}N(i,drbid)}{I(T,p)}\*10\right⌋}{10}$$It is obvious that the unit for $M(T,drbid,p)$ is 0.1, instead of integer. Therefore, we proposal to change the unit from integer to 0.1 for mean number of active UEs, in order to keep align with the equation.**[a]Proposal 1: The unit of mean number of active UEs is changed from integer to 0.1, in order to keep align with the equation.** | 4.1.1.3.1 Mean number of Active UEs in the DL per DRB per cellProtocol Layer: MAC, RLC

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| --- | --- |
| **Definition** | Mean number of Active UEs in the DL per DRB per cell. The DRBs are mapped with the same 5QI for NR SA or mapped with the same QCI for EN-DC. This measurement refers to UEs for which there is buffered data for the DL for DRBs. Detailed Definition:$M(T,drbid,p)=\frac{\left⌊\frac{\sum\_{∀i}^{}N(i,drbid)}{I(T,p)}\*10\right⌋}{10}$,whereexplanations can be found in the table 4.1.1.3.1-1 below. |

**Table 4.1.1.3.1-1**

|  |  |
| --- | --- |
| $$M(T,drbid,p)$$ | Mean number of Active UEs in the DL per DRB, averaged during time period $T$. Unit: 0.1. |
| $$N(i,drbid)$$ | Number of UEs for which there is buffered data for the DL in MAC or RLC protocol layers for a Data Radio Bearer of traffic class at sampling occasion$i$.In RLC and MAC layers, buffered data corresponds to *data available for transmission* according to the definitions in TS 38.322 and TS 38.321.Buffered data includes data for which HARQ transmission has not yet terminated. |
| $$i$$ | Sampling occasion during time period $T$. A sampling occasion shall occur once every $p$ seconds. |
| $$p$$ | Sampling period length. Unit: second. The sampling period shall be at most 0.1 s. |
| $$I(T,p)$$ | Total number of sampling occasions during time period $T$.  |
| $$T$$ | Time Period during which the measurement is performed, Unit: second. |
| $$drbid$$ | The DRBs mapped with the same 5QI for NR SA or mapped with the same QCI for EN-DC. |

 | QC: OKCMCC: The correction is needed.vivo: okIntel: okDOCOMO: OKNokia: AgreeEricsson: AgreeMediaTek: AgreeHuawei, HiSilicon: OKZTE2: OK.CATT: ok |
| NTT DOCOMO INC. [1]R2-2002751 | NTTDOCOMO [1] propose a correction on the wording. Number of active UEs per cell is measured in MAC and RLC layer, therefore PDCP should be deleted from Table 4.1.1.3.2-1.[a]Proposal 2: Remove the PDCP protocol layer in Table 4.1.1.3.2-1 in 38.314 running for Max number of Active UEs in the DL per DRB per cell | --------------------------------------------------- Excerpt from running CR 38.314[1] ------------------------------------------4.1.1.3.2 Max number of Active UEs in the DL per DRB per cellProtocol Layer: MAC, RLC

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| --- | --- |
| **Definition** | Maximum number of Active UEs in the DL per DRB per cell. The DRBs are mapped with the same 5QI for NR SA or mapped with the same QCI for EN-DC. This measurement refers to UEs for which there is buffered data for the DL for DRBs. Detailed Definition: $M(T,drbid,p)=\max\_{T}\left(N\left(i,drbid\right)\right)$,whereexplanations can be found in the table 4.1.1.3.2-1 below. |

**Table 4.1.1.3.2-1**

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| --- | --- |
| $$M(T,drbid,p)$$ | Maximum number of Active UEs in the DL per DRB per cell, averaged during time period $T$. Unit: Integer. |
| $$N(i,drbid)$$ | Number of UEs for which there is buffered data for the DL in MAC or RLC layers for a Data Radio Bearer of traffic class at sampling occasion$i$.In RLC and MAC layers, buffered data corresponds to *data available for transmission* according to the definitions in TS 38.322 and TS 38.321.Buffered data includes data for which HARQ transmission has not yet terminated. |
| $$i$$ | Sampling occasion during time period$T$. A sampling occasion shall occur once every $p$ seconds. |
| $$p$$ | Sampling period length. Unit: second. The sampling period shall be at most 0.1 s. |
| $$T$$ | Time Period during which the measurement is performed, Unit: second. |
| $$drbid$$ | The DRBs mapped with the same 5QI for NR SA or mapped with the same QCI for EN-DC. |

 | QC: no strong opinionCMCC: OKvivo :okIntel: okNokia: In our understanding this is applicable only if reporting over F1 is agreedEricsson: Agree. This measurement is performed in the DU and only RLC/MAC buffer status should be considered.MediaTek: AgreeHuawei, HiSilicon: OKZTE2: OK.CATT: ok |
| NTT DOCOMO INC. [1]R2-2002751 | In TS 38.314, the number of active UE is measured per cell. NTTDOCOMO [1] propose to introduce a new matric for number of active UE per CU.[b/c]Proposal1: RAN2 to capture the metric of number of active UEs in RRC connected by CU (split gNB deployment scenario) in ANNEX. | 4.1.2.1.1 Mean number of Active UEs in the DL per DRB per gNBProtocol Layer: PDCP

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| **Definition** | Mean number of Active UEs in the DL per DRB per gNB. The DRBs are mapped with the same 5QI for NR SA or mapped with the same QCI for EN-DC. This measurement refers to UEs for which there is buffered data for the DL for DRBs. Detailed Definition:$M(T,drbid,p)=\frac{\left⌊\frac{\sum\_{∀i}^{}N(i,drbid)}{I(T,p)}\*10\right⌋}{10}$,whereexplanations can be found in the table 4.1.1.3.1-1 below. |

 | ZTE: The number of active UE in LTE takes into account PDCP, RLC and MAC layer. Therefore we prefer to discuss before decide to postpone. Considering CU-DU case, it is ok to separate the active UE counting in DN and CU . But we think the correct granularity of the CU measurement shall be per cell per gNB-DU. QC: OKCMCC: We don’t see the need to introduce per gNB number of UE in parallel. 1) Current definition for number of active UE is measured per cell in MAC/RLC layer. That is because the load balancing and capacity expansion is performed at per cell level. We think it can be up to OAM to aggregate the measurements into per gNB. 2) In addition, the number of RRC connection is defined by SA5 in per gNB level. So I thought that would be just enough.Vivo: okIntel: okDOCOMO: Please be careful that this split gNB CU measurement is only applicable to PDCP protocol, we understand gNB CU (PDCP layer only) could not be aware of per cell level measurement, thus we modify the granularity to per gNB. Nokia: The concern here is that this ignores the fact that there is E1 interface separating CU-CP and CU-UP. “For the completeness of L2 measurement spec, the metric of number of active UEs in RRC connected conducted by CU based on PDCP protocol layer should be captured” => This should not result in an E1 metric reportage.Also, it is not clear if this is in addition to reporting from DU or an alternative.Ericsson: Same view as CMCC. We do not agree with the ‘per gNB’ metric. Only the RLC/MAC level active Ue measurement is useful for load balancing purposes and therefore we propose to reject this proposal.MediaTek: OKHuawei, HiSilicon: No strong opinion.ZTE2: We want to revise our comments to not agree to introduce this measurement as this stage . Considering the measurement will lead to different results in CU and DU for the same DRB the same UE, therefore it would be difficult to understand which results shall be used for load balancing. Considering the use case for measurements collected by CU is not clear, we decide to not to support this measurement at this release. CATT: We think it is not necessary to introduce this. It is not a requirement from SA5, so to follow LTE, recording the number of active UEs for CONNECTED mode for all gNB deployment scenarios is enough. |

## 2.4 L2M for EN-DC scenario

Agreements in RAN2#109e meeting related with EN-DC:

5 For EN-DC UL D1 delay measurement configuration for non-split bearer,

- D1 measurement of MN terminated bearer(including non-split bearer) can be configured by MN,

- D1 measurement of SN terminated bearer(including non-split bearer) can be configured by SN via RRC message (SRB3 or SRB1).

- For the SN terminated bearers, it is the SN to configure and calculate the UL/DL delay.

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| **Tdoc** | **Proposals** | **Corresponding TP** | **Comments** |
| Ericsson[4]R2-2003073 | Ericsson propose to follow the principle wherein the node associated to the scheduling request that impacts the D1 measurement to be the one that receives the D1 measurement report.LTE RLCLTE MAC + PHYNR MAC + PHYNR RLCNR PDCPLTE/NR PDCP**Figure 1 : Different direct bearer related configurations, MN terminated MCG bearer (blue), SN terminated MCG bearer (Orange) and SN terminated SCG bearer (black)**[a]Proposal 1: D1 measurement for MN terminated MCG bearer is configured by and reported to MN.[b]Proposal 2: D1 measurement for SN terminated MCG bearer is configured by and reported to MN.[a]Proposal 3: D1 measurement for SN terminated SCG bearer is configured by and reported to SN. | **N/A** | QC: Proposal 2 is the case of split-bearer and we should study this in Release 17.CMCC: OK with the proposals.Vivo: ok with the proposal, Intel: okDOCOMO: OK with the proposal. Share view with Ericsson that D1 measurement for SN terminated MCG bearer is configured by and reported to MN.Ericsson: Agree, proponents.MediaTek: Agree with QualcommHuawei, HiSilicon:OK to P1 and P3.For P2, RAN2 agreed that:the D1 measurement of SN terminated bearer(including non-split bearer) can be configured by SN via RRC message.In our understanding, the SN terminated bearer (including non-split bearer) include the SN terminated MCG bearer. The motivation is to calculate the whole RAN part of delay. So the delay measurement of this bearer type is configued and reported to SN.ZTE2: Agree with P1 and p3, but p2 has not been discussed before, prefer to postpone.CATT: ok |
| vivo[2-3]R2-2002897R2-2002898 | vivo discusses M5~M7 MDT in case of SN terminated MCG/split bearers and MN terminated SCG/split bearers.* M5: Average UE throughout measurement separately for DL and UL, per DRB per UE and per UE for the DL, per DRB per UE and per UE for the UL, by gNB

**[b]Proposal 1: Current L2 UE DL/UL throughput estimation cannot simply apply to EN-DC MN terminated SCG/split bearers as the PDCP is located at MN****[b]Proposal 2: For EN-DC SN terminated MCG/split bearers and MN terminated SCG/split bearers, UE throughput estimation coordination is required between MN and SN.*** M6: Packet Delay measurement separately for DL and UL, per DRB per UE

**[b]Proposal 3: For EN-DC SN terminated MCG/split bearers and MN terminated SCG/split bearers, UE packet delay needs to take into account the delay induced by data going through X2 interface between MN and SN.****[b]Proposal 4: Current L2 UE packet delay estimation cannot apply to EN-DC SN terminated MCG/split bearers and MN terminated SCG/split bearers****[b]Proposal 5: For EN-DC SN terminated MCG/split bearers and MN terminated SCG/split bearers, UE packet delay estimation coordination is required between MN and SN.*** M7: Packet loss rate measurement separately for DL and UL, per DRB per UE

**[b]Proposal 6: Current L2 UE packet loss estimation cannot simply apply to EN-DC SN terminated MCG/split bearers and MN terminated SCG/split bearers****[b]Proposal 7: For EN-DC SN terminated MCG/split bearers and MN terminated SCG/split bearers, UE packet loss estimation coordination is required between MN and SN.****Rapporteur Notes: RAN2 can focus on non-split bearer for R16.** | CR for 37.3205.4.1.1 Measurements and reporting triggers for Immediate MDTMeasurements to be performed for Immediate MDT purposes involve reporting triggers and criteria utilized for RRM. In addition, there are associated network performance measurements performed in the gNB.In particular, the following measurements shall be supported for Immediate MDT performance:Measurements:* ⁻ M1: DL signal quantities measurement results for the serving cell and for intra-frequency/Inter-frequency/inter-RAT neighbour cells, including cell/beam level measurement for NR cells only, TS 38.215 [19]
* ⁻ M2: Power Headroom measurement by UE, TS 38.213 [20]
* ⁻ M3: Received Interference Power measurement [The feasibility need to be confirmed by RAN1]
* ⁻ M4: Data Volume measurement separately for DL and UL, per DRB per UE, see TS 28.552 [17]
* ⁻ M5: Average UE throughout measurement separately for DL and UL, per DRB per UE and per UE for the DL, per DRB per UE and per UE for the UL, by gNB, see TS 28.552 [17]
* ⁻ M6: Packet Delay measurement separately for DL and UL, per DRB per UE, TS 28.552 [17] and TS 38.314 [18]
* ⁻ M7: Packet loss rate measurement separately for DL and UL, per DRB per UE, TS 28.552 [17] and TS 38.314 [18]

NOTE: M5 ~ M7 do not apply to EN-DC SN terminated MCG/split bearers and MN terminated SCG/split bearers in this release.* ⁻ M8: RSSI measurement by UE (for WLAN/Bluetooth measurement) see TS 38.331 [15].
* ⁻ M9: RTT Measurement by UE (for WLAN measurement) see TS 38.331 [15].
 | QC: Agreevivo: okIntel: okNOKIA: We were wondering about P1 and P2: if the metric is in PDCP, then the estimation may be possibleEricsson: P1 – P2: throughput is calculated at the RLC level. In our understanding for non-split bearers we should be able to use the RLC throughput and it is already agreed that split bearer related throughput KPI is postponed to rel-17. So, in our understanding MN terminated SCG bearer and SN terminated MCG bearer related throughputs can be measured. P3: In our understanding, the F1-U delay is what is being mentioned by Vivo, not X2. This F1-U delay is already captured in the delay measurements. So, we do not agree with this proposal.P4: The split bearer case can be postponed. Again we do not think why MN terminated SCG bearer cannot be supported for non split bearer.P5: To a large extent, this is part of the proposals P1,p2 and P3 in our previous paper.P6: We believe that the split bearer case needs to handled in rel-17 but for direct bearers, the specified meaurements already capture the packet loss over the air and over the F1-U interface. For the split DRB, we agree that the packet loss rate ‘per DRB’ might need to be revisited in rel-17 as there is a need for coordination.We can mention in 37.320 that the throughput, packet loss rate and delay measurements for split bearer are not included in this release. However, we believe it is possible to perform SN terminated MCG bearer and MN terminated SCG bearer related M5-M7 measurements.MediaTek: AgreeHuawei, HiSilicon: no strong opinions.ZTE2: It is noted that some measurements defined in LTE and NR is different,e.g.,M5/6/7, thus for these measurements performs in both MN and SN, it is still needed to discuss whether NR or LTE defined measurements shall applied. Also it is unclear if eNB or gNB can support NR or LTE defined measurements. Even for some measurements only performed in MN or SN, e.g. M4, there could be some problems, Take SN terminated MCG as an example, in our understanding, the configuration is received by SN while MN is the one to perform measurements, therefore SN shall be able to inform MN the configuration, which cannot be support by current specs since there is no Trace Start procedure from en-gNB to eNB.Considering the complexity of this issue and the limited time, we suggest to only support MN terminated MCG bearer and SN terminated SCG bearer in R16 and postpone the rest to R17. CATT: ok |

# Reference

1. R2-2002751 Discussion on metric of number of active UEs in RRC connected NTT DOCOMO INC.
2. R2-2002897 Remaining issues on L2 measurement vivo
3. R2-2002898 CR37320 for M5 ~ M7 vivo
4. R2-2003073 Open issues of L2 measurements Ericsson
5. R2-2003165 Correction of DL packet delay Nokia, Nokia Shanghai Bell
6. R2-2003489 Miscellaneous corrections for draft TS 38.314 CMCC
7. R2-2003575 Minor issues on L2M Huawei, HiSilicon