**3GPP TSG-RAN WG2 Meeting #110 electronic R2-2005433**

**Online, June 1 – June 12 2020**

**Agenda Item: 6.12.5 TS 38314 corrections**

**Source: CMCC**

**Title: Summary of AI 6.12.5 L2 measurements**

**Document for: Discussion and decision**

# 1 Introduction

Agreement from RAN2#109bis-e meeting:

Agreements:

1 Change word from ‘NR’ to ‘network’ for the sentence in draft TS 38.314 Chapter 1, i.e. change to “The present document contains the description and definition of the measurements performed by network or the UE”

2 Modify DL packet delay to the following texts:

4.1.1.2 Packet delay

Packet 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.

3 Introduce UE capability on UL delay measurement in LTE TS 36.306 and TS 36.331.

4 Clarify TS 38.314 that the delay measurements can be also used for QoS monitoring, and capture the corresponding TP in summary paper R2-2004005 into running TS 38.314.

6 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”

7 The unit of mean number of active UEs is changed from integer to 0.1, in order to keep align with the equation.

9 D1 measurement for MN terminated MCG bearer is configured by and reported to MN.

10 D1 measurement for SN terminated SCG bearer is configured by and reported to SN.

11 M5 ~ M7 do not apply to EN-DC SN terminated MCG/split bearers and MN terminated SCG/split bearers in Rel-16. And this should be captured as a note in TS 37.320 Chapter 5.4.1.1.

This contribution is a summary of AI 6.12.5 TS 38314 corrections. There are 5 contributions [1-5] and most of them are TPs or corrections for draft TS 38.314. So this summary is formed by tables to link the corresponding TP with each proposals. And companies are welcome to share views on each TP.

* Please share comments in the table in the right of each TP.
* If you got a better correction to share, please provide it in the table under each TP.

# 2 Summary for L2M contributions

## 2.1 Delay measurement

### General

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| **Tdoc** | **Proposals** | **Corresponding TP** | **Comments** |
| ZTE Corporation, Sanechips  R2-2005470  [5] | *Observation 1: According to current specs, the RAN part of packet delay for non-split case also takes into account the D2.3(average delay UL on F1-U) and D3 (DL delay on F1-U) measurement.*  **Proposal 1: It is required to clarify in the specs that for non-split case the RAN part of packet delay excludes D2.3 (average delay UL on F1-U) and D3 (DL delay on F1-U) .** | 4.1.1.2 Packet delay  Packet 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.  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 non CU-DU split case, RAN part of packet delay excludes the delay at FI-U interface, i.e. D2.3 and D3.  For the QoS monitoring in TS 23.501 [4], RAN informs the RAN part of UL packet delay measurement, or the RAN part of DL packet delay measurement, or both to the CN. | [QC]: Seems reasonable for non-split NG-RAN. |
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**For D2.1 and D2.2, 2 companies share different TPs for the correction. Companies are invited to share views on which correction is acceptable.**

### D2.1

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| **Tdoc** | **Proposals** | **Corresponding TP** | **Comments** |
| CATT  R2-2004415  [1] | *Observation: the sub-delay parts of the DL packet delay should better have the same granularities.*  **Proposal 2: Change the definition of *tSched(i,drbid)* of D2.1 measurement from ‘The point in time when the UL RLC SDU i is scheduled as per the scheduling grant provided’ to ‘The point in time when the first RLC PDU of the UL RLC SDU i is scheduled as per the scheduling grant provided’.**  **Proposal 3: Change the definition of *tSucc(i,drbid)* of D2.1 measurement from ‘The point in time when the RLC SDU i was received successfully by the network’ to ‘The point in time when the first RLC PDU of the RLC SDU i was received successfully by the network’.** | 4.1.1.2.1 Average over-the-air interface packet delay in the UL per DRB per UE  The 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 TS 23.501 [4].  Protocol Layer: MAC, RLC   |  |  | | --- | --- | | **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.  Detailed Definition:  ,where  explanations can be found in the table 4.1.1.2.1-1 below. |   **Table 4.1.1.2.1-1**   |  |  | | --- | --- | |  | Over-the-air packet delay in the UL per DRB per UE, averaged during time period . Unit: 0.1 ms. | |  | The point in time when the first RLC PDU of the UL RLC SDU i is scheduled as per the scheduling grant provided. | |  | The point in time when the first RLC PDU of the RLC SDU i was received successfully by the network. | |  | A MAC SDU that arrives at the RLC during time period . | |  | Total number of RLC SDUs . | |  | Time Period during which the measurement is performed | |  | The identity of the measured DRB. | | **ZTE: Since the denominator is the total number of RLC SDUs, maybe shall be the point in time when the “ the last RLC PDU of the RLC SDU i was received successfully by the network” instead of the first RLC PDU of the RLC SDU i was received successfully by the network.**  [QC]: Proposal 2 seems okay. However, the proposal 3 should be modified to measure last part of RLC SDU. In RLC-AM particularly, if any RLC-PDU is lost, RLC SDU is considered lost. Thus, modify proposal 3 as:  **Proposal 3: Change the definition of *tSucc(i,drbid)* of D2.1 measurement from ‘The point in time when the RLC SDU i was received successfully by the network’ to ‘The point in time when the ~~first~~ last RLC PDU of the RLC SDU i was received successfully by the network’.**  [HW] Firstly, our main intention is: ensure that each delay parts have no overlaps and can “precisely” combine into complete the final UL/DL delay. After checking the delay parts, we think that some delay parts may have overlaps, and thus the final UL/DL delay may include duplication delay measurements.  Secondly, we are open to any solutions that can meet the above intention.  [CATT]:  the impact of RLC segmentation is also considered when defining D2.1, because we think the average delay of total number of MAC SDU during a period is not a packet delay; if we want to have a unified definition of packet delay for D1, D2.1, D2.2, D2.3, D2.4, the impact of RLC segmentation should be considered in MAC  we’re fine to the suggestion by QC and ZTE, e.g. change the  ‘first RLC PDU’ to ‘last RLC PDU’, but one more question for definition of D2.2, we should also change ‘the first RLC PDU of the RLC SDU i is received’ to ‘the last RLC PDU of the RLC SDU i is received’ in D2.2 definition, otherwise, there is some time overlapping between D2.1 and D2.2 if we follow the suggestion from QC and ZTE, but also accept the changes for D2.2 from CATT.  [QC2] We agree with CATT solution. In my point of view, as D1 measured PDCP delay. Thus, the  D2.1 delay should be measured as indicated in the below figure:  I agree with the proposed change for D2.2, it should be measured when the last part of RLC PDU is received.  An RLC SDU is formed only after all consisting RLC PDU is received.    I believe in this measurement the granuarlity is based on RLC SDU. Thus, an RLC SDU should be considered transmiited when all consisting part of RLC SDU is transmitted. Furthermore, it becomes more crucial when RLC-AM is considered, where RLC PDU is considered successful transmitted when RLC ACK is recived. Thus, a RLC SDU can only be considered successfully transmitted when all consisting RLC PDU is successfully transmitted. |
| Huawei, HiSilicon  R2-2005379  [4] | **Proposal 1: 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 sends a DCI including the UL grant** | 4.1.1.2.1 Average over-the-air interface packet delay in the UL per UE  The 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 TS 23.501 [4].  Protocol Layer: MAC, RLC   |  |  | | --- | --- | | **Definition** | Average over-the-air packet delay in the UL per UE. This measurement is applicable for EN-DC and SA. This measurement provides the average (arithmetic mean) time it takes to successfully receive a transport block from the time when the network sends a DCI including the UL grant to schedule the MAC SDU i.  Detailed Definition:  ,where  explanations can be found in the table 4.1.1.2.1-1 below. |   **Table 4.1.1.2.1-1**   |  |  | | --- | --- | |  | Over-the-air packet delay in the UL per UE, averaged during time period . Unit: 0.1 ms. | |  | The point in time whenthe network sends a DCI including the UL grant to schedule the MAC SDU i. | |  | The point in time when the MAC SDU i was received successfully by the network. | |  | A MAC SDU that arrives at the RLC during time period . | |  | Total number of MAC SDUs . | |  | Time Period during which the measurement is performed | |  |  | | **ZTE:**  **- As for remove DRB, I wonder why per DRBs cannot be achieved in MAC layer since the LCH ID shall be included and it shall be possible to derive the DRB ID based on the LCH ID included.**  **-- the D2.1 shall reflect only the delay over the air-interface (including retransmission delay) and we think the current definition is correct. If we change the start point to the time when NW sends the DCI then we would count the scheduling time twice since in our understanding the waiting time has already included in PDCP packet average delay, “the UL grant to transmit the packet is available” means the time indicated in the UL grant.**  ----------------------------------------------------------------- From 38.314 -----------------------------------------------------------------  PDCP Packet Delay in the UL per DRB. 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). The measurement is done separately per DRB.  ----------------------------------------------------------------- From 38.314 -----------------------------------------------------------------  [QC]: This D2.1 delay should be computed per DRB. Otherwise the computed end-to-end delay will be erroneous. For example, let us assume a single UE is using a latency-sensitive application and latency-insensitive application. Then, if the D2.1 is measured per UE it will offset QoE or overload the network, significantly. Changing over-the-air delay from RLC-RLC to MAC-to-MAC should be okay for RLC-UM. However, the problem happens in RLC-AM, a packet is not consider successfully transmitted unless and until RLC ACK is received. In such case, over-the-air delay cannot be evaluated as MAC-MAC delay. |
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### D2.2

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| **Tdoc** | **Proposals** | **Corresponding TP** | **Comments** |
| CATT  R2-2004415  [1] | **Proposal 1: Change the definition of *tReceiv(i,drbid)* of D2.2 measurement from ‘The point in time when the RLC PDU including the RLC SDU i is received’ to ‘The point in time when the first RLC PDU of the RLC SDU i is received’.** | 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 or for the QoS monitoring as defined in TS 23.501 [4].  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) time it takes from the first RLC PDU of an RLC SDU is received to the RLC SDU is sent to PDCP or CU for split gNB.  Detailed Definition:  ,where  explanations can be found in the table 4.1.1.2.1-1 below. |   **Table 4.1.1.2.1-1**   |  |  | | --- | --- | |  | RLC delay in the UL per DRB per UE, averaged during time period . Unit: 0.1 ms. | |  | The point in time when the first RLC PDU of the RLC SDU i is received. | |  | The point in time when the RLC SDU i is sent to PDCP or CU for split gNB. | |  | A RLC SDU that is received by the RLC during time period . | |  | Total number of RLC SDUs . | |  | Time Period during which the measurement is performed | |  | The identity of the measured DRB. | | **ZTE: ok.**  [QC]: seems okay.  [CATT] see comments for D2.1  [QC2] We agree to the change ‘the first RLC PDU of the RLC SDU i is received’ to ‘the last RLC PDU of the RLC SDU i is received’ in D2.2 definition. |
| Huawei, HiSilicon  R2-2005379  [4] | **Proposal 2: 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 RLC PDU including 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 RLC PDU including the RLC SDU i is received” to “The point in time when the RLC PDU including the first part of the RLC SDU i is received”** | 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 or for the QoS monitoring as defined in TS 23.501 [4].  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) time it takes from the RLC PDU including the first part of an RLC SDU is received to the RLC SDU is sent to PDCP or CU for split gNB.  Detailed Definition:  ,where  explanations can be found in the table 4.1.1.2.1-1 below. |   **Table 4.1.1.2.1-1**   |  |  | | --- | --- | |  | RLC delay in the UL per DRB per UE, averaged during time period . Unit: 0.1 ms. | |  | The point in time when the RLC PDU including the first part of the RLC SDU i is received. | |  | The point in time when the RLC SDU i is sent to PDCP or CU for split gNB. | |  | A RLC SDU that is received by the RLC during time period . | |  | Total number of RLC SDUs . | |  | Time Period during which the measurement is performed | |  | The identity of the measured DRB. | | [QC]: Seems Okay. |
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## 2.2 Number of UE

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| **Tdoc** | **Proposals** | **Corresponding TP** | **Comments** |
| ZTE Corporation, Sanechips  R2-2005470  [5] | *Observation 2: Considering the number of active UE is measured using sampling method and averaged during configured period, and the packet buffered in PDCP layer shall be soon sent to lower layer during measuring period, there shall not be much difference whether PDCP layer is taken into account in the number of active UE measurement.*  **Proposal 2: RAN2 confirmed current defined number of active UE measurement is valid for non-split case, and no specs change is needed.** | N/A | [QC]: Agree. |
| Ericsson R2-2004714  [2] | Proposal 1 Remove the term ‘PDCP’ from the definition of ‘max number of active UEs in DL’. | 4.1.1.3.2 Max number of Active UEs in the DL per DRB per cell  Protocol Layer: MAC, RLC   |  |  | | --- | --- | | **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:  ,where  explanations can be found in the table 4.1.1.3.2-1 below. |   **Table 4.1.1.3.2-1**   |  |  | | --- | --- | |  | Maximum number of Active UEs in the DL per DRB per cell, averaged during time period . Unit: Integer. | |  | 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 .  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. | |  | Sampling occasion during time period . A sampling occasion shall occur once every seconds. | |  | Sampling period length. Unit: second. The sampling period shall be at most 0.1 s. | |  | Time Period during which the measurement is performed, Unit: second. | |  | The DRBs mapped with the same 5QI for NR SA or mapped with the same QCI for EN-DC. | | **ZTE: Agree.**  [QC]: Do not agree. What if UEs have DL and UL data in PDCP buffer but due to the high priority transmissions, packet is not sent to the RLC or MAC layer. |
| NTTDOCOMO, INC.  R2-2004789  [3] | ***Observation1: The definition of data available for transmission for Number of active UEs is not captured in TS 38.322 and TS 38.321.***  ***Observation2: The definition of data available for transmission for Number of active UEs in the DL shall not be defined in UE spec.***  ***Proposal1: RAN2 to discuss the following two solutions to resolve the number of active UEs measurement in non-split gNB scenario.***  ***Solution1: Ad a NOTE in definition of number of Active UEs measurement as shown in ANNEX.***  ***Solution2: Create a new subclause 4.1.3 Measurement valid for non-split gNB deployment scenario to capture the related measurements.***  ***Proposal2: RAN2 to agree add a note in definition of number of Active UEs measurement as shown in Annex.***  ***Proposal3: RAN2 to discuss the following solutions to resolve the definition of data available for transmission.***  ***Solution1: Leave the definition of buffered data to network implementation. So remove the wording “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.”***  ***Solution2: RAN2 define the buffered data for Number of Active UEs measurement in TS 38.314 as shown in ANNEX.***  ***Proposal4: RAN2 to agree to define the buffered data for number of active UEs measurement in TS 38.314 as shown in ANNEX.*** | 4.1.1.3 Number of active UEs in RRC\_CONNECTED  The objective of the measurement is to measure number of active UEs per QoS level for OAM performance observability. It is intended to be part of a calculation to determine the bitrate UEs achieve when they are active, i.e. when applications are transmitting and receiving data. The measurements are applicable for both non-split gNB and split gNB deployment scenario.  4.1.1.3.1 Mean number of Active UEs in the DL per DRB per cell  Protocol Layer: MAC, RLC   |  |  | | --- | --- | | **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:  ,where  explanations can be found in the table 4.1.1.3.1-1 below. |     **Table 4.1.1.3.1-1**   |  |  | | --- | --- | |  | Mean number of Active UEs in the DL per DRB, averaged during time period . Unit: 0.1. | |  | 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.  In RLC layer, the buffered data corresponds to the following available data for transmission in the RLC buffer.   * RLC SDUs, or * RLC PDUs   In MAC layer, the buffered data correspond to the following available data for transmission in the MAC buffer.   * MAC SDUs, or * MAC PDUs   Buffered data includes data for which HARQ transmission has not yet terminated.  Note: For non-split gNB deployment, Number of UEs can be defined for which there is buffered data for the DL in MAC, RLC, or PDCP protocol layer. In PDCP layer, the buffered data corresponds to the following available data for transmission in the PDCP buffer.   * PDCP SDUs, or * PDCP PDUs | |  | Sampling occasion during time period . A sampling occasion shall occur once every seconds. | |  | Sampling period length. Unit: second. The sampling period shall be at most 0.1 s. | |  | Total number of sampling occasions during time period . | |  | Time Period during which the measurement is performed, Unit: second. | |  | The DRBs mapped with the same 5QI for NR SA or mapped with the same QCI for EN-DC. | | **ZTE: As analyzed in our contribution, we think it is sufficient to take only MAC/RLC layer for active UE counting, and it is preferred to have a unified measurement definition for split and non-split gNB scenarios.**  [QC]: For proposal 1 and 2 adding a note should be fine. For proposal 3 and 4, RAN2 should define the buffered data for active users. |
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## 2.3 Received Random Access Preambles

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| **Tdoc** | **Proposals** | **Corresponding TP** | **Comments** |
| **Ericsson R2-2004714**  **[2]** | Proposal 3 Received RA preambles per SSB is defined as the ratio of the number of received preambles associated to the SSB to the total number of PRACHs configured in the SSB of the cell. | 4.1.1.1.2 Received Random Access Preambles per SSB  A use case for this measurement is RACH configuration optimization, where Received Random Access Preambles is signalled across an OAM interface.  Protocol Layer: MAC   |  |  | | --- | --- | | **Definition** | Received Random Access Preambles per SSB. This measurement is applicable to PRACH. The reference point is the Service Access Point between MAC and L1. The measured quantity is the number of received Random Access preambles during a time period over all PRACHs configured in the SSB of the cell. The measurement is done separately for:  - Dedicated preambles  - Randomly selected preambles in the low range  - Randomly selected preambles in the high range.  The unit of the measured value is [/s]. | | **ZTE: Ok. seems reasonable.**  [QC]: Prefer previous definition. Anyways proposed changes do not make much difference. The current definition is simpler if exact number of PRACH needs to be evaluated. Otherwise, we may have to remember the configured PRAC per SSB per cell. |
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# Reference

1. R2-2004415 Consideration on UL Packet Delay CATT discussion Rel-16 38.314 NR\_SON\_MDT-Core
2. R2-2004714 Corrections to TS 38.314 Ericsson discussion
3. R2-2004789 Remaining issues for Number of active UEs NTTDOCOMO, INC. discussion
4. R2-2005379 Minor issues on TS 38.314 Huawei, HiSilicon discussion Rel-16 NR\_SON\_MDT-Core
5. R2-2005470 Remianing issues on L2 measurement ZTE Corporation, Sanechips discussion Rel-16 NR\_SON\_MDT-Core