**3GPP TSG-SA5 Meeting #130e *S5-202105rev1***

**20-28 April 2020, E-meeting**

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| *CR-Form-v11.4* |
| **CHANGE REQUEST** |
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|  | **28.552** | **CR** | **0215** | **rev** | **-** | **Current version:** | **16.5.0** |  |
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| *For* [***HELP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* |
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| ***Proposed change affects:*** | UICC apps |  | ME |  | Radio Access Network | **X** | Core Network |  |

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| ***Title:***  | Add measurements related to DL packet delay between NG-RAN and UE |
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| ***Source to WG:*** | Intel |
| ***Source to TSG:*** | S5 |
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| ***Work item code:*** | 5G\_SLICE\_ePA |  | ***Date:*** | 2020-04-10 |
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| ***Category:*** | **B** |  | ***Release:*** | Rel-16 |
|  | *Use one of the following categories:****F*** *(correction)****A*** *(mirror corresponding to a change in an earlier release)****B*** *(addition of feature),* ***C*** *(functional modification of feature)****D*** *(editorial modification)*Detailed explanations of the above categories canbe found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | *Use one of the following releases:Rel-8 (Release 8)Rel-9 (Release 9)Rel-10 (Release 10)Rel-11 (Release 11)Rel-12 (Release 12)Rel-13 (Release 13)Rel-14 (Release 14)Rel-15 (Release 15)Rel-16 (Release 16)* |
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| ***Reason for change:*** | The DL packet delay between NG-RAN and UE (including the delay at gNB-CU-UP, on F1-U and on gNB-DU and the delay over Uu interface) is one significant part of the e2e delay that has impact to users’ experience for some types of services (e.g., URLLC). The measurements on DL packet delay between NG-RAN and UE are missing. |
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| ***Summary of change:*** | Added measurements on DL packet delay between NG-RAN and UE |
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| ***Consequences if not approved:*** | The DL packet delay between NG-RAN and UE cannot be monitored. |
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| ***Clauses affected:*** | 5.1.1.1.x (new), 5.1.1.1.y (new), A.4 |
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|  | **Y** | **N** |  |  |
| ***Other specs*** |  | **X** |  Other core specifications  | TS/TR ... CR ...  |
| ***affected:*** |  | **X** |  Test specifications | TS/TR ... CR ...  |
| ***(show related CRs)*** |  | **X** |  O&M Specifications | TS/TR ... CR ...  |
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| ***Other comments:*** |  |

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| **1st Modified Section** |

##### 5.1.1.1.x Average DL delay between NG-RAN and UE

a) This measurement provides the average DL packet delay between NG-RAN and UE, which is the average of the summed delay incurred in NG-RAN (including the delay at gNB-CU-UP, on F1-U and on gNB-DU) and the delay over Uu interface. This measurement is split into subcounters per 5QI and subcounters per S-NSSAI.

b) DER (n=1).

c) The measurement is obtained by the following method:

 The gNB performs the GTP PDU packet delay measurement for QoS monitoring per the GTP PDU monitoring packets received from UPF, and records the following time stamps and information included in the GTP-U header of each GTP PDU monitoring response packet (packet i) sent to UPF (see 23.501 [4] and 38.415 [31]):

- The DL Delay Result from NG-RAN to UE indicating the downlink delay measurement result which is the sum of the delay incurred in NG-RAN (including the delay at gNB-CU-UP, on F1-U and on gNB-DU) and the delay over Uu interface (see 38.415 [31], and the DL Delay Result is denoted by in the present document);

- The 5QI and S-NSSAI associated to the GTP PDU monitoring response packet.

 The gNB counts the number (N) of GTP PDU monitoring response packets for each 5QI and each S-NSSAI respectively, and takes the following calculation for each 5QI and each S-NSSAI:

d) Each measurement is a real representing the average delay in 0.1ms.

e) DRB.DelayDlNgranUeAve.*5QI, where 5QI* identifies the 5QI;
DRB.DelayDlNgranUeAve.*SNSSAI, where SNSSAI* identifies the S-NSSAI.

f) NRCellCU (for non-split and 2-split scenario);
GNBCUUPFunction (for 3-split scenario).

g) Valid for packet switched traffic.

h) 5GS.

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| **Next Modified Sections** |

##### 5.1.1.1.y Distribution of DL delay between NG-RAN and UE

a) This measurement provides the distribution of DL packet delay between NG-RAN and UE, which is the delay incurred in NG-RAN (including the delay at gNB-CU-UP, on F1-U and on gNB-DU) and the delay over Uu interface. This measurement is split into subcounters per 5QI and subcounters per S-NSSAI.

b) DER (n=1).

c) The measurement is obtained by the following method:

 The gNB performs the GTP PDU packet delay measurement for QoS monitoring per the GTP PDU monitoring packets received from UPF, and records the following time stamps and information included in the GTP-U header of each GTP PDU monitoring response packet (packet i) sent to UPF (see 23.501 [4] and 38.415 [31]):

- The DL Delay Result from NG-RAN to UE indicating the downlink delay measurement result which is the sum of the delay incurred in NG-RAN (including the delay at gNB-CU-UP, on F1-U and on gNB-DU) and the delay over Uu interface (see 38.415 [31], and the DL Delay Result is denoted by in the present document);

- The 5QI and S-NSSAI associated to the GTP PDU monitoring response packet.

 The gNB increments the corresponding bin with the delay range where the falls into by 1 for the subcounters per 5QI and subcounters per S-NSSAI.

d) Each measurement is an integer representing the number of GTP PDUs measured with the delay within the range of the bin.

e) DRB.DelayDlNgranUeDist.*5QI.Bin,* where *Bin* indicates a delay range which is vendor specific, and *5QI* identifies the 5QI;
DRB.DelayDlNgranUeDist.*SNSSAI.Bin,* where *Bin* indicates a delay range which is vendor specific, and *SNSSAI* identifies the S-NSSAI.

f) NRCellCU (for non-split and 2-split scenario);
GNBCUUPFunction (for 3-split scenario).

g) Valid for packet switched traffic.

h) 5GS.

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| **Next Modified Sections** |

# A.4 Monitoring of UL and DL user plane delay in NG-RAN

Satisfying low packet delay is of prime concern for some services, particularly conversational services like speech and instant messaging. As the performance in UL and DL differs, it is important for operators to be able to monitor the UL and DL user plane delay separately. With performance measurements allowing the operator to obtain or derive the UL and DL user plane delay information separately, the operators can pinpoint the services performance problems to specific problems in UL or DL.

The DL delay monitoring in gNB refers to the delay of any packet within NG-RAN, including air interface delay until the UE receives the packet. A gNB deployed in a split architecture, the user plane delay will occur in gNB-CU-UP, on the F1 interface, in gNB-DU and on the air interface. Therefore, the measurements related to the total delay between NG-RAN and NE, and the delay occurred in the four segments needs to be monitored for the DL delay to pinpoint where end user impact from packet delay occurs.

The average DL delay needs to be measured to give a general indication of the delay performance; further more the delay distributions (into bins with delay ranges) need to be measured, to tell the occurrences about the packets with each certain range of delay and better reflect the user experience.

The UL delay monitoring in gNB refers to the delay of any packet within NG-RAN, including air interface delay until the packet leaves gNB-CU-UP. There are 5 components associated to UL delay (PDCP queuing delay in UE, UL over-the-air interface delay, gNB-DU delay, F1-U delay, CU-UP delay). Therefore, the delay measurements related to these five segments needs to be monitored for the UL delay to pinpoint where end user impact from packet delay occurs. The beamforming capabilities of the NRCellDU and of the UE can be different. This might create a difference in the successful reception probability of the DL data transmitted by the gNB-DU, versus the UL data transmitted by the UE as the later might involve more retransmission than the former one. This will increase the UL over-the-air delay compared to the DL over-the-air delay.

Different network slices may have different requirements on the delay, so the delay needs to be measured for each S-NSSAI.

To further pinpoint a detected delay performance problem, the packet delay measurement separation may be based on mapped 5QI (or for QCI in case of NR option 3).

NOTE: It is an asumtion that the DL/UL delay on the F1 interface is equal, only DL measurement is defined. It is also assumed that the UL delay in the gNB-DU and in the gNB-CU-UP is small (compared to over-the-air delay) and not considered.

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| **End of Modified Sections** |