**3GPP TSG-SA5 Meeting #145-e *S5-225354***

**Online, , 15th Aug 2022 - 24th Aug 2022**

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
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|  | **28.552** | **CR** | **0381** | **rev** | **-** | **Current version:** | **17.7.1** |  |
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| *For* [***HE******LP***](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:***  |  |
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| ***Source to WG:*** | China Telecomunication Corp., ZTE, Nokia, China Unicom |
| ***Source to TSG:*** | S5 |
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| ***Work item code:*** | PM\_KPI\_5G\_Ph3 |  | ***Date:*** | 2022-08-05 |
|  |  |  |  |  |
| ***Category:*** | **B** |  | ***Release:*** | Rel-18 |
|  | *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-16 (Release 16)Rel-17 (Release 17)Rel-18 (Release 18)Rel-19 (Release 19)* |
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| ***Reason for change:*** | With Bandwidth Adaptation (BA), the transmit bandwidth of a UE need not be as large as the bandwidth of the cell and can be adjusted. BA is achieved by configuring the UE with BWP(s) and telling the UE which of the configured BWPs is currently the active one. The value of the activated BWP of the UE will affect the UE throughput and thus the cell throughput. As the UE throughput is usually used for evaluating network’s performance, it is of great importance to add UE throughput measurement in BWP granularity. |
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| ***Summary of change:*** | Add UE throughput measurements in BWP granularity. |
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| ***Consequences if not approved:*** | Poor-quality cells with unsatisfied throughput may be incorrectly identified. |
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| ***Clauses affected:*** | 5.1.1.3.1, 5.1.1.3.3, A.X(new) |
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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:*** |  |
|  |  |
| ***This CR's revision history:*** |  |

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| **1st change** |

##### 5.1.1.3.1 Average DL UE throughput in gNB

a) This measurement provides the average UE throughput in downlink. This measurement is intended for data bursts that are large enough to require transmissions to be split across multiple slots. The UE data volume refers to the total volume scheduled for each UE regardless if using only primary- or also supplemental aggregated carriers. The measurement is optionally split into subcounters per QoS level (mapped 5QI or QCI in NR option 3) and subcounters per supported S-NSSAI, and subcounters per PLMN ID, and subcounters per BWP. In the case of per BWP, the UE data volume refers to the total volume scheduled for each Active BWP with same bandwith except UEs with activated supplemental aggregated carrier(s).

b) DER (N=1)

c) This measurement is obtained according to the following formula based on the "ThpVolDl" and "ThpTimeDl" defined below. Separate counters are maintained for each mapped 5QI (or QCI for option 3) and for each supported S-NSSAI, and for each PLMN ID, and for each Active BWP.

If$ \sum\_{}^{}UE\_{S}\sum\_{}^{}ThpTimeDl>0$ , $\frac{\sum\_{}^{}UE\_{S}\sum\_{}^{}ThpVolDl}{\sum\_{}^{}UE\_{S}\sum\_{}^{}ThpTimeDl}$×1000 [kbit/s]

If$ \sum\_{}^{}UE\_{S}\sum\_{}^{}ThpTimeDl=0$ , 0 [kbit/s]

For small data bursts, where all buffered data is included in one initial HARQ transmission,$ThpTimeDl=0$, otherwise$ ThpTimeDl=T1-T2[ms]$

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| ThpTimeDl | The time to transmit a data burst excluding the data transmitted in the slot when the buffer is emptied. A sample of "ThpTimeDl" for each time the DL buffer for one DataRadioBearer (DRB) is emptied. |
| T1 | The point in time after T2 when data up until the second last piece of data in the transmitted data burst which emptied the RLC SDU available for transmission for the particular DRB was successfully transmitted, as acknowledged by the UE.  |
| T2 | The point in time when the first transmission begins after a RLC SDU becomes available for transmission, where previously no RLC SDUs were available for transmission for the particular DRB. |
|  ThpVolDl | The RLC level volume of a data burst, excluding the data transmitted in the slot when the buffer is emptied. A sample for ThpVolDl is the data volume, counted on RLC SDU level, in kbit successfully transmitted (acknowledged by UE) in DL for one DRB during a sample of ThpTimeDl. (It shall exclude the volume of the last piece of data emptying the buffer). |

d) Each measurement is a real value representing the throughput in kbit per second. The number of measurements is equal to one. If the optional QoS level subcounter and S-NSSAI subcounter and PLMN ID subcounter and BWP subcounter measurements are performed, the number of measurements is equal to the number of mapped 5QIs and the number of supported S-NSSAIs, and the number of PLMN IDs, and the number of Active BWPs.

e) The measurement name has the form
DRB.UEThpDl, or optionally DRB.UEThpDl.*QOS,* where *QOS* identifies the target quality of service class, and DRB.UEThpDl.*SNSSAI,* where *SNSSAI* identifies the S-NSSAI, and DRB.UEThpDl.*PLMN,* where *PLMN* identifies the PLMN ID, and DRB.UEThpDl.*BWP,* where *BWP* identifies the Active BWP.

f) NRCellDU

g) Valid for packet switched traffic

h) 5GS

i) One usage of this measurement is for performance assurance within integrity area (user plane connection quality).

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| **next change** |

##### 5.1.1.3.3 Average UL UE throughput in gNB

a) This measurement provides the average UE throughput in uplink. This measurement is intended for data bursts that are large enough to require transmissions to be split across multiple slots. The UE data volume refers to the total volume scheduled for each UE regardless if using only primary- or also supplemental aggregated carriers. The measurement is optionally split into subcounters per QoS level (mapped 5QI or QCI in NR option 3) and subcounters per supported S-NSSAI, and subcounters per PLMN ID, and subcounters per BWP. In the case of per BWP, the UE data volume refers to the total volume scheduled for each Active BWP with same bandwith except UEs with activated supplemental aggregated carrier(s).

B) DER(N=1)

c) This measurement is obtained according to the following formula based on the "ThpVolUl" and "ThpTimeUl" defined below. Separate counters are maintained for each mapped 5QI (or QCI for option 3) and for each supported S-NSSAI, and for each PLMN ID, and for each Active BWP.

If$ \sum\_{}^{}UE\_{S}\sum\_{}^{}ThpTimeUl>0$ , $\frac{\sum\_{}^{}UE\_{S}\sum\_{}^{}ThpVolUl}{\sum\_{}^{}UE\_{S}\sum\_{}^{}ThpTimeUl}$×1000 [kbit/s]

If$ \sum\_{}^{}UE\_{S}\sum\_{}^{}ThpTimeUl=0$ , 0 [kbit/s]

For small data bursts, where all buffered data is included in one initial HARQ transmission,$ThpTimeUl=0$, otherwise,$ ThpTimeUl=T1-T2[ms]$

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| ThpTimeUl | The time to transmit a data burst excluding the data transmitted in the slot when the buffer is emptied. A sample of "ThpTimeUl" for each time the UL buffer for one DataRadioBearer (DRB) is emptied. |
| T1 | The point in time when the data up until the second last piece of data in data burst has been successfully received for a particular DRB  |
| T2 | The point in time when transmission is started for the first data in data burst for a particular DRB. |
| ThpVolUl  | The RLC level volume of a data burst, excluding the data transmitted in the slot when the buffer is emptied. A sample for ThpVolUl is the data volume counted on RLC SDU level in kbit received in UL for one DRB during a sample of ThpTimeUl, (It shall exclude the volume of the last piece of data emptying the buffer). |

d) Each measurement is a real value representing the throughput in kbit per second. The number of measurements is equal to one. If the optional QoS level subcounter and S-NSSAI subcounter and PLMN ID subcounter and BWP subcounter measurements are performed, the number of measurements is equal to the number of mapped 5QIs and the number of supported S-NSSAIs, and the number of PLMN IDs, and the number of Active BWPs.

e) The measurement name has the form
DRB.UEThpUl, or optionally DRB.UEThpUl.*QOS,* where *QOS* identifies the target quality of service class and DRB.UEThpUl.*SNSSAI,* where *SNSSAI* identifies the S-NSSAI, and DRB.UEThpUl.*PLMN,* where *PLMN* identifies the PLMN ID, and DRB.UEThpUl.*BWP,* where *BWP* identifies the Active BWP.

f) NRCellDU

g) Valid for packet switched traffic

h) 5GS

i) One usage of this measurement is for performance assurance within integrity area (user plane connection quality).

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| **next change** |

# A.X Monitoring of UE Throughput per BWP in NG-RAN

UE throughput is one of the key indicators to reflect cell quality. Keeping track of UE throughput in NG-RAN is helpful for cell configurations and features scheduling to ensure user satisfication and network performance.

With Bandwidth Adaptation (BA), the receive and transmit bandwidth of a UE needs not to be as large as the bandwidth of the cell and can be adjusted (e.g., to shrink the bandwidth during the period of low activity to save power). A subset of the total cell bandwidth is referred to as a Bandwidth Part (BWP) and BA is achieved by configuring the UE with BWP(s) and telling the UE which of the configured BWPs is currently the active one. The value of the activated BWP of the UE will affect the UE throughput and thus the cell throughput. The larger BWP is activated, the higher the throughput will achieve.

When monitoring the quality of a cell with a 100MHz bandwidth, in case that all UEs are activated with 100 MHz BWP, it is reasonable to consider the cell as a poor-quality cell if the UE throughput is lower than a fixed threshold. However, when small bandwidth BWP is activated, for example, to save power, some UEs in the cell are activated with 20 MHz Dedicated BWP, other UEs are activated with 100Mhz Dedicated BWP, the previous fixed threshold for judging poor-quality cell is not applicable since peak throughput of some users is limited by the small active BWP. In this case, the UE throughput per BWP needs to be considered to set the proper threshold, so as to correctly estimate whether the cell quality is poor or not. Therefore, measurements and monitoring of UE throughput per BWP is needed.

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| **End of changes** |