**3GPP TSG-SA5 Meeting #134e *S5-206206rev3***

**e-meeting 16th 25th November 2020**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **28.554** | **CR** | **0071** | **rev** | **-** | **Current version:** | **17.0.0** |  |
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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 | **X** |

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| ***Title:*** | Add EE KPI definitions for network slices | | | | | | | | | |
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| ***Source to WG:*** | Orange, AT&T, Huawei, Deutsche Telekom, China Unicom | | | | | | | | | |
| ***Source to TSG:*** | S5 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | EE5GPLUS | | | | |  | ***Date:*** | | | 05/11/2020 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | B |  | | | | | ***Release:*** | | | Rel-17 |
|  | *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 can be 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:*** | | No Energy Efficiency (EE) KPI has been defined for network slices eMBB, URLLC and MIoT. | | | | | | | | |
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| ***Summary of change:*** | | Add EE KPI definitions for network slices eMBB, URLLC and MIoT. | | | | | | | | |
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| ***Consequences if not approved:*** | | It would not be possible to measure the Energy Efficiency (EE) of network slices eMBB, URLLC and MIoT. | | | | | | | | |
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| ***Clauses affected:*** | | 6.7.X (New), A.16 | | | | | | | | |
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|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **N** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **N** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **N** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

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| **1st change** |

## 6.7 Energy Efficiency (EE) KPI

### 6.7.X Network slice Energy Efficiency (EE)

#### 6.7.X.1 Generic Network Slice Energy Efficiency (EE) KPI



where:

- ‘Performance of network slice’ (Pns) is defined per type of network slice;

- ‘Energy Consumption of network slice’ (ECns) is defined independently from any type of network slice.

Editor’s note: the definition of ECns is FFS.

For one unit of ECns, the higher Pns is, the higher the generic network slice EE KPI is, i.e. the more energy efficient the network slice is.

#### 6.7.X.2 Energy efficiency of eMBB network slice

a) EEeMBB,DV

b) A KPI that shows the energy efficiency of network slices of type eMBB. The Pns for a network slice of type eMBB is obtained by summing up UL and DL data volumes at N3 interface(s) of the network slice.



, where *SNSSAI* identifies the S-NSSAI.

This KPI is obtained by the sum of UL and DL data volumes at N3 interface(s) of the network slice, divided by the energy consumption of the network slice. The unit of this KPI is bit/J.

c)



d) NetworkSlice

e) In case of redundant transmission paths over the N3 interface for high reliability communication (cf. TS 23.501 [7] clause 5.33.2), it is expected that the data volume is counted once. In particular:

- In case of Dual Connectivity based end to end Redundant User Plane Paths (cf. TS 23.501 [7] clause 5.33.2.1), in which a UE may set up two redundant PDU Sessions over the 5G network, the Data Volume related to only one PDU session is to be considered;

- In case of redundant transmission with two N3 tunnels between the PSA UPF and a single NG-RAN node (cf. TS 23.501 [7] figure 5.33.2.2-1) which are associated with a single PDU Session, the Data Volume related to only one N3 tunnel is to be considered;

- In case of two N3 and N9 tunnels between NG-RAN and PSA UPF for redundant transmission (cf. TS 23.501 [7] figure 5.33.2.2-2) associated with a single PDU Session, the Data Volume related to only one N3 tunnel is to be considered.

For the measurement of the energy efficiency of the 5G core network, the 3GPP management system in charge of collecting the data volume measurements listed here below shall consider them only once in case of redundant transmission over the N3 interface.

#### 6.7.X.3 Energy efficiency of URLLC network slice

a) EEUrllc,Latency

b) A KPI that shows the energy efficiency of network slices of type URLLC. The Pns for a network slice of type URLLC is the inverse of the average end-to-end User Plane (UP) latency of the network slice.



, where ‘Network slice mean latency’ is defined as the average end-to-end User Plane (UP) latency of the network slice, and where the average end-to-end User Plane (UP) latency for one S-NSSAI is defined by:



This KPI is obtained by the inverse of the average end-to-end User Plane (UP) latency of the network slice divided by the energy consumption of the network slice. The unit of this KPI is (0.1ms \* J)-1.

c)



d) NetworkSlice

#### 6.7.X.4 Energy efficiency of MIoT network slice

##### 6.7.X.4.1 Based on the number of registered subscribers of the network slice

a) EEMIoT,RegSubs

b) A KPI that shows the energy efficiency of network slices of type MIoT. In this case, the Pns for a network slice of type MIoT is the maximum number of subscribers registered to the network slice.



, where *SNSSAI* identifies the S-NSSAI.

This KPI is obtained by the maximum number of registered subscribers to the network slice divided by the energy consumption of the network slice. The unit of this KPI is user/J.

c)



d) NetworkSlice

##### 6.7.X.4.2 Based on the number of active UEs in the network slice

a) EEMIoT,ActiveUEs

b) A KPI that shows the energy efficiency of network slices of type MIoT. In this case, the Pns for a network slice of type MIoT is the mean number of active UEs of the network slice.



, where *SNSSAI* identifies the S-NSSAI.

This KPI is obtained by the mean number of active UEs of the network slice divided by the energy consumption of the network slice. The unit of this KPI is UE/J.

c)



d) NetworkSlice

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| **Next change** |

# A.16 Use case for 5G Energy Efficiency (EE) KPI

Assessment of Energy Efficiency in network is very important for operators willing to control their OPEX and, in particular, their network energy OPEX.

5G energy efficiency can be addressed from various perspectives:

- NG-RAN

Mobile Network data Energy Efficiency (EEMN,DV) is the ratio between the performance indicator (DVMN) and the energy consumption (ECMN) when assessed during the same time frame, see ETSI ES 203 228 [8] clause 3.1 and clause 5.3.

where EEMN,DV is expressed in bit/J.

Assessment of EEMN,DV needs the collection of both Data Volumes (DV) and Energy Consumption (EC) of 5G Network Functions (NF). How this EE KPI can be applied to NG-RAN is specified in clause 4.1 of TS 28.310 [9].

Before the network operator takes any action to save network energy OPEX, the network operator needs to know the energy efficiency of its 5G network.

This KPI needs to be used for observing the impact of NG-RAN on data energy efficiency of 5G access networks.

- Network slices

In a Network Slice as a Service (NSaaS) model, a Network Slice Customer (NSC) may ask to its Network Slice Provider (NSP) a network slice with certain characteristics, among which the expected EE of the network slice. It is therefore required that a standardized definition of EE KPIs exists, per type of network slice, and that such EE KPIs can be measured and delivered by Network Slice Providers.

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| **End of changes** |