**3GPP TSG-SA5 Meeting #139e *S5-215048rev1***

**e-meeting 11th – 20th October 2021**

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| *CR-Form-v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
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|  | **28.554** | **CR** | **0086** | **rev** | **-** | **Current version:** | **17.4.0** |  |
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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 definition of ECns | | | | | | | | | |
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| ***Source to WG:*** | Orange, Huawei | | | | | | | | | |
| ***Source to TSG:*** | S5 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | EE5GPLUS | | | | |  | ***Date:*** | | | 29/09/2021 |
|  |  | | | |  | |  | | |  |
| ***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:*** | | There is no definition of the energy consumed by network slices (ECns) though the EE KPI for network slices uses it as denominator. | | | | | | | | |
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| ***Summary of change:*** | | A definition of ECns is introduced.  The existing editor’s notes stating that the definition of ECns and ECRANonlyns are FFS are removed. | | | | | | | | |
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| ***Consequences if not approved:*** | | There would be no definition of the energy consumption of a network slice, making the definition of the EE KPI for network slices incomplete. | | | | | | | | |
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| ***Clauses affected:*** | | 6.7.2.1, 6.7.2.2a.1, 6.7.3.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 ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
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| ***This CR's revision history:*** | |  | | | | | | | | |

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| **1st change** |

#### 6.7.2.1 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.

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.

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| **Next change** |

#### 6.7.2.2a Energy efficiency of eMBB network slice – RAN-based

##### 6.7.2.2a.1 Definition

a) EERANonlyeMBB,DV

b) A KPI that shows the energy efficiency of network slices of type eMBB based on NR measurements. The Pns for a network slice of type eMBB is obtained by summing up UL and DL data volumes at F1-U, Xn-U and X2-U interface(s) of gNBs, on a per S-NSSAI basis.

c)

For non-split gNBs:



, where:

- DRB.PdcpSduVolumeUl.*SNSSAI* is the Data Volume (amount of PDCP SDU bits) in the uplink delivered to PDCP layer per S-NSSAI - see TS 28.552 [4] clause 5.1.2.1.2.1,

- DRB.PdcpSduVolumeDl.*SNSSAI* is the Data Volume (amount of PDCP SDU bits) in the downlink delivered to PDCP layer per S-NSSAI - see TS 28.552 [4] clause 5.1.2.1.1.1.

For split gNBs:



, where:

- DRB.F1uPdcpSduVolumeDl.*SNSSAI* is the number of DL PDCP SDU bits sent to GNB-DU (F1-U interface) per S-NSSAI - see TS 28.552 [4] clause 5.1.3.6.2.3,

- DRB.F1uPdcpSduVolumeUl.*SNSSAI* is the number of UL PDCP SDU bits entering the GNB-CU-UP from GNB-DU (F1-U interface) per S-NSSAI - see TS 28.552 [4] clause 5.1.3.6.2.4,

- DRB.XnuPdcpSduVolumeDl.*SNSSAI* is the number of DL PDCP SDU bits sent to external gNB-CU-UP (Xn-U interface) per S-NSSAI - see TS 28.552 [4] clause 5.1.3.6.2.3,

- DRB.XnuPdcpSduVolumeUl.*SNSSAI* is the number of UL PDCP SDU bits entering the GNB-CU-UP from external gNB-CU-UP (Xn-U interface) per S-NSSAI - see TS 28.552 [4] clause 5.1.3.6.2.4,

- DRB.X2uPdcpSduVolumeDl.*SNSSAI* is the number of DL PDCP SDU bits sent to external eNB (X2-U interface) per S-NSSAI - see TS 28.552 [4] clause 5.1.3.6.2.3,

- DRB.X2uPdcpSduVolumeUl.*SNSSAI* is the number of UL PDCP SDU bits entering the GNB-CU-UP from external eNB (X2-U interface) per S-NSSAI - see TS 28.552 [4] clause 5.1.3.6.2.4.

The final Network Slice EE KPI definition, based on Data Volume, for RAN-only eMBB type of network slice, would be defined as follows:



, where ECRANonlyns is the energy consumption of the RAN-only network slice over the same observation period.

d) NetworkSlice

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| **Next change** |

#### 6.7.3.X Network Slice Energy Consumption (EC)

a) ECns

b) This KPI describes the Energy Consumption (EC) of the network slice. It is obtained by summing up the Energy Consumption of all the Network Functions (ECNF) that compose the network slice. The unit of this KPI is J.

c)



As a network slice may be composed of a RAN network slice subnet, a Transport Network (TN) network slice subnet and a 5GC network slice subnet, they all participate to the energy consumption of the network slice. However, the definition and way to measure the energy consumption of the TN segment is not in the scope of the present document.

The definition of ECns based on the following principles:

- For all gNBs in the network slice, clause 5.1.1.19.3 (PNF Energy consumption) of TS 28.552 [6] applies. This measurement is obtained according to the method defined in ETSI ES 202 336-12 [10] – clauses 4.4.3.1, 4.4.3.4, Annex A;

- In case a 5GC NF is composed of Virtualized Network Functions (VNF) and/or Physical Network Functions (PNF), clause 6.7.3.1 of this document defines the NF Energy Consumption (EC);

- In case a NF is dedicated to a network slice, the energy consumption of the NF is entirely attributable to the network slice;

- In case a NF is shared between multiple network slices, the participation of the NF to the energy consumption of the network slice has to be estimated, as it can't be measured:

- In case of a gNB shared between multiple network slices, the energy consumption attributable to each network slice is estimated as a proportion of the total gNB energy consumption, where the proportion is calculated as the data volume of the network slice relatively to the total data volume carried by the gNB,

- In case of a AMF shared between multiple network slices, the energy consumption attributable to each network slice is estimated as a proportion of the total estimated AMF energy consumption, where the proportion is calculated as the mean number of registered subscribers of the network slice relatively to the overall mean number of registered subscribers of the AMF during the same time period (cf. TS 28.552 [6] clause 5.2.1.1 for the definition of the mean number of registered subscribers),

- In case of a SMF shared between multiple network slices, the energy consumption attributable to each network slice is estimated as a proportion of the total estimated SMF energy consumption, where the proportion is calculated as the mean number of PDU sessions of the network slice relatively to the overall mean number of PDU sessions of the SMF during the same time period (cf. TS 28.552 [6] clause 5.3.1.1 for the definition of the mean number of PDU sessions),

- In case of a UPF shared between multiple slices, the energy consumption attributable to each network slice is estimated as a proportion of the total estimated UPF energy consumption, where the proportion is calculated as the data volume of the network slice relatively to the overall data volume of the UPF during the same time period.

- In case of a UPF with N3 interface(s), the data volume of the UPF is obtained by summing up, for all N3 interface(s), the number of octets of incoming GTP data packets on the N3 interface, from (R)AN to UPF (cf. TS 28.552 [6] clause 5.4.1.3) and the number of octets of outgoing GTP data packets on the N3 interface, from UPF to (R)AN (cf. TS 28.552 [6] clause 5.4.1.4)

- In case of a PSA UPF with no N3 interface(s), the data volume of the UPF is obtained by summing up, for all N9 interface(s), the number of octets of incoming GTP data packets on the N9 interface for PSA UPF (cf. TS 28.552 [6] clause 5.4.4.2.3) and the number of octets of outgoing GTP data packets on the N9 interface for PSA UPF (cf. TS 28.552 [6] clause 5.4.4.2.4)

- The case of other 5GC NFs shared between network slices is not addressed in the present document.

d) NetworkSlice

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| **End of changes** |