**3GPP TSG-SA5 Meeting #140-e *S5-216048rev4***

e-meeting, 15 - 24 November 2021 (revision of S5-21xxxx)

**Source: Orange**

**Title: New SID on new aspects of EE for 5G networks Phase 2**

**Document for: Approval**

**Agenda Item: 6.2**

3GPP™ Work Item Description

Information on Work Items can be found at <http://www.3gpp.org/Work-Items>
See also the [3GPP Working Procedures](http://www.3gpp.org/specifications-groups/working-procedures), article 39 and the TSG Working Methods in [3GPP TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm)

Title: Study on new aspects of EE for 5G networks Phase 2

Acronym: FS\_EE5G\_Ph2

Unique identifier:

{A number to be provided by MCC at the plenary}

Potential target Release: Rel-18

# 1 Impacts

{For Normative work, identify the anticipated impacts. For a Study, identify the scope of the study}

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Affects: | UICC apps | ME | AN | CN | Others (specify) |
| Yes |  |  | X | X |  |
| No | X | X |  |  |  |
| Don't know |  |  |  |  |  |

# 2 Classification of the Work Item and linked work items

## 2.1 Primary classification

### This work item is a …

|  |  |
| --- | --- |
|  | Feature |
|  | Building Block |
|  | *Work Task* |
| X | Study Item |

## 2.2 Parent Work Item

For a brand-new topic, use “N/A” in the table below. Otherwise indicate the parent Work Item.

|  |
| --- |
| Parent Work / Study Items  |
| Acronym | Working Group | Unique ID | Title (as in 3GPP Work Plan) |
|  |  |  |  |

### 2.3 Other related Work Items and dependencies

|  |
| --- |
| Other related Work /Study Items (if any) |
| Unique ID | Title | Nature of relationship |
| 870021 | Study on new aspects of EE for 5G networks | This study is the continuation of the Rel-17 ‘Study on new aspects of EE for 5G networks’. |
|  | Enhancements of EE for 5G Phase 2 | This study will feed the work item ‘Enhancements of EE for 5G Phase 2’. |
|  | Rel-18 SA5 Study on AI/ML management | This study will focus on end-to-end energy saving use case description and potential solution(s) leveraging the Rel-18 study on AI/ML management. |

# 3 Justification

The Release 17 work item on energy efficiency of 5G networks led to the specification of use cases, requirements and solutions for the measurement of the energy efficiency of 5G, including NG-RAN, core network and network slices and for the optimization of the energy efficiency, i.e. the management of the saving of the energy, in 5G.

Current 3GPP technical specifications dealing with energy efficiency of 5G have the following limitations:

* the energy consumption of VNFs is estimated based on their virtual CPU usage. Two axes of improvement remain to be investigated:
* Study whether additional virtual resource metrics provided by NFV MANO other than virtual CPU usage, such as e.g. virtual disk usage, virtual link usage, etc. (cf. ETSI NFV IFA 006 and IFA 008), could participate to define the VNF energy consumption,
* Study how the accuracy of the existing virtual CPU usage metric provided by NFV MANO (cf. ETSI NFV IFA 006 and IFA 008) could be improved;
* Energy efficiency KPIs for various types of network slices have been defined, namely for eMBB, URLLC and MIoT. However, V2X has not been addressed yet. Also the EE KPI for URLLC network slice based on reliability is not defined yet.

In addition, new aspects of energy efficiency have been identified that should be studied:

* With regard to energy efficiency:
	+ the existing method to estimate the energy consumption of VNFs relies on that VNFs are based on Virtual Machines (VM). Containerized Network Functions (CNF) have not yet been addressed; corresponding energy consumption KPI(s) definition should be studied as well;
* With regard to energy saving:
	+ New use cases for energy saving, applying to NG-RAN and/or 5GC and/or network slicing
	+ AI/ML assisted energy saving
	+ OA&M support to TSG RAN energy saving use cases and solutions, e.g. from 3GPP TR 37.817 Study on enhancement for Data Collection for NR and EN-DC;
* With regard to digital sobriety applied to 3GPP. Given that a) the cheapest energy is the energy which is not used and b) the energy consumed by network elements / network functions has some dependency on data or signalling volumes processed and/or transported and/or stored by the network elements / network functions:
	+ Study which forms digital sobriety could take in SA5, e.g. minimize the volume of OA&M data (number of operation parameters, input data to MDAF, etc.) to be processed and/or transported and/or stored,
	+ Study if any metrics can be defined to compare different alternative solutions with regards to digital sobriety.

# 4 Objective

The objective of this study is to investigate on the following main axis:

* On the energy consumption of Network Functions:
* Study whether additional virtual resource metrics provided by NFV MANO other than virtual CPU usage, such as e.g. virtual memory usage, virtual disk usage, etc., could participate to define VNF energy consumption,
* Study how the existing virtual CPU usage metric provided by NFV MANO could give more accurate measurements,
* Study a method to estimate the energy consumption of Containerized Network Functions (CNF) and elaborate corresponding energy consumption KPI(s) definition;
* On the energy efficiency KPIs:
	+ Investigate on the definition of new EE KPIs which consider aspects such as e.g. coverage area, user experience, reliability of URLLC network slice,
	+ Investigate how to define the energy efficiency KPI for V2X type of network slice,
	+ Investigate further on definition of the Resource Efficiency KPI, in particular on the Useful Output of 5GC network functions,
	+ Investigate further for solutions to any outstanding issue from Rel-17;
* On energy saving:
	+ Study new use cases, requirements and solutions for energy saving, applying to NG-RAN and/or 5GC and/or network slicing, including AI/ML assisted energy saving. This study will focus on end-to-end energy saving use case(s) description and potential solution(s) leveraging the Rel-18 study on AI/ML management,
	+ Study OA&M support to other 3GPP WGs energy saving use cases and solutions, if any;
* On digital sobriety:
	+ Study which forms digital sobriety could take in SA5, e.g. minimize the volume of OA&M data (number of operation parameters in MnS APIs, input data to MDAF, etc.) to be transported and/or stored,
	+ Study if any metrics can be defined to compare different alternative solutions with regards to digital sobriety.

This study will feed the companion Rel-18 work item ‘Enhancements of EE for 5G Phase 2’.

For the aforementioned items, exchanges with other 3GPP WGs, ETSI TC EE, ETSI NFV, ITU-T SG5, GSMA and NGMN may be needed.

# 5 Expected Output and Time scale

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| --- |
| New specifications {One line per specification. Create/delete lines as needed} |
| Type  | TS/TR number | Title | For info at TSG#  | For approval at TSG# | Rapporteur |
| Internal TR | 28.8xx | Study on new aspects of Energy Efficiency (EE) for 5G Phase 2 | TSG SA#99 | TSG SA#100 | Cornily Jean-Michel, Orange, jeanmichel.cornily@orange.com |
|  |  |  |  |  |  |

|  |
| --- |
| Impacted existing TS/TR {One line per specification. Create/delete lines as needed} |
| TS/TR No. | Description of change  | Target completion plenary# | Remarks |
|  |  |  |  |
|  |  |  |  |

# 6 Work item Rapporteur(s)

Cornily Jean-Michel, Orange, jeanmichel.cornily@orange.com

# 7 Work item leadership

SA5

# 8 Aspects that involve other WGs

Interactions with RAN WGs may be needed, e.g. with regard to the potential OA&M support to TSG RAN energy saving use cases and solutions.

# 9 Supporting Individual Members

{At least 4 supporting Individual Members are needed. There is an expectation that these companies will provide resources to progress the work. Note that having 4 supporting companies is a necessary but not sufficient condition: the usual TSG approval process by consensus is needed for the WID approval}

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| Supporting IM name |
| Orange |
| Telefonica |
| AT&T |
| Deutsche Telekom |
| China Unicom |
| Verizon |
|  |
| Huawei |
| Intel |
| Samsung |
| Ericsson |