**3GPP TSG-SA4 Meeting # 128 S4-240877\_r1**

**Jeju, KR, 20th - 24th May 2024**

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| *CR-Form-v12.2* | | | | | | | | |
| **PSEUDO CHANGE REQUEST** | | | | | | | | |
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|  | **26.942** | **CR** |  | **rev** |  | **Current version:** | **0.1.1** |  |
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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 | **X** | Radio Access Network |  | Core Network | **X** |

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| ***Title:*** | FS\_MediaEnergyGREEN KI#1 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Orange | | | | | | | | | |
| ***Source to TSG:*** | S4 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | FS\_MediaEnergyGREEN | | | | |  | ***Date:*** | | | 2024-05-20 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | B |  | | | | | ***Release:*** | | | Rel-19 |
|  | *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-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)  Rel-20 (Release 20)* | |
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| ***Reason for change:*** | | Add a section on describing use cases and describe Key Issue #1: Information exposure and list the associated requirements. | | | | | | | | |
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| ***Summary of change:*** | | Additiopn of a section for use cases description and description of the Key Issue #1: Information exposure and add associated requirements. | | | | | | | | |
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| ***Consequences if not approved:*** | | SID objectives will not be met. | | | | | | | | |
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| ***Clauses affected:*** | |  | | | | | | | | |
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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:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

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| **1st Change** |

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non‑specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[28554] 3GPP TS 28.554: "5G end to end Key Performance Indicators (KPI)".

[28552] 3GPP TS 28.552: "Management and orchestration; 5G performance measurements".

[28533] 3GPP TS 28.533: "Management and orchestration; Architecture framework".

[28622] 3GPP TS 28.622: "Telecommunication management; Generic Network Resource Model (NRM) Integration Reference Point (IRP); Information Service (IS)".

[28532] 3GPP TS 28.532: "Management and orchestration; Generic management services".

[L.1210] International Telecommunication Union, Recommendation ITU-T L.1210, "Sustainable power-feeding solutions for 5G networks", 12/2019

[L.1220] International Telecommunication Union, Recommendation ITU-T L.1220, "Innovative energy storage technology for stationary use – Part 1: Overview of energy storage", 8/2017

[L.1221] International Telecommunication Union, Recommendation ITU-T L.1221, "Innovative energy storage technology for stationary use – Part 2: Battery", 11/2018

[L.1222] International Telecommunication Union, Recommendation ITU-T L.1222, "Innovative energy storage technology for stationary use – Part 3: Supercapacitor technology", 5/2018

[L.1331] International Telecommunication Union, Recommendation ITU-T L.1331, "Assessment of mobile network energy efficiency", 1/2022

[L.1350] International Telecommunication Union, Recommendation ITU-T L.1350, "Energy efficiency metrics of a base station site", 10 /2016

[L.1351] International Telecommunication Union, Recommendation ITU-T L.1351, "Energy efficiency measurement methodology for base station sites", 8/2018

[L.1380] International Telecommunication Union, Recommendation ITU-T L.1380, "Smart energy solution for telecom sites", 11/2019

[L.1381] International Telecommunication Union, Recommendation ITU-T L.1381, "Smart energy solutions for data centres", 6/2020

[L.1382] International Telecommunication Union, Recommendation ITU-T L.1382, "Smart energy solution for telecommunication rooms", 6/2020

[L.1383] International Telecommunication Union, Recommendation ITU-T L.1383, "Smart energy solutions for city and home applications", 10/2021

[L.1310] International Telecommunication Union, Series L Supplement 36, "ITU-T L.1310 – Study on methods and metrics to evaluate energy efficiency for future 5G systems", 11/2017

[L.sup43] International Telecommunication Union, Series L Supplement 43, "Smart energy saving of 5G base stations: Traffic forecasting and strategy optimization of 5G wireless network energy consumption based on artificial intelligence and other emerging technologies", 5/2021

[L.1450] International Telecommunication Union, Recommendation ITU-T L.1450, "Methodologies for the assessment of the environmental impact of the information and communication technology sector", 9/2018

[ICT] Jens Malmodin, Nina Lövehagen, Pernilla Bergmark, and Dag Lundén. "[ICT sector electricity consumption and greenhouse gas emissions–2020 outcome.](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4424264)" Telecommunications Policy (2024): 102701

[BT2385] International Telecommunication Union, Report ITU-R BT.2385-1, "Reducing the environmental impact of terrestrial broadcasting systems", 03/2022

[OP104] International Telecommunication Union, Opinion ITU-R OP.104, "Advice for sustainability strategies incorporating carbon offsetting policies", 2022

[BT2521] International Telecommunication Union, Report ITU-R BT.2521-0, "Practical examples of actions to realize energy aware broadcasting", 3/2023

[23001-11] ISO/IEC 23001-11:2023 Information technology, MPEG systems technologies, Part 11: Energy-efficient media consumption (green metadata)

[S100] DVB, "Study Mission report on Energy Aware service Delivery and Consumption", DVB Document S100, 11/2023

[PT9] ATSC Planning Team 9, https://www.atsc.org/subcommittees/planning-team-9-sustainability/

[GoS] Greening of Streaming, <https://www.greeningofstreaming.org/>

[DIMPACT] DIMPACT, <https://dimpact.org/>

[DTMeth] DIMPACT, "Methodology: Estimating the carbon impacts of serving digital media and entertainment products", version 1.0, October 2022

[DTPaper] DIMPACT, Draft paper "Literature review and policy principles for streaming and digital media carbon footprinting", March 2023

[UHDF] Ultra HD Forum, <https://ultrahdforum.org/ibc2023-press-release-ultra-hd-forum-to-showcase-efficient-hdr-sdr-sustainability-demos/>

[22282] 3GPP TR 22.882: "Study on Energy Efficiency as a service criteria".

[26501] 3GPP TS 26.501: "5G Media Streaming (5GMS); General description and architecture".

[26502] 3GPP TS 26.502: "5G multicast-broadcast services; User service architecture".

[26506] 3GPP TS 26.506: "5G Real-time Media Communication Architecture".

…

[x] <doctype> <#>[ ([up to and including]{yyyy[-mm]|V<a[.b[.c]]>}[onwards])]: "<Title>".

It is preferred that the reference to TR 21.905 be the first in the list.

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| **2nd Change** |

# 5 Use cases

## 5.1 Baseline use cases defined by SA1

### 5.1.1 Introduction

Use cases regarding enhancements to Energy Efficiency of 5G network and application service enabler aspects are listed in TR 22.882 [22282]. Five of them have been identified as media-related and therefore fall within the scope of this study:

- *Use case 5.5 on service energy monitoring by an Application Server:* The Application Service Provider cares about energy consumption in the Data Network as a result of the service provided by an Application Server to UEs. This could be for one or more of the following three reasons:

- The Application Service Provider needs to demonstrate that it is reducing energy consumption;

- The service has an associated energy cost, and the Application Service Provider wants to reduce it;

- The Application Service Provider recognises that there are policies that limit energy use and controls the overall use of the service to operate within those constraints.

- *Use case 5.8 on Application service Energy Efficiency (AEE) monitoring:* The energy consumed by an application service at the device side as well as at the network side is be monitored and predicted by the 5G System and is exposed as a monitoring event to the Application Service Provider to allow an application layer action. In the context of media delivery, this action could be for example trigerring multicast/broadcast delivery for a given service area and time of the day.

- *Use case 5.9 on renewable energy consumption information exposure:* Mobile Network Operators need to understand and track the proportion of energy consumed in their networks that is sourced from renewable sources, which can be made available to customers and authorized third parties.

- *Use case 5.10 on supporting carbon-aware communication service:* The Mobile Network Operator provides to end users an estimate of the carbon emissions for the services consumed, for example the equivalent carbon dioxide emissions corresponding to the data consumed by a user during a particular billing cycle.

- *Use case 5.14 on reducing GHG footprint of Application Services:* By considering the temporal and spatial information of sustainable energy source and availability, the possibility of reduction of the greenhouse gas footprint for application services is explored. Rather than optimising compute tasks for highest throughput or lowest latency, those tasks having flexibility in both when and where they are executed (e.g., some AI/ML training or video processing) are routed to a computing node using the (most) sustainable energy sources at that moment.

Media-related requirements associated with these use cases are addressed in the following Key Issues, complemented by requirements associated with the findings identified in clause 4.

### 5.1.2 Exposure of energy consumption to Application Service Provider

## 5.2 Additional use cases defined by SA4

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| **3rd Change** |

# 6 Key issues

[Editor’s note: Description of key issues and their potential requirements]

## 6.1 Key Issue #1: Information exposure

### 6.1.1 Description

As described in the use cases summarised in clause 5.1, energy-related information needs to be collected, estimated, and exposed by the 5G System. This information is not only necessary for internal network optimisation, but will also benefit service adaptation by third-party Application Service Providers. With the consent of Mobile Network Operators, it is relevant to expose energy-related information (e.g., energy consumption information, energy efficiency information, renewable energy and carbon emission information) to authorised consumers.Network energy information exposure has already been studied in TR 23.700-66 [23700-66]. The purpose of this Key Issue is to extend this work, taking into consideration the media context (e.g., the 5G Media Streaming System according to TS 26.501 [26501], 5G Multicast–Broadcast User Services according to TS 26.502 [26502], the Real-time Media Communication according to TS 26.506 [26506]) including UE-related energy information exposure. As explained in clause 4.2.2, a UE data collection and reporting architecture already exist in the 5G System. But energy-related information is missing.

In this context, several questions are pertinent:

1. How should UE energy consumption data be reported by a UE to the 5G System?

2. Which reference points should be used to report UE energy consumption data to the Data Collection AF?

3. Would it be useful to expose energy-related information of the network to the Media Session Handler to help it optimize its media session in an energy-efficient way?

[Editor’s note: Additional questions will probably to be added when other 4.2 clauses will be completed]

These questions will need answers, taking into consideration existing work done in 3GPP but also other market trends. Application Service Providers are often reluctant to deploy solutions specific to mobile networks. Proposing technologies already supported in their services or technologies that are agnostic to the network, or which operate passively without the active involvement or knowledge of applications, are more likely adopted.

### 6.1.2 Potential requirements

The following potential requirements are identified in relation to this Key Issue:

PR-1-1 Subject to operator policy and agreement with a third-party Application Service Provider, the 5G System shall be able to expose to this third party information on energy consumption associated with the consumption of a media delivery service provided by this third party.

PR-1-2 Subject to operator policy, agreement with a third party and consent by the end user, the 5G System shall be able to expose to this third party consumption information (e.g., the data rate, video resolution and screen size) together with energy consumption information resulting from a media delivery service provided by this third party to the end user related to some regular time interval e.g., hourly or daily.

PR-1-3 Subject to operator policy, the 5G System shall provide means for a trusted third party to configure which consumption information (e.g., the data rate, video resolution and screen size) for the media delivery service provided to the third party, and which energy consumption information is to be exposed in relation to this third party.

PR-1-4 Based on operator policy and agreement with a third party, the 5G System shall be able to expose energy consumption information and prediction on energy consumption of the 5G System to this third party per application service.

PR-1-5 Subject to operator policy and agreement with a third party, the 5G System shall support a mechanism for the third party to provide current or predicted energy consumption information over a specific period of time per application service.

NOTE: Requirements PR-1-1 to PR-1-5 are consolidated requirements extracted from clause 6.4 of TR 22.882 [22882].

PR-1-6 Where possible, existing mechanisms (e.g., UE data collection and reporting architecture as in TS 26.531 [26531]) and information shall be reused for exposure of energy-related information.

PR-1-7 Commonly supported client data reporting formats shall be reused for energy-related information exposure when possible.

PR-1-8 The Media Session Handler shall be able to obtain energy-related information from the UE, allowing it to optimise the media delivery sessions it is handling in an energy-efficient manner.

[Editor’s note: Additional Potential Requirements will probably to be added when other 4.2 clauses will be completed]

## 6.2 Key Issue #2: Monitoring and measurement

### 6.2.1 Description

### 6.2.2 Potential requirements

## 6.3 Key Issue #3: Evaluation framework

### 6.3.1 Description

### 6.3.2 Potential requirements

# 7 Potential Solutions

[Editor’s note: Description of potential solutions]

## 7.1 Mapping of Solutions to Key issues

## 7.X Solution #<X>: <Solution Title>

### 7.X.1 Key issue mapping

### 7.X.2 Functional Description

### 7.X.3 Procedures

### 7.X.4 Impacts on existing services, entities and interfaces

# 8 Conclusions and proposed next steps

[Editor’s note: This clause will list conclusions that have been agreed in the study.]

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| **End of Changes** |