**3GPP TSG-SA WG4 Meeting post 130** **S4-242024**

**Orlando, 4 revision of *S4aI240170***

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| *CR-Form-v12.2* |
| **CHANGE REQUEST** |
|  |
|  | **26.942** | **pCR** |  | **rev** | **1** | **Current version:** | **0.3.2** |  |
|  |
| *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:***  | Update to Potential solution to Key Issue #1: Information exposure |
|  |  |
| ***Source to WG:*** | Nokia, Interdigital |
| ***Source to TSG:*** | S4 |
|  |  |
| ***Work item code:*** | FS\_MediaEnergyGREEN |  | ***Date:*** | 2024-11-08 |
|  |  |  |  |  |
| ***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 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:*** | The latest draft of 3GPP TR 26.942 contains clause 7 on Potential Solutions to the already defined and described key issues. In this context, under KI #1; the following questions were defined:In this context, the subsequent analysis by this Key Issue should consider:1. How should UE energy-related information be reported by a UE to the 5G System?2. Which reference points should be used to report UE energy-related information 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? 4. How to allow a UE to report its energy-related information without exposing its energy consumption rate?It is proposed to add the proposed content to the latest draft of TR 26.942 v 0.3.2 under clause 7.1 as one of the potential solutions so that it is not left incomplete. |
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| ***Summary of change:*** | This CR proposes new text to be added in TR 26.942 on “Clause 7 Potential Solutions”. |
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| ***Consequences if not approved:*** | Proposed objectives will not be met. |
|  |  |
| ***Clauses affected:*** | 7 (new), 7.1 (new), 7.2 (new), 7.2.1 (new) |
|  |  |
|  | **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

[22261] 3GPP TS 22.261: "Service requirements for the 5G system".[x] "[Electrochemical Energy Storage for Renewable Sources and Grid Balancing", 2015, pp. 411–435](https://www.sciencedirect.com/science/article/pii/B9780444626165000206).

[y]R1-2206921: "Summary for low power high accuracy positioning".

[z] Accubattery: <https://play.google.com/store/apps/details?id=com.digibites.accubattery>

[26565] 3GPP TS 26.565: "Split Rendering Media Service Enabler".

[26119] 3GPP TS 26.119: "Media Capabilities for Augmented Reality".

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| 2nd Change |

## 7 Potential solutions

Editor’s note: Description of potential solutions.

## 7.1 Mapping of solutions to Key Issues

Table 7.1-1: Mapping of solutions to Key Issues

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| --- | --- | --- | --- |
| Solutions |  |  |  |
|  | KI#1 | KI#2 | KI#3 |
| #1 | X |  |  |
| #2 |  |  |  |
| #3 |  |  |  |
| #4 |  |  |  |
| #5 |  |  |  |
| #6 |  |  |  |
| #7 |  |  |  |
| #8 |  |  |  |
| #9 |  |  |  |

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| 3rd Change(all new text) |

## 7.2 Solution #1: Energy-related information exposure from UE

### 7.2.1 Key Issue mapping

This solution addresses Key Issue #1.

### 7.2.2 Functional description

#### 7.2.2.1 Introduction

Clause 6.15A.5 of TS 22.261 [22261] defines information exposure, which clearly states that information related to energy consumption and efficiency is not only necessary for network internal optimization, but also will benefit service adjustment by a third party such as an Application Service Provider.

In this candidate solution, *Energy credit* is defined as a service criterion which can be used as an abstract measure of the energy impact on the network of delivering a service to a UE. This candidate solution determines the method of obtaining this additional energy-related information, enhancements to the entities involved in obtaining relevant information, and the impact of them, taking into consideration the media context (e.g., the 5G Media Streaming System as defined in TS 26.501 [26501], 5G Multicast–Broadcast User Services as defined in TS 26.502 [26502], the Real-time Media Communication System defined in TS 26.506 [26506], Split rendering for media Session Enabler as specified in TS 26.565 [26565], etc. including UE-related energy information exposure.

#### 7.2.2.3 Energy credit abstraction

Subject to operator policy, the 5G System is required to support a mechanism to perform energy consumption credit limit control for services without taking into account any network Quality of Service (QoS) criteria. Energy credits, associated with a subscriber and used by the network operator’s “credit control” function, are consumed depending on the UE behaviour, for example:

- The number of simultaneously active services.

- The volume of data transferred via the network over a certain period of time.

- The type of media data transferred.

- The geographical area in which the UE is located

- The amount of energy consumed by the network to provide the services.

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#### 7.2.2.4 UE Energy-related information collection and reporting functionality

Clause 6.2.8 of TS 23.288 [23228] envisages a set of high-level procedures by which data is collected by a Network Data Analytics Function (NWDAF) from UE Application(s) via an intermediary Direct Data Collection Client residing in the UE and an Application Function residing in the Data Network that provides an Event Exposure service to *event consumers*. A reference architecture satisfying these requirements in defined in TS 26.531 [26531].

To obtain and maintain the UE energy-related information, a new generic functionality in the UE called the *Energy-Related Information Collection and Reporting entity* is defined within the Direct Data Collection Client as illustrated in figure 7.2.2.4-1. This entity is responsible for collecting and reporting energy-related information in the UE.



Figure 7.2.2.4-1: UE energy information handler entity within generic Direction Data Collection Client

Based on the generic architecture for UE data collection, reporting and event exposure defined in TS 26.531 [26531], figure 7.2.2.4-1 shows different interfaces between the UE and the Data Network, including the new *UE Energy-Related Information Collection and Reporting* functionality in the Direct Data Collection Client. In this case, UE energy-related information is reported to the Data Collection AF at reference point R2 for onward exposure to the NWDAF (at reference point R5) or to the Application Service Provider’s Event Consumer AF (at reference point R6).

As described in clause 4.1 of TS 26.531 [26531], the Data Collection AF is responsible for receiving data reports –the scope of which is extended by this candidate solution to include energy-related information reports – from UEs pertaining to a particular UE data domain, for processing the UE data contained in those reports, and for exposing them to subscribed event consumers in the form of *events*.

When the Direct Data Collection Client is instantiated in the 5G Media Streaming System per clause 4.7.1 of TS 26.501 [26501], the UE Energy Related-Information Collection and Reporting functionality is a subfunction of the Media session Hanlder and plays the role of UE energy information collection and reporting to the Data Collection AF instantiated inside the 5GMS AF. This instantiation in the 5GMS architecture is illustrated in figure 7.2.2.4-2.



Figure 7.2.2.4-2: UE energy information handler entity instantated within
5GMS Media Session Handler

#### 7.2.2.5 Energy-related information relevant to UE

Table 7.2.2.2-1 lists several device properties which are UE energy-related information and which are exposed through the *Energy-Related Information Collection and Reporting* entity. These may be sent along with the properties of the deviceCapabilities object specified in table 8.4.2.2-1 of TS 26.565 [26565].

Table 7.2.2.2-1: UE-related energy information

|  |  |  |  |
| --- | --- | --- | --- |
| Property | Type | Cardinality | Description |
|  |  |  |  |
| UE battery life | Number | 0..1 | Level of the battery of the UE (e.g. in %). |
| UE energy consumption rate (power in W) | Number | 0..1 | UE charging/discharging rate or speed (e.g. in Watts, negative or positive). |
| UE energy preference | Number | 0..1 | Remaining time during which the UE wants to be considered in energy saving (e.g. in mn). “0” means that the end time in unknown. |
| UE battery capacity | Number | 0..1 | The total UE battery capacity (e.g. in mAh). |
| UE source of power supply | enum | 0..1 | e.g. “battery”, “plug-in”, “renewable”. |
| UE discharge rate  | Number | 1..1 | e.g. between 0 and 1000. |
| UE measurement duration | Number | 1..1 | Energy Measurement interval. |
| UE carbon intensity | Number | 1..1 | In -e /  |

- *UE battery discharge rate:* Calculated as the battery capacity (in Ah) divided by the number of hours it takes to charge/discharge the battery [x].

 For example, a battery capacity of 500 Ah that is theoretically discharged to its cut-off voltage in 20 hours has a discharge rate of 500 Ah/20 h = 25 A.

- *UE battery life:* How long the battery will power the device on a single charge. In simple terms, 'battery life' is about how long the UE can run before needing a recharge, which can be a matter of hours or a day, depending on usage [y].

- *UE battery capacity:* Calculated as the total amount of electricity generated due to electrochemical reactions in the battery and expressed in ampere hours (Ah).

 For example, a constant discharge current of 1 C (5 A) can be drawn from a 5 Ah battery for 1 hour [x].

- *UE source of power supply:* An indication of whether the UE is currently operating on battery or mains power (“plugged in”) or by renewable energy (e.g. solar panel). This can include the ratio of renewable energy over different time granularities (e.g. 30% renewable over the last 24h – see TS 28.310 [28310]).

- *UE energy consumption rate:* The integral of power consumption over time (as defined in TS 28.310 [28310]).

- *UE carbon intensity:* Global greenhouse gases emitted per unit of generated electricity, measured in grams of CO₂ equivalents per watt-hour (for conversion to carbon emissions as defined in TS 22.261 [22261] and TS 23.700-66 [23700]).

### 7.2.3 Procedures

The high-level procedure for data collection and reporting, including energy-related information is the same as that defined in clause 5.1 of TS 26.531 [26531] and the detailed call flow for reporting to the Data Collection AF is the same as that defined in clause 5.5 of [26531] except the UE data report includes energy-related information.



Figure 5.5‑1: High-level procedures for UE enery-related data reporting and exposure phase

As specified in clause 6.2.8.2.1 of TS 23.288 [23228], both the direct reporting procedure and indirect reporting procedure are required to be supported. The indirect reporting procedure may be used when a Direct Data Collection Client is not available in the UE or when the Indirect Data Collection Client needs to modify the collected UE data to satisfy the requirements of its data collection and reporting configuration.

Steps 1 to 12 are the same as those in clauses 5.2, 5.3, 5.4 of TS 26.531 [26531]. The three different data collection clients then proceed as follows, with differences fromt the baseline call flow highlighted in **boldface**:

13. If present in the instantiation, the UE Application reports data to the Direct Data Collection Client according to the configuration provided in step 10 of clause 5.4 of TS 26.531 [26531] for inclusion in a data report including energy-related information. The UE application may instruct the Direct Data Collection Client to prioritise immediate delivery of a UE data report **including per-application UE energy-related information** to the Data Collection AF.

14. The Direct Data Collection Client may submit a data report **including per-application UE energy-related information** to the Data Collection AF via reference point R2 by invoking the Ndcaf\_DataReporting service defined in TS 26.531 [26531] and specified in TS 26.532 [26532]. The Direct Data Collection Client may indicate that the data report includes UE data requiring expedited processing by the Data Collection AF.

15. The UE Application may send application-specific data reporting **including per-application UE energy-related information** to the Application Service Provider.

16. ...and the Indirect Data Collection Client may, as a result, submit a data report **including per-application UE energy-related information** to the Data Collection AF by invoking the Ndcaf\_DataReporting service defined in TS 26.531 [26531] and specified in TS 26.532 [26532].

17. The AS may submit a data report to the Data Collection AF by invoking the Ndcaf\_DataReporting service defined in the present document and specified in TS 26.532 [26532].

In response to receiving a data report:

18. The Data Collection AF processes the **per-application UE energy-related information in the** data report.

Reception of a data report by the Data Collection AF may result in an event being exposed to subscribed event consumers:

19. The Data Collection AF may expose a **UE energy consumption** event to the NWDAF by invoking the Naf\_EventExposure\_Notify service operation on the latter, as defined in clause 5.2.19.2.4 of TS 23.502 [23502].

20. The Data Collection AF may expose a **UE energy consumption** event to the Event Consumer AF by invoking the Naf\_EventExposure\_Notify service operation on the latter, as defined in clause 5.2.19.2.4 of TS 23.502 [23502].

### 7.2.4 Impacts on existing services, entities and interfaces

#### 7.2.4.1 Direct Data Collection Client

- Collect and report per-application UE energy-related information to the Data Collection AF according to the procedures described in clause 7.2.3.

#### 7.2.4.2 Data Collection AF

- Expose UE energy-related information events according to the procedures described in clause 7.2.3.

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| End of change |