**3GPP SA WG2 Meeting#166 S2-2412516**

**Orlando, US, November 18 – 22, 2024** **(revision of S2-2412128)**

**Source: Huawei, HiSilicon**

**Title: New WID on Architecture support of Ambient power-enabled Internet of Things**

**Document for: Approval**

**Agenda Item: 30.1**

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: Architecture support of Ambient power-enabled Internet of Things

Acronym: AmbientIoT

Unique identifier: xxx

Potential target Release: Rel-19

# 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 | X |  |
| No |  |  |  |  |  |
| Don't know | X |  |  |  | X |

# 2 Classification of the Work Item and linked work items

## 2.1 Primary classification

### This work item is a …

|  |  |
| --- | --- |
|  | Study |
|  | Normative – Stage 1 |
| X | Normative – Stage 2 |
|  | Normative – Stage 3 |
|  | Normative – Other\* |

## 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) |
| N/A |  |  |  |

### 2.3 Other related Work Items and dependencies

{List here other Work Items which relate to the proposed one, such as a Work Item in an earlier Release if further enhancing the feature from the previous Release)}

|  |  |  |
| --- | --- | --- |
| Other related Work /Study Items (if any) | | |
| Unique ID | Title | Nature of relationship |
| 1020071 | Study on Architecture support of Ambient power-enabled Internet of Things | SA2 study on Architecture support of Ambient power-enabled Internet of Things |
| 1030031 | Study on Security Aspect of Ambient IoT Services in 5G | SA3 study on Architecture support of Ambient power-enabled Internet of Things |
| 1020085 | Study on solutions for Ambient IoT (Internet of Things) in NR | RAN aspects of the Ambient IoT feature in Rel-19 |
| 1020030 | Service requirements for Ambient power-enabled IoT | SA1 requirements for Ambient IoT in Rel-19 |

# 3 Justification

To open up new markets and opportunities for 3GPP systems supporting local device density in the order of magnitude higher than existing 3GPP IoT technologies, Ambient IoT, the new IoT technology, aims to be able to provide complexity and power consumption significantly lower than the existing 3GPP IoT technologies (e.g. NB-IoT and eMTC).

SA1 specifies in TS 22.369 the service and performance requirements for ambient power-enabled Internet of Things (i.e. Ambient IoT). Ambient IoT device is an IoT device powered by energy harvesting, being either battery-less or with limited energy storage capability (e.g. using a capacitor). An Ambient IoT device has low complexity, small size and lower capabilities and lower power consumption than previously defined 3GPP IoT devices (e.g. NB-IoT/eMTC devices). Ambient IoT devices can be maintenance free and can have long life span (e.g. more than 10 years).

The service requirements defined in TS 22.369 include:

- Overview of Ambient IoT service and operation,

- Functional service requirements for Ambient IoT, including communication, positioning, management, exposure, charging, security and privacy.

- Performance service requirements for Ambient IoT, including inventory, sensors, tracking, and actuator.

RAN WGs has investigated RAN level solutions for Ambient IoT in TR 38.769, and the scope includes:

1. Traffic types:

* DT: Device-terminated;
* DO-DTT: Device-originated – device-terminated triggered.

1. Connectivity topologies:

* Topology 1: BS Reader ↔ Ambient IoT Device;
* Topology 2: RAN ↔ UE Reader ↔ Ambient IoT Device;

Aligned with the same scope as RAN study, SA2 has progressed a study to investigate solutions for architectures to support Ambient IoT, identifier of Ambient IoT Device and end-to-end procedure of Ambient IoT Services (Inventory and Command) in TR 23.700-13.

# 4 Objective

NOTE 1: Coordination with RAN is required to determine the scope of the work item.

NOTE 2: The objectives need to be aligned with the TR conclusion.

This work item is to specify the architecture support for Ambient IoT Device and Ambient IoT Services, as per conclusions reached within TR 23.700-13 (clause 8).

Specifically, the work item objectives are:

* WT#1 Architecture to support Ambient IoT, including:
  + Architecture to Support Topology 1.
  + Architecture to Support Topology 2.
  + Common architecture aspects for both topologies.
* WT#2 Ambient IoT Device management, including:
  + Identifier of Ambient IoT Device (i.e. permanent Device ID).
  + Subscription-like information management of Ambient IoT Device.
* WT#3 Ambient IoT Service enabler for Inventory, Read, Write and permanently Disable, including:
  + Exposure of NEF for AIOT services to AF.
  + BS/UE Reader selection/authorization.
  + Data transfer between Device/BS/UE reader and AIOTF.

## TU estimation for the proposed WID

|  |  |  |
| --- | --- | --- |
| **Work Task ID**  **(WT description is extracted from SP-240969** | **TU Estimate**  **(Study)** | **TU Estimate**  **(Normative)** |
| WT#1  Architecture to support Ambient IoT including support of security, validation of the device’s ID, and securing device operations and services for an Ambient IoT device or a group of Ambient IoT devices. | 2.5 | 2.5  NOTE: may update depending on the final scope of architecture options decided at SA#106. |
| WT#2  Identification, Subscription, Registration and Connection management to support Ambient IoT devices | 5 | 2 |
| WT#2.1  Study whether subscription management, registration management and/or connection management are necessary, and if so identify the necessary state machine(s), procedures and functionality considering the Ambient IoT devices capability and characteristics; | 2 | 1  NOTE: scope reduced, only “AIoT Device subscription management” for normaive work |
| WT#2.2  Study whether and how reachability and paging apply to Ambient IoT device(s) considering the Ambient IoT devices capability and characteristics, and if so, what are the impacts. | 1.5 | 0.5  NOTE: scope reduced, “Paging apply to Ambient IoT device(s)” for normaive work |
| WT#2.3  Study how to identify Ambient IoT device or group of devices and how to format the identifier. | 1.5 | 0.5  NOTE: scope reduced, “Ambient IoT Device Identifier” for normative work |
| WT#3  Ambient IoT Services | 4 | 2.5 |
| WT#3.1  Study how to support information transfer for Ambient IoT services and related system functionality. | 2 | 1.5 |
| WT#3.2  Study which Ambient IoT services enabled in WT#3.1 to be exposed to AF and how. | 2 | 1 |

**Total TU estimates for the normative phase: 7**

# 5 Expected Output and Time scale

***{If this WID covers both stage 2 and stage 3, clearly indicate the different completion dates.}***

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 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 |
| New TS | TS 23.xyz | Architecture support of Ambient power-enabled Internet of Things | TSG#107 | TSG#108 | TBD |
|  |  |  |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| Impacted existing TS/TR {One line per specification. Create/delete lines as needed} | | | |
| TS/TR No. | Description of change | Target completion plenary# | Remarks |
| TS 23.501 | Potential update to add reference to new TS of Ambient IoT | TSG#108  (June 2025) |  |
| TS 23.502 | Potential updates to NF services | TSG#108  (June 2025) |  |

# 6 Work item Rapporteur(s)

SA2

# 7 Work item leadership

SA2

# 8 Aspects that involve other WGs

SA3 for the Security aspects

SA5 for the Charging and OA&M aspects

RAN WGs for the RAN related aspects

# 9 Supporting Individual Members

|  |
| --- |
| Supporting IM name |
| Cybercore? |
| FirstNet? |
| Futurewei? |
| HiSilicon |
| Huawei |
| InterDigital? |
| KPN? |
| Lenovo? |
| LG Uplus? |
| MediaTek Inc.? |
| NEC? |
| NTT DOCOMO? |
| OPPO? |
| Philips? |
| SHARP? |
| Sony? |
| Vivo? |
| Xiaomi? |
| ZTE? |
| China Mobile? |
| China Unicom? |
| China Broadnet? |
| T-Mobile USA? |
| Vodafone? |
| Intel? |
| Verizon? |
| MATRIXX Software? |
| Telecom Italia? |
| BUPT? |
| Xidian University? |
| Google? |
| China Telecom? |
| CATT? |
| SyncTechno Inc.? |
| Cablelabs? |