3GPP TSG-WG SA2 Meeting #169 S2-2505373r01

Fukuoka City, Fukuoka, JP, 19th May – 23rd May, 2025 (revision of xx-yyxxxx)

**Source: Huawei (Moderator)**

**Title: NEW SID on Architecture support of Ambient power-enabled Internet of Things-Phase 2**

**Document for: Approval**

**Agenda Item: 30.2**

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 Architecture support of Ambient power-enabled Internet of Things-Phase 2

Acronym: FS\_AmbientIoT-ARC-Ph2

Unique identifier:

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

Potential target Release: Rel-20

# 1 Impacts

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

# 2 Classification of the Work Item and linked work items

## 2.1 Primary classification

### This work item is a …

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

## 2.2 Parent Work Item

|  |
| --- |
| Parent Work / Study Items  |
| Acronym | Working Group | Unique ID | Title (as in 3GPP Work Plan) |
| AmbientIoT-ARC | SA2 | 1070010 | Work item on Architecture support of Ambient power-enabled Internet of Things in rel-19 |
| FS\_AmbientIoT | SA2 | 1020071 | Study item on Architecture support of Ambient power-enabled Internet of Things in rel-19 |

### 2.3 Other related Work Items and dependencies

|  |
| --- |
| Other related Work /Study Items (if any) |
| Unique ID | Title | Nature of relationship |
| 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

Ambient IoT is expected to support additional features and aspects which will require study work in SA2 in Rel-20, including supporting new devices and scenarios, in addition to aspects which were studied or concluded on in Rel-19 Ambient IoT study, which were not included in normative work.

RAN (TR 38.848) captures traffic assumption of an Ambient IoT device which includes:

- DT: Device-terminated; and

- DO: Device-originated. While DO further includes:

- DO-A: Device-originated – autonomous; and

- DO-DTT: Device-originated – device-terminated triggered.

In order to support new business models (e.g., sensor data report), DO-A type of communication is critical for Rel-20 study.

For the aspects which were studied or concluded in Rel-19 but not included in the Rel-19 normative work, TR 23.700-13 contains conclusions for aspects such as reader authorization etc, and those aspects should not be revisited in Rel-20.

# 4 Objective

NOTE 1: Coordination with RAN on the final scope is required to determine the Ambient IoT device types, traffic scenarios, connectivity topologies etc.

The work tasks are:

**WT#1: Study the support of Device 1 in Topology 2**, including:

- Determine whether to use the User Plane option or the RRC-based option for UE Reader connectivity.

- How to enhance AIoT Reader Selection, considering NG-RAN Reader, fixed UE Readers and mobile UE Readers, including when a deployment supports both topologies.

NOTE 2: Rel-19 TR solution and interim conclusion should be used as basis for rel-20 work. No AIoT Device impact from this WT is expected.

**WT#2: Study the support of DO-A Capable AIoT Devices in Topology 1**, including:

- Support of the AIoT Device informing the network of its presence autonomously (e.g., an AIoT Device initiated registration-like procedure), which can be used when the AIoT Device initially contacts the network and when the AIoT Device moves within the network (e.g., between Readers/RAN3 defined A-IoT areas). This allows improved e.g., MT reachability to the AIoT Device from the network.

- Support for an autonomous AIoT Device originated procedure to send data to the AIOTF using the AIOT NAS, and per AIoT Device configuration in the network for the routing of the received data.

- Naiotf and Nnef interface enhancements to provide the data received from an AIoT Device to the AF.

**WT#3: Study the support of DO-A Capable AIoT Devices in Topology 2**, including:

- Whether and how to support the DO-A capability devices to access the network in topology 2.

NOTE 3: This WT needs WT#1 and WT2 to be included.

**WT#4: Study the support of temporarily disabling and re-enabling AIoT Devices**

NOTE 4: Before the study begins, it needs to be decided whether SA2 or SA3 will lead this work task.

**WT#5: Whether and how to support positioning for AIoT Device 1 or AIoT Device 2b/C or both devices, in Topology 1, Topology 2 or both topologies.**

NOTE 5: If “positioning” is included in RAN Rel-20 scope, and objectives in RAN is outlined, SA2 could determine actual WTs involved.

**WT#6: Whether and how to support congestion control for AIoT services**

**[Justification]**

As Ambient IoT deployments scale to support humongous (e.g. billions) of low-cost, battery-less or energy-harvesting devices, networks will face severe challenges in handling simultaneous or bursty uplink transmissions. Congestion can lead to increased collisions, degraded reliability, energy inefficiency, and higher latency, which are critical issues for time-sensitive to time and large-scale applications.

**[Example Use Cases]**

1. Smart Warehousing / Logistics Hubs: Thousands of tagged items may enter or exit a facility simultaneously, triggering near-simultaneous status updates or inventory scans.
2. Retail Inventory Management: Periodic or event-driven scans in large retail environments may involve a massive number of devices transmitting concurrently to report their presence or status.
3. Smart Cities (e.g., air quality sensors): Dense deployments in urban areas can result in congested radio environments, especially when multiple sensors try to send data around the same event or time frame (e.g., weather change, pollution alert).
4. Emergency Event Detection: In cases like fire or structural failure, many Ambient IoT devices might attempt to send emergency signals simultaneously, potentially overloading the network.

**[WT description]**

Study potential mechanisms for congestion control in Ambient IoT scenarios, particularly addressing massive uncoordinated transmissions and high device density environments.

## TU estimates and dependencies

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Work Task ID | TU Estimate(Study) | TU Estimate(Normative) | RAN Dependency(Yes/No/Maybe)  | Inter Work Tasks Dependency  |
| WT#1 | 0.5 | 1.5 | YES |  |
| WT#2 | 3 | 3 | YES  |  |
| WT#3 | 1 | 1 | YES |  |
| WT#4 | 0.5 | 0.5 | Maybe |  |
| WT#5 | don’t know | don’t know | YES |  |
| WT#6 | don’t know | don’t know | Maybe |  |
| NOTE 1: WT#4 “0.5 TU” assuming SA2 leads the WT, otherwise it is just alignment work and no study.NOTE 2: WT#5 TU needs RAN scope and actual SA2 work task decided. |

**Total TU estimates for the study phase: 5 + “don’t know”**

**Total TU estimates for the normative phase: 6 + “don’t know”**

**Total TU estimates: to be decided**

# 5 Expected Output and Time scale

|  |
| --- |
| New specifications |
| Type  | TS/TR number | Title | For info at TSG#  | For approval at TSG# | Rapporteur |
| NEW TR | New TR | Study on Architecture support of Ambient power-enabled Internet of Things-phase 2 | TSG#110 | TSG#110 |  |

# 6 Work item Rapporteur(s)

To be added.

# 7 Work item leadership

SA2

# 8 Aspects that involve other WGs

SA3 for the Security aspects,

SA5 for the OAM and Charging aspects,

RAN WGs for the RAN related issues,

# 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 |