**SA WG2 Meeting #S2-147ES2-2107084**

**18 - 22 October, 2021, Electronic meeting** (revision of SP-211125)

**Source: China Mobile, Spreadtrum Communications, Huawei, HiSilicon, China Telecom, China Unicom, CATT, Tencent, vivo, Quanray, NTT DOCOMO, Vodafone**

**Title: Study on Passive Internet of Things (Passive IoT) for 5G Advanced**

**Document for: Approval**

**Agenda Item: 9.1.3**

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 Passive Internet of Things (Passive IoT) for 5G Advanced

Acronym: FS\_PIoT

Unique identifier:

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 | 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 …

|  |  |
| --- | --- |
|  | 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) |
| N/A |  |  |  |

### 2.3 Other related Work Items and dependencies

|  |
| --- |
| Other related Work /Study Items (if any) |
| Unique ID | Title | Nature of relationship |
| 850046 | Asset Tracking for 5G | Some Asset Tracking requirements are introduced in SA1 Rel-17 TS22.261.  |

# 3 Justification

3GPP has specified NB-IoT/eMTC and NR RedCap before Rel-18 to support various IoT requirements. However, existing 3GPP mMTC technology usually consume tens or hundreds of milliwatts power during transceiving data and require a battery to support it. As a result, the battery leads to a high complexity and high cost of the IoT device, usually a few dollars. Additionally, the labor cost to manage the battery, e.g. replace or charge the battery, is even more expensive. So, existing mMTC technology is not proper to be used in the use cases that require a very low complexity and low cost of IoT device without battery. Typically, logistics/warehousing management and wireless sensor network in smart agriculture/industrial automation, which require tremendous amounts of IoT device and very sensitive to the cost of IoT device.

For logistics/warehousing management, via obtaining the information (e.g. identifier) in the equipped IoT device, vertical company maintain an accurate and up-to-date database of goods and assets during the entire process including storage, transportation and delivery. The amount of the goods and assets is extremely large. So, it is vitally important to keep the equipped IoT device very low complexity and low cost without battery.

Wireless sensor networks promote the development of smart agriculture and industrial automation. As an example, sensors are used to monitor temperature, humidity in smart agriculture for yielding higher quality products. Another example is industrial wireless sensors for process and asset monitoring. Pressure, flow rate sensors can be used for data analytics and process optimization. Vibration sensors can be used for predict failure for motors and tubes. Similar as logistics/warehousing management, it would be important to keep the sensor and the integrated IoT device very low complexity and low cost without battery as the amount of the sensors is large. Thanks to the development of microelectromechanical system (MEMS) techniques, the ultra-low power consumption already makes the sensor works without battery feasible.

Safety is another motivation to introduce the IoT device without battery for some special industries. For example, monitoring of electricity power grid, oil and gas, battery is dangerous as it may cause exploding. In such scenarios, it is required to take use of the IoT device without battery.

The mMTC with connecting everything is a key motivation of the 3GPP 5G. It is valuable for 3GPP to study this new type of device to meet the requirement of a very low complexity and low cost IoT device without battery, which called Passive IoT in this SID context. The cost of Passive IoT device is expected 10 times lower than existing mMTC technologies in 3GPP. Passive IoT device needs to harvest energy for working e.g. from RF energy or its surrounding environment.

This study is proposed to study the architecture enhancement to manage the Passive IoT device, e.g. how to establish the secured connectivity for the Passive IoT device; how to enable the mobility of the Passive IoT device.

# 4 Objective

The objective of this SID includes investigating the key issues and corresponding enablers from network architecture aspects on the following areas:

WT#1: Study the how to support Passive IoT management in 5G system.

Note 1: Passive IoT device connecting to the NG-RAN or UE can be considered.

WT#2: Study how to manage the Passive IoT device, including, e.g.:

* Whether and how Passive IoT device registered to 5GC;
* Whether and how to manage the CM states for the Passive IoT device;
* Policy enhancement to manage the Passive IoT device.

WT#3: Study how to manage the connectivity for the Passive IoT device, including, e.g.:

* Establish the connectivity for the Passive IoT device for data transmission;
* QoS handling for the Passive IoT device data transmission;
* Policy enhancement to manage the connectivity for Passive IoT device.

WT#4: Study how to support the mobility for Passive IoT device.

Note 2: Gap analysis with the existing 5G system should be studied.

Note 3: This SA2 study item has dependency to RAN and will start the study in case that the related RAN study is approved in RAN.

## TU estimates and dependencies

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Work Task ID** | **TU Estimate****(Study)** | **TU Estimate****(Normative)** | **RAN Dependency****(Yes/No/Maybe)**  | **Inter Work Tasks Dependency**  |
| WT#1 | 3 | 2 | Yes | WT#1 is self-contained |
| WT#2 | 3 | 1 | Yes | WT#2 is dependent on WT#1 |
| WT#3 | 2 | 1 | Yes | WT#3 is dependent on WT#1&2 |
| WT#4 | 2 | 1 | Yes | WT#4 is dependent on WT#1&2&3 |
|  |  |  |  |  |

**Total TU estimates for the study phase: 10**

**Total TU estimates for the normative phase: 5**

**Total TU estimates: 10 + 5 = 15**

# 5 Expected Output and Time scale

|  |
| --- |
| 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 | 23.xyz | Study on Passive Internet of Things (Passive IoT) in the 5G System (5GS) | SA#96 (June. 2022) | SA#97 (Sep. 2022) | The primary Rapporteur: Zhu Chunhui, Spreadtrum Communications, tom.zhu@unisoc.com, is responsible for Objective 3&4 and TR editing;The secondary Rapporteur: Li Aihua, China Mobile, liaihua@chinamobile.com, is responsible for Objective 1&2. |

|  |
| --- |
| 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)

The primary Rapporteur: Zhu Chunhui, Spreadtrum Communications, tom.zhu@unisoc.com, is responsible for Objective 3&4 and TR editing;

The secondary Rapporteur: Li Aihua, China Mobile, liaihua@chinamobile.com, is responsible for Objective 1&2.

# 7 Work item leadership

SA2

# 8 Aspects that involve other WGs

-SA3 for Security aspects, SA5 for Charging aspects

-RAN for RAN related issues

# 9 Supporting Individual Members

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| --- |
| Supporting IM name |
| China Mobile |
| Spreadtrum Communications |
| Huawei |
| HiSilicon |
| China Telecom |
| China Unicom |
| CATT |
| Tencent |
| vivo |
| BMW Brilliance Automotive |
| Quanray |
| ROBERT BOSCH GmbH |
| NTT DOCOMO |
| Philips |
| KPN |
| Vodafone |