**3GPP TSG WG-2 Meeting #159 S2-23**

**Xiamen, China, 9 - 13 Oct 2023** **(revision of SP-231087)**

**Source: Xiaomi (Moderator of ISAC)**

**Title: New SID on Study on Architecture Enhancement to support Integrated Sensing and Communication**

**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: Study on Architecture Enhancement to support Integrated Sensing and Communication

Acronym: FS\_ISAC\_ARC

Unique identifier:

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

Potential target Release: Rel-19

# 1 Impacts

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 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 …

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

**\* Other = e.g. testing**

## 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) |
|  |  |  |  |

### 2.3 Other related Work Items and dependencies

|  |
| --- |
| Other related Work /Study Items (if any) |
| Unique ID | Title | Nature of relationship |
| 950003 | Study on Integrated Sensing and Communication | Use cases scenarios and service requirements of Integrated Sensing and Communication services |
| 1000026 | Integrated Sensing and Communication | Service requirements of Integrated Sensing and Communication services |

**Dependency on non-3GPP (draft) specification:**

# 3 Justification

The rapid growth of wireless communication technologies and the increasing demand for high-quality data transmission have led to the development of advanced communication systems. One such promising technology is the integration of sensing and communication, which has the potential to revolutionize various industries, including automotive, healthcare, and smart cities.

Integrated sensing and communication involves the simultaneous use of radio frequency (RF) signals for both sensing and communication purposes. This integration can lead to improved spectrum efficiency, reduced latency, and enhanced reliability in various applications. Integrated Sensing and Communication is particularly relevant in the context of mobile operators, User Equipment (UE) vendors, automobile vendors, and subscribers, as it can significantly enhance the overall user experience, improve network efficiency, and enable new business opportunities.

Integrated sensing and communication enables 3GPP network to evolve from communication network to communication sensing integrated network. By replicating the physical world through sensing and exchanging information through communication, it also connects the cyber world and the physical world and provides the key technical foundation for the integration of virtual world and reality, which expands 3GPP technical scope.

Functional requirements and performance requirements of integrated sensing and communication services that have architectural impacts have been studied in SA1. Within this study, sensing applications such as intruder detection applications (highway, railway, restricted area for UAV, yard and home), monitoring applications (rainfall, tourist, flood, respiration and sport), navigation assistance applications, real-time map generation applications, collision avoidance application, etc., can be achieved via 5G system using different sensing methods to fulfil the required sensing accuracy. It can be supported for a target object (and its environment) with or without UE on board over licensed or unlicensed spectrum for commercial, V2X, public safety and emergency services use cases. The SA1 study also identified the service requirements on sensing configuration, 5G wireless sensing service, exposure, security and charging, and SA2 is assumed to address the above requirement.

This study item aims to study the various aspects of integrated sensing and communication and provide insights for the future development of technical specifications.

# 4 Objective

The study item aims at investigating on architecture and function enhancement, end to end service operations and procedures to support Integrated Sensing and Communication with the considerations of various use cases (e.g. commercial, automotive, public safety and emergency services), deployment options and sensing modes.

Various deployment options to support different use cases shall be studied considering different configurations for "sensing service control" location and "sensing measurement data processing and result calculation" location (e.g. centralised or at the edge or in the RAN).

The study aims to investigate architecture and function enhancements, end to end service operations and procedures to support the following sensing modes:

* Monostatic base station based sensing (i.e. a single base station acting as the sounder and receiver)
* Monostatic UE based sensing (i.e. a single UE acting as the sounder and receiver)
* Bi/Multi static sensing with different base stations acting as the sounder and receiver.
* Bi/Multi static sensing with different UEs acting as the sounder and receiver.
* Bi/Multi static sensing with a base station is acting as the sounder and one/more UE acting as the receiver.
* Bi/Multi static sensing with a UE is acting as the sounder and one/more base stations acting as the receiver.

The study would investigate the following areas for each of the above sensing modes and various deployment options:

* WT-1: ISAC service authorization and control. This includes investigating mechanisms for authorization sensing service requests from an AF (trusted/untrusted) and from another consumer NF, selection of sensing method to be used for a specific authorized sensing request, and configuring the sensing devices/entities to perform the requested sensing operation.
* WT-2: Discovery and selection of sensing devices/entities (e.g. UE, gNB) considering the requested sensing service, the required Quality of service for sensing, the selected sensing method(s) and the sensing capabilities of the corresponding sensing devices (e.g. UE, gNB).
* WT-3: Sensing measurement data collection and result calculation based on the collected data. This includes both event based data collection/reporting and continuous streaming of sensing measurement data.
* WT-4: Sensing result exposure. This includes exposure of both one time and periodic reporting of sensing result.
* WT-5: Supporting a continuous sensing session for an object moving across sensing areas of different sensing devices/entities.
* WT-6: Configuration of parameters andpolicies to the sensing devices/entities (e.g. UE, gNB) for the support of ISAC services. This includes policy authorization aspects when only UEs are involved in the sensing operation (i.e. only UEs act as the sounders and receivers) for both when the UEs are served by NG RAN and when the UEs are not served by NG RAN.

NOTE 1: The overall architecture and function enhancements will be studied, which may be designed to be referenced for solution development or be derived from the solutions.

NOTE 2: Privacy protection and other security aspects will be tasked to SA3, and the related impact to architecture enhancement will be based on SA3 conclusion.

NOTE 3: Charging aspects will be tasked to SA5, and the related impact to architecture enhancement will be based on SA5 conclusion.

NOTE 4: Architectural implications to RAN or RAN dependent aspects will be coordinated with RAN WGs.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Work Task ID** | **TU Estimate****(Study)** | **TU Estimate****(Normative)** | **RAN Dependency****(Yes/No/Maybe)**  | **Inter Work Tasks Dependency** Editor’s Note: This column should highlight if WT#x is self-contained, or is depended on completion of other WTs |
| WT-1 | 3 TU | 0 TU | Maybe | self-contained |
| WT-2 | 2 TU | 0 TU | Yes | self-contained |
| WT-3 | 3 TU | 0 TU | Yes | self-contained |
| WT#-4 | 2 TU | 0 TU | No | self-contained |
| WT-5 | 3 TU | 0 TU | Maybe | self-contained |
| WT-6 | 3 TU | 0 TU | Yes | self-contained |

**Total TU estimates for the study phase: 16**

**Total TU estimates for the normative phase: 0**

**Total TU estimates: 16 + 0 = 16**

# 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 |
| Internal TR | 23.xyz | Study on Architecture Enhancement to support Integrated Sensing and Communication | SA#106 (Sep. 2024) | SA#107 (Dec. 2024) | {<FamilyName>, <GivenName>, <Company>, <email address>. See Note 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)

# 7 Work item leadership

SA2

# 8 Aspects that involve other WGs

SA3 for the Security aspects, SA5 for the Charging aspects, RAN for the RAN related issues.

# 9 Supporting Individual Members

|  |
| --- |
| Supporting IM name |
| FirstNet |
| MATRIXX Software |
| Xiaomi |
|  |
|  |
|  |