**3GPP TSG RAN Meeting #104 RP-242348**

**Melbourne, Australia, September 9-12, 2024 Revision of RP-240799**

**Source: Xiaomi, AT&T**

**Title: Revised SID:** **Study on channel modelling for Integrated Sensing And Communication (ISAC) for NR**

**Document for: Approval**

**Agenda Item: 9.2.3**

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 channel modelling for Integrated Sensing and Communication (ISAC) for NR

Acronym: FS\_Sensing\_NR

Unique identifier: 1020086

NOTE: For new WIs/SIs leave the Unique identifier empty and make a proposal for an Acronym.

 For a revised WI/SI: Take Unique identifier and acronym as shown in 3GPP workplan.

 If this is a RAN WID including Core and Perf. part, then Title, Acronym and Unique identifier refer to the feature WI.

 Please tick (X) the applicable box(es) in the table below:

 Either:

|  |  |
| --- | --- |
| **This WID includes a Core part** |  |
| **This WID includes a Performance part** |  |

 or:

|  |  |
| --- | --- |
| **This WID includes a Testing part** |  |
| **and it addresses the following 3GPP work area:** | **Radio Access** |  |
| **Core Network** |  |
| **Services** |  |

Potential target Release: *Rel-19*

# 1 Impacts

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

# 2 Classification of the Work Item and linked work items

### 2.1 Primary classification

This description is either a …

|  |  |
| --- | --- |
| X | Study Item |

or a

|  |
| --- |
| Normative Work Item:*tick applicable boxes below* |
|  | Stage 1 |
|  | Stage 2 |
|  | Stage 3 |
|  | Other (e.g. testing) |

### 2.2 Parent Work Item

|  |
| --- |
| Parent Work / Study Items  |
| Acronym | Working Group | Unique ID | Title (as in 3GPP Work Plan) |
| FS\_NR\_newRAT | RAN1 | 710062 | Study on New Radio (NR) Access Technology |

NOTE: RAN agreed some time ago, that it describes the feature WI + Core/Perf. part WI or Testing part WI in one WID. Therefore the table above should include the feature WI data (In case the feature covers Core and Perf. part, please list under Working Group the leading WG of the Core part).

### 2.3 Other related Work Items and dependencies

|  |
| --- |
| Other related Work/Study Items (if any) |
| **Acronym** | Unique ID | Title | Nature of relationship |
|  |  |  | *{optional free text}*  |

NOTE: Also related or dependent WIs/SIs in other TSGs shall be indicated here.

# 3 Justification

Current 5G-Advanced network design focuses primarily on data transmission, and the radio channel model defined to cover frequencies up to 100GHz was developed with this in mind. Although RAT-based positioning is supported, the specifications do not offer the in-built capability to detect objects not connected to the network.

If sensing capability is integrated into the design of the system, sensing may be offered as a service alongside communications.

TR22.837 identifies a very wide range of use cases for such integrated sensing.

It is therefore important to establish a solid channel modelling framework to enable evaluation of sensing techniques for such use cases. The existing models in TR38.901 are not designed for sensing, in particular as they do not address target modelling and sensing, and background environment modelling and differentiation from targets. Both radar cross-section (RCS) and mobility of targets and other objects in the environment need to be modelled, and the model must be spatially consistent.

This study addresses these gaps in the channel model in 38.901 to enable evaluation of sensing techniques.

# 4 Objective

### 4.1 Objective of SI

The focus of the study is to define channel modelling aspects to support object detection and/or tracking (as per the SA1 meaning in TS 22.137). The study should aim at a common modelling framework capable of detecting and/or tracking the following example objects and to enable them to be distinguished from unintended objects:

* UAVs
* Humans indoors and outdoors
* Automotive vehicles (at least outdoors)
* Automated guided vehicles (e.g. in indoor factories)
* Objects creating hazards on roads/railways, with a minimum size dependent on frequency

All six sensing modes should be considered (i.e. TRP-TRP bistatic, TRP monostatic, TRP-UE bistatic, UE-TRP bistatic, UE-UE bistatic, UE monostatic).

Frequencies from 0.5 to 52.6 GHz are the primary focus, with the assumption that the modelling approach should scale to 100 GHz. (If significant problems are identified with scaling above 52.6 GHz, the range above 52.6 GHz can be deprioritized.)

For the above use cases, sensing modes and frequencies:

* Identify details of the deployment scenarios corresponding to the above use cases.
* Define channel modelling details for sensing using 38.901 as a starting point, and taking into account relevant measurements, including:
1. modelling of sensing targets and background environment, including, for example (if needed by the above use cases), radar cross-section (RCS), mobility and clutter/scattering patterns;
2. spatial consistency.

### 4.2 Objective of Performance part WI

NOTE: Leave empty if the WI proposal does not contain a RAN performance part.

### 4.3 RAN time budget request (not applicable to RAN5 WIs/SIs)

NOTE: For all new RAN related WIs/SIs which are not led by RAN WG5 the WI/SI rapporteur has to fill out the attached Excel table to request time budgets for corresponding RAN WG meetings.
The Excel table has to be filled out for all affected RAN WGs and up to the target date of the WI/SI.
One time unit (TU) corresponds to ~ 2 hours in the meeting.
If no TU is needed, then leave the field empty otherwise enter a number >0 in the field.

 For revisions of already approved WI/SI descriptions: Please remove the Excel table from the WID/SID's zip file. The time budgets are already recorded. If you want to modify them, then this has to be done via the status report and not via a revised WID/SID.

 If this WID is covering Core and Performance part, then please fill out one line for each part in the attached Excel table.

**additional comments to the time budget request in the attached Excel table:**

# 5 Expected Output and Time scale

|  |
| --- |
| **New specifications**  |
| Type  | TS/TR number | Title | For info at TSG#  | For approval at TSG# | Remarks |
|  |  |  |  |  |  |

NOTE: If this is a RAN WI including Core and Perf. part, then all new Core part specs have to be listed first and then all new Perf. part specs. Indicate "Core part" or "Perf. part" under Remarks for each spec.
By default a new specs can only be new for one of both parts.

|  |
| --- |
| **Impacted existing TS/TR**  |
| TS/TR No. | Description of change  | Target completion plenary# | Remarks |
| 38.901 | Modifications for sensing aspects of channel model | RAN#108 |  |

NOTE: If this is a RAN WI including Core and Perf. part, then all new Core part specs have to be listed first and then all new Perf. part specs. Indicate "Core part" or "Perf. part" under Remarks for each spec.
If an existing spec is affected by both (Core part and Perf. part), then it has to be listed twice with appropriate approval dates.

# 6 Work item Rapporteur(s)

*Li, Yingyang, Xiaomi,* *liyingyang@xiaomi.com*

*Vogedes, Jerome, AT&T,* *jerome.vogedes@att.com*

NOTE: The first listed Rapporteur has the overall responsibility for this WI (incl all secondary tasks).

# 7 Work item leadership

RAN1

# 8 Aspects that involve other WGs

# 9 Supporting Individual Members

|  |
| --- |
| Supporting IM name |
| Apple |
| AT&T |
| BUPT |
| CATT |
| CEWiT |
| Charter |
| China Telecom |
| China Unicom |
| CHTTL |
| CMCC |
| Continental Automotive Technologies GmbH  |
| Deutsche Telekom  |
| DISH |
| Ericsson |
| ETRI |
| EURECOM |
| FirstNet |
| Fraunhofer HHI  |
| Fraunhofer IIS  |
| Fujitsu |
| Futurewei |
| H3C |
| HiSilicon |
| Honor |
| Huawei |
| III |
| IIT Kanpur |
| IIT Madras |
| Intel |
| InterDigital |
| ITL |
| ITRI |
| Keysight |
| KT Corp. |
| Langbo |
| Lenovo |
| LG Electronics |
| LG Uplus  |
| MediaTek |
| Motorola Mobility |
| NEC |
| New H3C  |
| NIST |
| Nokia |
| Nokia Shanghai Bell |
| NTT Docomo |
| NVIDIA |
| OPPO |
| Qualcomm |
| Robert Bosch GmbH |
| Rohde & Schwarz |
| Samsung |
| Sanechips |
| Semtech |
| Sharp |
| SK Telecom |
| Sony |
| Spark |
| Spreadtrum |
| SyncTechno |
| TCL |
| Tejas Networks |
| Telefónica  |
| Telstra |
| TOYOTA InfoTechnology Center |
| Transsion |
| Verizon |
| vivo |
| WILUS |
| Xiaomi |
| ZTE |