**3GPP TSG RAN meeting #106 RP-242804**

**Madrid, Spain, December 9-12, 2024**

## Status Report to TSG

**Agenda item:** 9.2.3

|  |  |
| --- | --- |
| **WI / SI Name** |  |
| included in this status report | Study Item: Yes | Core part: No | Performance part:No | Testing part:No |
| **Acronym** | FS\_Sensing\_NR |
| **Unique ID** | 1020086 |
| **TSG Tdoc of latest approved WI/SI description (if any)** | [RP-242348](https://www.3gpp.org/ftp/tsg_ran/TSG_RAN/TSGR_103/Docs/RP-242348.zip) |
| **Target Completion Date****(indicate if changed)** | Study Item: 06/2025 | Core part:  | Performance part:  | Testing part:  |
| **Overall Completion level** | Study Item: 55 % | Core part:  | Performance Part:  | Testing part:  |

Note: Overall completion level percentage numbers should use one of the colors below:

* xx%: Normal progress, no RAN plenary action needed
* xx%: Progress behind schedule, may need RAN plenary intervention. If so, SR should clearly define requested action
* xx%: Progress critically behind, RAN plenary shall intervene. SR should define requested action

**Source:**

|  |  |
| --- | --- |
| **Leading WG** | RAN1 |
| **Rapporteur** | **Name** | Yingyang Li, Jerome Vogedes |
| **Company** | Xiaomi, AT&T  |
| **Email** | liyingyang@xiaomi.com, jerome.vogedes@att.com |

## 1 Work plan related evaluation

|  |  |
| --- | --- |
| **Do you want to modify the time budget for this WI/SI compared to what was endorsed at the last RAN meeting?** | No |

*If you answered No: Then please remove the Excel file from the zip file of this status report.*

*If you answered Yes: Then please fill out the attached Excel template to request a modification of the time budgets for your WI /SI. The Excel table has to be filled out for all affected RAN WGs and up to the target date of the WI/SI. The basis are the endorsed time budgets of the last RAN meeting. Please highlight all changes of the values.
 One time unit (TU) corresponds to ~ 2 hours in the meeting.
 If this status report covers a WI with Core and Performance part, then please have one line for each in the attached Excel table.
 Note: If no Excel table is attached, then this means no time budget change.*

**Additional explanations/motivations for the time budget changes in the attached Excel table:**

## 2. Detailed progress in RAN WGs since last TSG meeting (for all involved WGs)

 NOTE: Agreements and Open issues impacted cross-TSG aspects shall be explicitly highlighted

## 2.1 RAN1

#### 2.1.1 Agreements

##### RAN1 #118bis, Hefei, CN, Oct 14th – 18th, 2024

*ISAC deployment scenarios*

Agreement

For Automotive sensing target scenarios, the following table is used as a starting point for deployment scenario parameters/values.

The detailed scenario description in this clause can be used for channel model calibration.

Note: Additional parameters, value/value ranges are not precluded.

Table x. Evaluation parameters for Automotive sensing scenarios

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| Applicable communication scenarios | Highway, Urban Grid. NOTE1 |
| Sensing transmitters and receivers properties | Rx/Tx locations are selected among the TRPs and UEs (e.g., VRU, vehicle, RSU-type UEs) locations in the corresponding communication scenario. NOTE2FFS: Option 2: ISD between TRPs of Urban Grid is 250 meters |
| Sensing target | LOS/NLOS | LOS and NLOS (including NLOSv) |
| Outdoor/indoor | Outdoor |
| Mobility (horizontal plane only) | Based on TR37.885 mobility for urban grid or highway scenario |
| Distribution (horizontal) | Based on dropping in TR37.885 per urban grid or highway communication scenario |
| Orientation | Lane direction in horizontal plane |
| Physical characteristics (e.g., size) | Type 1/2 (passenger vehicle) Type 3 (truck/bus) Vehicle type distribution per TR 37.885 as a starting pointFFS: Other sizes, additional distributions, and vehicle types, e.g. one new type of e-scooter/motorcycle/bike  |
| Minimum 3D distances between pairs of Tx/Rx and sensing target | Option 1: Min distances based on min. TRP/UE distances defined in TR37.885 as a starting point.Option 2: Min. distance is larger than the min. far-field distance of the sensing Tx/Rx |
| Minimum 3D distance between sensing targets | Option 1: At least larger than the physical size of a sensing targetOption 2: Fixed value, [x] m. value of x is FFS |
| Environment Objects, e.g., types, characteristics, mobility, distribution, etc. | EO Type 2 for Urban Grid* FFS: details, e.g. 4 walls (as EO type 2) per building of size [413mx230mx20m]
 |

NOTE1: calibration for UMi, Uma, RMa is not performed for the automotive scenario, but UMi, Uma, RMa can be considered for future evaluations of the automotive sensing target scenarios. Calibration for UMi, Uma, RMa is expected to be performed for another sensing scenario.

NOTE2: A percentage of TRPs/UEs that have sensing capabilities may be considered for future evaluations.

Agreement

For Human sensing target scenarios, (indoor and outdoor), the following table is used as a starting point for deployment scenario parameters/values.

The detailed scenario description in this clause can be used for channel model calibration.

Note: Additional parameters, value/value ranges are not precluded.

Table x. Evaluation parameters for Human (indoor and outdoor) sensing scenarios

|  |  |  |
| --- | --- | --- |
| **Parameters** | **Indoor Values** | **Outdoor Values** |
| Applicable communication scenarios NOTE1 | Indoor office, indoor factory [TR38.901]Indoor room [TR38.808] | UMi, Uma, RMa [TR38.901] |
| Sensing transmitters and receivers properties | Rx/Tx LocationsNOTE 2 | Rx/Tx locations are selected among the TRPs and UE locations in the corresponding communication scenario | Rx/Tx locations are selected among the TRPs and UE locations in the corresponding communication scenario |
| Rx/Tx Mobility for UEs | Option 1: 0km/hOption 2: 3km/hOption 3: Uniform distribution between 0km/h and 3km/hr | Option 1: 0km/hOption 2: 3km/hOption 3: Uniform distribution between 0km/h and 10km/hr |
| Sensing target | Outdoor/indoor | Indoor | Outdoor |
| 3D mobility | Option 1: 0km/hOption 2: 3km/hOption 3: Uniform distribution between 0km/h and 3km/hr (horizontal plane with random direction straight-line trajectory) | Option 1: 0km/hOption 2: 3km/hOption 3: Uniform distribution between 0km/h and 10km/hr (horizontal plane with random direction straight-line trajectory) |
| 3D distribution | N targets uniformly distributed over the horizontal area of the convex hull of the TRP deploymentFFS: Value of N | Uniform in horizontal plane |
| Orientation | Random over the horizontal area | Random over the horizontal area |
| Physical characteristics (e.g., size) | Size (Length x Width x Height):* Child: 0.2m x 0.3m x 1m
* Adult Pedestrian: 0.5m x 0.5m x 1.75m
 | Size (Length x Width x Height):* Child: 0.2m x 0.3m x 1m
* Adult Pedestrian: 0.5m x 0.5m x 1.75m
 |
| Minimum 3D distances between pairs of Tx/Rx and sensing target | Option 1: Min. distance is larger than the min. far-field distance of the sensing Tx/RxOption 2: Min distances defined in TR 38.901 as a starting point | Option 1: Min. distance is larger than the min. far-field distance of the sensing Tx/RxOption 2: Min distances defined in TR 38.901 as a starting point |
| Minimum 3D distance between sensing targets | Option 1: At least larger than the physical size of a sensing targetOption 2: Fixed value, [x] m. value of x is FFS | Option 1: At least larger than the physical size of a sensing targetOption 2: Fixed value, [x] m. value of x is FFS |
| Environment Objects, e.g., types, characteristics, mobility, distribution, etc. | FFS, based on outcome for AI 9.7.2 | FFS, based on outcome for AI 9.7.2 |

NOTE1: For the human (indoor and outdoor) sensing targets, additional communication scenarios can be considered for future evaluations. Channel model calibration for Urban Grid with outdoor humans is expected to be performed from Objects creating hazards on the road/railway sensing scenarios.

NOTE2: A percentage of TRPs/UEs that have sensing capabilities may be considered for future evaluations.

Agreement

For Automated Guided Vehicles (AGV) target scenarios, the following table is used as a starting point for deployment scenario parameters/values.

The detailed scenario description in this clause can be used for channel model calibration.

Note: Additional parameters, value/value ranges are not precluded.

**Table x. Evaluation parameters for Automated Guided Vehicles**

|  |  |
| --- | --- |
| **Parameters** | **Value** |
| Applicable communication scenariosNOTE1 | InF (TR38.901 including Table 7.8-7) |
| Sensing transmitters and receivers properties NOTE2 | Rx/Tx location are selected among the TRPs and UEs location in the corresponding communication scenarioRx/Tx Mobility for UEs* Option 1: 0 km/h
* Option 2: 3km/h
* Option 3: Uniform distribution between 0km/h and 3km/h
 |
| Sensing target | LOS/NLOS | LOS and NLOS |
| Outdoor/indoor | Indoor |
| 3D mobility | Horizontal velocity with random straight-line trajectory * Option 1: Uniform distribution in the range of up to 30 km/h
* Option 2: Fixed velocities [3, 10] km/h
 |
| 3D distribution | Option A: Uniformly distributed in the convex hull of the horizontal BS deploymentOption B: Uniformly distributed in horizontal plane |
| Orientation | Horizontal plane only |
| Physical characteristics (e.g., size) | Size (L x W x H)* Option 1: 0.5m x 1.0m x 0.5m
* Option 2: 1.5 m x 3.0m x 1.5 m
* FFS: Material, Additional sizes, and AGV size distribution
 |
| Minimum 3D distances between pairs of Tx/Rx and sensing target | Option 1: Min. distance is larger than the min. far-field distance of the sensing Tx/Rx from the sensing targetOption 2: Min distances based on min. TRP/UE distances defined in TR38.901  |
| Minimum 3D distance between sensing targets | Option A: At least larger than the physical size of a targetOption B: Fixed value, [x] m. value of x is FFS |
| Environment objects, e.g., types, characteristics, mobility, distribution, etc. | FFS |

NOTE1: For the AGV sensing targets, additional communication scenarios can be considered for future evaluations.

NOTE2: A percentage of TRPs/UEs that have sensing capabilities may be considered for future evaluations.

NOTE3: RAN1 can further discuss narrowing down the number of sub-scenarios of InF

Agreement

For objects creating hazards, the following proposals are suggested to be discussed by RAN1:

For objects creating hazards use cases, RAN1 to consider the following table as a starting point for deployment scenario parameters/values.

The detailed scenario description in this clause can be used for channel model calibration.

Note: Additional parameters, value/value ranges are not precluded.

**Table x. Evaluation parameters for objects creating hazards**

|  |  |
| --- | --- |
| **Parameters** | **Value** |
| Applicable communication scenarios NOTE1 | Highway, Urban grid, HST (High Speed Train) |
| Sensing transmitters and receivers propertiesNOTE2 | Rx/Tx Locations | Rx/Tx locations are selected among the TRPs and UEs (e.g., VRU, vehicle, RSU-type UEs) locations in the corresponding communication scenarios.FFS: Option 2: ISD between TRPs of Urban Grid is 250 meters |
| Sensing target | LOS/NLOS | LOS and NLOS |
| Outdoor/indoor | Outdoor |
| 3D mobility | Horizontal velocity: up to [10] km/h for humans and animalsFFS: Additional velocities, trajectory |
| 3D distribution | Uniformly distributed in horizontal plane |
| Orientation | Random distribution in horizontal plane |
| Physical characteristics (e.g., size) | For human/pedestrians: Child: 0.2m x 0.3m x 1mAdult: 0.5m x 0.5m x 1.75m For animals:Size: 1.5m x 0.5m x 1 mFFS: other types of targets |
| Minimum 3D distances between pairs of Tx/Rx and sensing target | Option 1: Min. distance is larger than the min. far-field distance of the sensing Tx/Rx from the sensing targetOption 2: based on TR37.885 and TR38.802 |
| Minimum 3D distance between sensing targets | Option 1: At least larger than the physical size of a targetOption 2: Fixed value, [x] m. value of x is FFS |
| Environment objects, e.g., types, characteristics, mobility, distribution, etc. | EO Type 2 for Urban Grid* FFS: details, e.g. 4 walls (as EO type 2) per building of size [413mx230mx20m]
 |

NOTE1: For the objects creating hazards sensing targets, additional communication scenarios can be considered for future evaluations.

NOTE2: A percentage of TRPs/UEs that have sensing capabilities may be considered for future evaluations.

*ISAC channel modelling*

Agreement

RAN1 strives to define a single option per target per monostatic/bistatic sensing mode from the following two options to generate RCS values/patterns for a scattering point of a target.

* Option 2: The RCS=A\*B of a scattering point can be generated by
	+ The component A is commonly applied to any incident/scattered angles at the scattering point
		- A is [mean] RCS value. FFS value(s) A
			* Note: Mean RCS value is defined as the mean value of the distribution of RCS
	+ The component B
		- B is generated by [log-normal] distribution, the related [log-normal] distribution has mean μ=1 and variance V, FFS σ2
			* B is separately generated for each direct/indirect path at the scattering point. FFS correlation dependent on the incident/scattered angles of the direct/indirect paths
	+ FFS whether/how power of all generated direct/indirect paths need to be normalized considering impact of RCS
* Option 3: The RCS=A\*B=A\*B1\*B2 of a scattering point can be generated by
	+ The component A is commonly applied to any incident/scattered angles at the scattering point
		- FFS: A = 1 m2 or [mean] RCS value
			* Note: Mean RCS value is defined as the mean value of the distribution of RCS
	+ The component B is further split into B1, B2, i.e., B=B1\*B2
		- B1 is deterministic based on incident/scattered angles
			* FFS: B1 is defined by a function or by a table
		- B2 is generated by [log-normal] distribution, the related [log-normal] distribution has mean μ=1 and variance V, FFS σ2
			* B2 is separately generated for each direct/indirect path at the scattering point. FFS correlation dependent on the incident/scattered angles of the direct/indirect paths
	+ FFS whether/how power of all generated direct/indirect paths need to be normalized considering impact of RCS

Agreement

RCS Option 3 is selected to model RCS of UAV with single scattering point for monostatic

* + B2 of UAV is modelled using log-normal distribution for monostatic
	+ Different mean RCS values can be supported for UAV due to different size, shape, frequency, etc.
	+ For UAV of small size (option 2 for UAV size in UAV parameters table)
		- B1=1
		- A is mean RCS value
	+ For UAV of large size (option 1 for UAV size in UAV parameters table)
		- B1 have dependency on incident/scattered angles
		- A is mean RCS value

Agreement

To model the effect of polarization for each direct/indirect path:

* Polarization of a direct/indirect path is product of polarization matrix of Tx-target link, the target, and the target-Rx link
	+ Total polarization of a direct/indirect path is *CPMtx,sp,rx= CPMsp,rx* . *CPMsp* . *CPMtx,sp*
		- For a LOS ray from Tx to target or from target to Rx, $CPM=\left[\begin{matrix}1&0\\0&-1\end{matrix}\right]$ for *CPMtx,sp* or *CPMsp,rx*
		- For a NLOS ray generated by a stochastic cluster from Tx to target or from target to Rx, *CPMtx,sp* or *CPMsp,rx* is generated by XPR ratio *κ* and initial random phases referring to TR 38.901 as start point
		- FFS how to normalize on *CPMtx,sp,rx*
		- FFS *CPMsp* of a scattering point of the target
* FFS: how to model the effect of polarization when EO type-2 is present

Agreement

A single direct path is modeled for a scattering point of target

* In each of the Tx-target and target RX links, the first NLOS cluster is generated with same delay as the LOS ray (when the absolute delay modelling of $Δτ$ as in section 7.6.9, TR 38.901 is not applied) and with the same direction as the LOS ray.
	+ FFS how to generate NLOS cluster when $Δτ$ is applied

Agreement

In order to generate each of the Tx-target link and target-Rx link in the target channel, the large scale and small scale parameters defined in existing 3GPP TRs, e.g., TR 38.901. TR 36.777, TR 37.885, TR 38.858, TR 38.859, TR 38.802, TR 38.854, etc. are used as starting point

Agreement

On the background channel for TRP-TRP and UE-UE bistatic sensing mode, the large scale and small scale parameters defined in TR 38.901, TR 38.858, 37.885, 38.859 are used as starting point

* Update on values of the LSP/SSP parameters can be discussed based on validation data acquired by measurement or ray-tracing model
	+ FFS The power threshold for removing clusters in step 6, i.e., -25 dB is revised to X<-25 dB. FFS X
* FFS whether/how to resolve the inconsistency between TRP-TRP channel according to TR 38.858 and the TRP-target (UAV) channel according to TR 36.777 when UAV and TRP are set to same height

Agreement

3D spatial consistency needs to be studied for at least UAV scenario

Agreement

In LOS condition between sensing Tx/Rx and target, the power of LOS ray is generated following power of LOS ray in TR 38.901.

Agreement

The following options are to be studied for the concatenation of Tx-target and target-Rx link in the target channel

* Direct path (if present) is always kept
* Indirect paths of LOS+NLOS, NLOS+LOS (if present) are generated
* On other indirect paths of NLOS + NLOS
	+ Option 0: ray level full convolution between Tx-target link and target-Rx link for radio propagation Case 1/2/3/4
	+ Option 0A: ray level full convolution between Tx-target link and target-Rx link only for radio propagation Case 4
	+ Option 1: cluster level full convolution between Tx-target link and target-Rx link, then 1-by-1 coupling rays within each pair of clusters for radio propagation Case 1/2/3/4
	+ Option 1A: cluster level full convolution between Tx-target link and target-Rx link, then 1-by-1 coupling rays within each pair of clusters only for radio propagation Case 4
	+ Option 2: cluster level 1-by-1 coupling between Tx-target link and target-Rx link, then 1-by-1 coupling rays within each pair of clusters for radio propagation Case 1/2/3/4
	+ Option 2A: cluster level 1-by-1 coupling between Tx-target link and target-Rx link, then 1-by-1 coupling rays within each pair of clusters only for radio propagation Case 4
	+ Option 3: ray level 1-by-1 coupling between Tx-target link and target-Rx link for radio propagation Case 1/2/3/4
	+ Option 3A: ray level 1-by-1 coupling between Tx-target link and target-Rx link only for radio propagation Case 4
* Note: reducing the number of rays per cluster and/or reducing the number of clusters can be considered for the options above
* Any indirect path with power metric less than [threshold] is dropped
	+ the power metric of a path is the product of power of a ray in Tx-target link, power of a ray in target-Rx link and RCS of the pair of rays
	+ FFS power normalization of target channel after path dropping
	+ FFS the set of remaining indirect paths can be updated during movement of Tx, target or Rx

##### RAN1 #119, Orlando, US, Nov 18th – 22nd, 2024

*ISAC deployment scenarios*

Guidance for further work

1. Rapporteurs are encouraged to start providing a draft CR for both agendas to RAN1#120

2. Jerome to provide an initial proposal for calibrations discussions by the end of RAN1#119

3. RAN1 agenda will clarify that input on calibrations discussions is to be provided to agenda 9.7.1 starting at RAN1#120

Agreement

For UAV sensing target scenarios, the following table is agreed for deployment scenario parameters/values using the agreements from RAN1#118 as a baseline:

The detailed scenario description in this clause can be used for channel model calibration.

**ISAC-UAV**

Details on ISAC-UAV scenarios are listed in Table x.

Table x. Evaluation parameters for UAV sensing scenarios

|  |  |
| --- | --- |
| **Parameters** | **Value** |
| Applicable communication scenarios | UMi, UMa, RMa [38.901]UMi-AV, UMa-AV, RMa-AV |
| Sensing transmitters and receivers properties | Rx/Tx Locations | Rx/Tx locations are selected among the TRPs and UEs locations in the corresponding communication scenarios.NOTE1: This may include aerial UEs for UMi-AV, UMa-AV, RMa-AV communication scenarios. In this case, other Rx/Tx properties (e.g. mobility) are also taken from the corresponding communication scenario. |
| Sensing target | LOS/NLOS | LOS and NLOS  |
| Outdoor/indoor | Outdoor |
| 3D mobility | Horizontal velocity: uniform distribution between 0 and 180km/h, if horizontal velocity is not fixed to 0. Vertical velocity: 0km/h, optional {20, 40} km/hNOTE2: 3D mobility can be horizontal only or vertical only or a combination for each sensing target~~FFS: time-varying velocity.~~NOTE 3: time-varying velocity may be considered for future evaluations. |
| 3D distribution | Horizontal plane: Option A: *N* targets uniformly distributed within one cell. Option B: *N* targets uniformly distributed per cell. Option C: *N* targets uniformly distributed within an area not necessarily determined by cell boundaries.~~FFS: Value of~~ *~~N~~*~~, defined area, and other distributions~~*N* = {1, 2, 3, 4, 5}NOTE4: *N*=0 may be considered for the evaluation of false alarmVertical plane: Option A: Uniform between 1.5m and 300m.Option B: Fixed height value chosen from {25, 50, 100, 200, 300} m assuming vertical velocity is equal to 0. ~~FFS Other options are not precluded.~~~~NOTE5: target(s) are outside the minimum distance to the Tx/Rx~~  |
| Orientation | Random in horizontal domain |
| Physical characteristics (e.g., size) | Size:* Option 1: 1.6m x 1.5m x 0.7m
* Option 2: 0.3m x 0.4m x 0.2m

~~FFS: Material(s), Structure, Other size(s)~~ |
| Minimum 3D distances between pairs of Tx/Rx and sensing target | ~~Option B:~~ Min distances based on min. TRP/UE distances defined in TR36.777 as a starting point.NOTE5: the sensing target is assumed in the far field of sensing Tx/Rx~~Option C: Min. distance is larger than the min. far-field distance of the sensing Tx/Rx~~ |
| Minimum 3D distance between sensing targets | Option 1: At least larger than the physical size of a targetOption 2: 10 meters |
| [Unintended/Environment objects, e.g., types, characteristics, mobility, distribution, etc.] | FFS |

NOTE: A percentage of TRPs/UEs that have sensing capabilities may be considered for future evaluations.

Agreement

For Automotive sensing target scenarios, the following table is agreed for deployment scenario parameters/values using the agreements from RAN1#118-bis as a baseline:

The detailed scenario description in this clause can be used for channel model calibration.

**ISAC-Automotive**

Details on ISAC-Automotive scenarios are listed in Table x.

Table x. Evaluation parameters for Automotive sensing scenarios

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| Applicable communication scenarios | Highway, Urban Grid. NOTE1 |
| Sensing transmitters and receivers properties | Rx/Tx locations are selected among the TRPs and UEs (e.g., VRU, vehicle, RSU-type UEs) locations in the corresponding communication scenario. NOTE2~~FFS:~~ Additional option: ISD between TRPs of Urban Grid is 250m |
| Sensing target | LOS/NLOS | LOS and NLOS (including NLOSv) |
| Outdoor/indoor | Outdoor |
| Mobility (horizontal plane only) | Based on TR37.885 mobility for urban grid or highway scenario |
| Distribution (horizontal) | Based on dropping in TR37.885 per urban grid or highway communication scenario  |
| Orientation | Lane direction in horizontal plane |
| Physical characteristics (e.g., size) | Type 1/2 (passenger vehicle) Type 3 (truck/bus) Vehicle type distribution per TR 37.885 as a starting point~~FFS:~~ ~~Other sizes, additional distributions, and vehicle types, e.g. one new type of e-scooter/motorcycle/bike~~  |
| Minimum 3D distances between pairs of Tx/Rx and sensing target | ~~Option 1:~~ Min distances based on min. TRP/UE distances defined in TR37.885 as a starting point.~~Option 2: Min. distance is larger than the min. far-field distance of the sensing Tx/Rx~~NOTE3: the sensing target is assumed in the far field of sensing Tx/Rx |
| Minimum 3D distance between sensing targets | Option 1: At least larger than the physical size of a sensing targetOption 2: Fixed value, ~~[~~10~~]~~ m. ~~value of x is FFS~~ |
| Environment Objects, e.g., types, characteristics, mobility, distribution, etc. | EO Type 2 for Urban Grid* ~~FFS: details, e.g.~~ up to 4 walls modelled as EO type 2, per building of size ~~[~~413m x 230m x 20m~~]~~. FFS: number of buildings, how many walls are modelled, additional building sizes, etc.
 |

NOTE1: calibration for UMi, Uma, RMa is not performed for the automotive scenario, but UMi, Uma, RMa can be considered for future evaluations of the automotive sensing target scenarios. Calibration for UMi, Uma, RMa is expected to be performed for another sensing scenario.

NOTE2: A percentage of TRPs/UEs that have sensing capabilities may be considered for future evaluations.

Agreement

For Human (indoor and outdoor) sensing target scenarios, the following table is agreed for deployment scenario parameters/values using the agreements from RAN1#118-bis as a baseline:

The detailed scenario description in this clause can be used for channel model calibration.

**ISAC-Human**

Details on ISAC-Human scenarios are listed in Table x.

Table x. Evaluation parameters for Human (indoor and outdoor) sensing scenarios

|  |  |  |
| --- | --- | --- |
| **Parameters** | **Indoor Values** | **Outdoor Values** |
| Applicable communication scenarios NOTE1 | Indoor office, indoor factory [TR38.901]Indoor room [TR38.808] | UMi, Uma, RMa [TR38.901] |
| Sensing transmitters and receivers properties | Rx/Tx LocationsNOTE 2 | Rx/Tx locations are selected among the TRPs and UE locations in the corresponding communication scenario | Rx/Tx locations are selected among the TRPs and UE locations in the corresponding communication scenario |
| Rx/Tx Mobility for UEs | Option 1: 0km/hOption 2: 3km/hOption 3: Uniform distribution between 0km/h and 3km/hr | Option 1: 0km/hOption 2: 3km/hOption 3: Uniform distribution between 0km/h and 10km/hr |
| Sensing target | LOS/NLOS | LOS and NLOS  | LOS and NLOS |
| Outdoor/indoor | Indoor | Outdoor |
| 3D mobility | Option 1: 0km/hOption 2: 3km/hOption 3: Uniform distribution between 0km/h and 3km/hr (horizontal plane with random direction straight-line trajectory) | Option 1: 0km/hOption 2: 3km/hOption 3: Uniform distribution between 0km/h and 10km/hr (horizontal plane with random direction straight-line trajectory) |
| 3D distribution | *N* targets uniformly distributed over the horizontal area of the convex hull of the TRP deployment~~FFS: Value of N~~NOTE1: *N*=0 may be considered for the evaluation of false alarm | Option A: *N* targets uniformly distributed within one cell. Option B: *N* targets uniformly distributed per cell. Option C: *N* targets uniformly distributed within an area not necessarily determined by cell boundaries. ~~Uniform in horizontal plane~~NOTE1: *N*=0 may be considered for the evaluation of false alarm |
| Orientation | Random over the horizontal area | Random over the horizontal area |
| Physical characteristics (e.g., size) | Size (Length x Width x Height):* Child: 0.2m x 0.3m x 1m
* Adult Pedestrian: 0.5m x 0.5m x 1.75m
 | Size (Length x Width x Height):* Child: 0.2m x 0.3m x 1m
* Adult Pedestrian: 0.5m x 0.5m x 1.75m
 |
| Minimum 3D distances between pairs of Tx/Rx and sensing target | ~~Option 1: Min. distance is larger than the min. far-field distance of the sensing Tx/Rx~~~~Option 2:~~ Min distances defined in TR 38.901 and TR36.843 and TR38.859as a starting pointNOTE2: the sensing target is assumed in the far field of sensing Tx/Rx | ~~Option 1: Min. distance is larger than the min. far-field distance of the sensing Tx/Rx~~~~Option 2:~~ Min distances defined in TR 38.901 and TR36.843 and TR38.859 as a starting pointNOTE3: the sensing target is assumed in the far field of sensing Tx/Rx |
| Minimum 3D distance between sensing targets | Option 1: At least larger than the physical size of a sensing targetOption 2: Fixed value, [x] m. value of x is FFS | Option 1: At least larger than the physical size of a sensing targetOption 2: Fixed value, [x] m. value of x is FFS |
| Environment Objects, e.g., types, characteristics, mobility, distribution, etc. | FFS, based on outcome for AI 9.7.2 | FFS, based on outcome for AI 9.7.2 |

NOTE1: For the human (indoor and outdoor) sensing targets, additional communication scenarios can be considered for future evaluations. Channel model calibration for Urban Grid with outdoor humans is expected to be performed from Objects creating hazards on the road/railway sensing scenarios.

NOTE2: A percentage of TRPs/UEs that have sensing capabilities may be considered for future evaluations.

Agreement

For AGV sensing target scenarios, the following table is agreed for deployment scenario parameters/values using the agreements from RAN1#118-bis as a baseline:

The detailed scenario description in this clause can be used for channel model calibration.

**ISAC-AGV**

Details on ISAC-AGV are listed in Table x.

**Table x. Evaluation parameters for Automated Guided Vehicles**

|  |  |
| --- | --- |
| **Parameters** | **Value** |
| Applicable communication scenariosNOTE1 | InF (TR38.901 including Table 7.8-7) |
| Sensing transmitters and receivers properties NOTE2 | Rx/Tx location are selected among the TRPs and UEs location in the corresponding communication scenarioRx/Tx Mobility for UEs* Option 1: 0 km/h
* Option 2: 3km/h
* Option 3: Uniform distribution between 0km/h and 3km/h
 |
| Sensing target | LOS/NLOS | LOS and NLOS |
| Outdoor/indoor | Indoor |
| 3D mobility | Horizontal velocity with random straight-line trajectory * Option 1: Uniform distribution in the range of up to 30 km/h
* Option 2: Fixed velocities [3, 10] km/h
 |
| 3D distribution | Option A: Uniformly distributed in the convex hull of the horizontal BS deploymentOption B: Uniformly distributed in horizontal plane |
| Orientation | Horizontal plane only |
| Physical characteristics (e.g., size) | Size (L x W x H)* Option 1: 0.5m x 1.0m x 0.5m
* Option 2: 1.5 m x 3.0m x 1.5 m
* FFS: Material, Additional sizes, and AGV size distribution
 |
| Minimum 3D distances between pairs of Tx/Rx and sensing target | ~~Option 1: Min. distance is larger than the min. far-field distance of the sensing Tx/Rx from the sensing target~~~~Option 2:~~ Min distances based on min. TRP/UE distances defined in TR38.901NOTE: the sensing target is assumed in the far field of sensing Tx/Rx |
| Minimum 3D distance between sensing targets | Option A: At least larger than the physical size of a targetOption B: Fixed value, [x] m. value of x is FFS |
| Environment objects, e.g., types, characteristics, mobility, distribution, etc. | FFS |

NOTE1: For the AGV sensing targets, additional communication scenarios can be considered for future evaluations.

NOTE2: A percentage of TRPs/UEs that have sensing capabilities may be considered for future evaluations.

NOTE3: RAN1 can further discuss narrowing down the number of sub-scenarios of InF

Agreement

For Objects creating hazards sensing target scenarios, the following table is agreed for deployment scenario parameters/values using the agreements from RAN1#118-bis as a baseline:

The detailed scenario description in this clause can be used for channel model calibration.

**ISAC-Hazards**

Details on ISAC-Hazards are listed in Table x.

**Table x. Evaluation parameters for objects creating hazards**

|  |  |
| --- | --- |
| **Parameters** | **Value** |
| Applicable communication scenarios NOTE1 | Highway, Urban grid, HST (High Speed Train) |
| Sensing transmitters and receivers propertiesNOTE2 | Rx/Tx Locations | Rx/Tx locations are selected among the TRPs and UEs (e.g., VRU, vehicle, RSU-type UEs) locations in the corresponding communication scenarios.~~FFS:~~ ~~Option 2~~ Additional option ISD between TRPs of Urban Grid is 250 m |
| Sensing target | LOS/NLOS | LOS and NLOS |
| Outdoor/indoor | Outdoor |
| 3D mobility | Horizontal velocity: up to [10] km/h for humans and animalsFFS: Additional velocities, trajectory |
| 3D distribution | Uniformly distributed in horizontal plane |
| Orientation | Random distribution in horizontal plane |
| Physical characteristics (e.g., size) | For human/pedestrians: Child: 0.2m x 0.3m x 1mAdult: 0.5m x 0.5m x 1.75m For animals:Size: 1.5m x 0.5m x 1 m~~FFS: other types/sizes of targets may be considered for future evaluations~~ |
| Minimum 3D distances between pairs of Tx/Rx and sensing target | ~~Option 1:~~ Min. distance is ~~larger than the min. far-field distance of the sensing Tx/Rx from the sensing target~~~~Option 2:~~ based onmin TRP/UE distances defined in TR37.885 and TR38.802 and TR36.843 and TR38.859NOTE: the sensing target is assumed in the far field of sensing Tx/Rx |
| Minimum 3D distance between sensing targets | Option 1: At least larger than the physical size of a sensing targetOption 2: Fixed value, ~~[~~10~~]~~ m. ~~value of x is FFS~~ |
| Environment objects, e.g., types, characteristics, mobility, distribution, etc. | EO Type 2 for Urban Grid* ~~FFS: details, e.g.~~ up to 4 walls modelled as EO type 2, per building of size ~~[~~413m x 230m x 20m~~]~~. FFS: number of buildings, how many walls are modelled, additional building sizes, etc.
 |

NOTE1: For the objects creating hazards sensing targets, additional communication scenarios can be considered for future evaluations.

NOTE2: A percentage of TRPs/UEs that have sensing capabilities may be considered for future evaluations.

*ISAC channel modelling*

Agreement

Bistatic RCS values for a scattering point of a target are obtained by fixing an incident direction in LCS of target and varying the scattered directions in LCS of target; then changing to other incident direction.

Agreement

* To generate indirect paths of NLOS ray + NLOS ray in the target channel
	+ Option 0 is recommended, i.e., ray level full convolution between Tx-target link and target-Rx link for radio propagation Case 1/2/3/4
	+ Option 3 to generate a reduced number of indirect paths of NLOS ray + NLOS ray is recommended, i.e., ray level 1-by-1 random coupling between Tx-target link and target-Rx link is supported for radio propagation Case 1/2/3/4
		- If number of rays in the two links are different, e.g., M1, M2 respectively for link 1 and link 2,
			* If M1<M2, randomly M1 rays are selected in link 2, otherwise randomly M2 rays are selected in link 1
	+ Other methods are up to company choice for complexity reduction
	+ Both option 0 and 3 will be calibrated independently. Company should report which option is used in calibration
* The power threshold for path dropping is X=[-25] dB
	+ X is relative to the strongest indirect path in the target channel
* FFS: further power normalization of target channel is performed after path dropping,
* Note: power normalization when target channel and background channel are combined can be discussed separately
* FFS The set of remaining indirect paths can be updated during movement of Tx, target or Rx

Agreement

The following RCS models are supported when human is modelled with single scattering point for monostatic, where different RCS values and/or models can be supported for human due to different size, shape, frequency, etc.

* Model 1
	+ B1=0 dB
	+ A is mean RCS value
	+ B2 is modelled using log-normal distribution
* Model 2
	+ B1 have dependency on incident/scattered angles, with further down-selection among the alternatives below:
		- Alt 1: formulated similar as the antenna radiation power pattern in 38.901
		- Alt 2: a function
		- Alt 3: Lookup table
	+ B2 is modelled using log-normal distribution
	+ FFS RCS component A
* FFS: conditions for using which model

Agreement

The following RCS model is supported when vehicle is modelled with single scattering point for monostatic, where different RCS values can be supported for vehicle due to different size, shape, frequency, etc.

* + B1 have dependency on incident/scattered angles, with further down-selection among the alternatives below:
		- Alt 1: formulated similar as the antenna radiation power pattern in 38.901
		- Alt 2: a function
		- Alt 3: Lookup table
	+ B2 is modelled using log-normal distribution
	+ FFS RCS component A

Agreement

When vehicle is modelled with multiple scattering points for monostatic, where different RCS values can be supported for vehicle due to different size, shape, frequency, etc.

* the recommended five scattering points are located in front, left, back, right and roof side of the vehicle
* the following RCS model is supported for each scattering point
	+ B1 have dependency on incident/scattered angles, with further down-selection among the alternatives below:
		- Alt 1: formulated similar as the antenna radiation power pattern in 38.901
		- Alt 2: a function
		- Alt 3: Lookup table
	+ B2 is modelled using log-normal distribution
	+ FFS RCS component A

Agreement

EO type-1 (when modelled) is modelled in the same way as a sensing target in the ISAC channel model.

Agreement

* If blockage/forward scattering between sensing targets is not considered, a propagation path from Tx to Rx interacting with more than one sensing targets is not modelled
* FFS whether/how blockage/forward scattering can be modelled in the target channel.

Agreement

* Doppler for a target including both macro-Doppler and micro-Doppler can be modeled using a unified formula,

$\frac{^\_{rx,n^{'},m^{'}}^{T}\left(t\right).¯\_{rx}\left(t\right)+^\_{p,n^{'},m^{'}}^{T}\left(t\right)¯\_{sp}\left(t\right)+^\_{tx,n,m}^{T}\left(t\right).¯\_{tx}\left(t\right)+^\_{p,n,m}^{T}\left(t\right)∙¯\_{sp}\left(t\right)}{λ\_{0}}+f\left(t\right)$

Where,

* + - $^\_{rx,n^{'},m^{'}}^{T}$ is the spherical unit vector at receiver for the link from Rx to the scattering point
		- $^\_{tx,n,m}^{T}$ is the spherical unit vector at transmitter for the link from Tx to the scattering point
		- $^\_{p,n^{'},m^{'}}^{T}$ is the spherical unit vector at the scattering point for the link from the scattering point to Rx
		- $^\_{p,n,m}^{T}$ is the spherical unit vector at the scattering point for the link from the scattering point to Tx
	+ Dual mobility model in 7.6.10, TR 38.901 is used as start point to model Doppler effect $f\left(t\right)$ due to movement of stochastic clusters, i.e., $\frac{2α\_{n,m}D\_{n,m}}{λ\_{0}}$
		- $f\left(t\right)$ is only applicable for indirect path
		- Support one term of $\frac{2α\_{n,m}D\_{n,m}}{λ\_{0}}$ for indirect path of LOS ray+NLOS ray, NLOS ray+LOS ray
		- Support two terms of $\frac{2α\_{n,m}D\_{n,m}}{λ\_{0}}$ for indirect path of NLOS ray+NLOS ray
	+ Doppler is separately determined for each of the multiple scattering points of a target
	+ $\overline{v}\_{sp}\left(t\right)$ can include macro-Doppler and/or micro-Doppler motion,
	$$\overline{v}\_{sp}\left(t\right)=¯\_{macro}\left(t\right)+¯\_{micro,p}\left(t\right)$$
	+ FFS: maximum speed of moving scatterers
	+ FFS: ratio of moving scatterers among all scatterers

Agreement

* The following options are supported to generate the combined ISAC channel
	+ Option 1: The ISAC channel of a pair of sensing Tx/Rx is obtained by summing the target channel(s) and background channel, i.e., power normalization is not performed.
	+ Option 2: As an additional modelling component, power normalization is performed when summing the target channel(s) and background channel, to keep the same/similar channel power as the background channel without target. Down select between
		- Alt 1: Power normalization on both target channel and background channel
		- Alt 2: Power normalization on background channel only
		- Alt 3: the target channel of a target will replace one cluster in the background channel
* FFS Blockage is modelled for the background channel due to sensing target and/or EO type-2
* FFS condition to select option, e.g. depending on scenario, sensing mode, number of target/EO type-2

Agreement

To model the polarization matrix of a direct/indirect path at a scattering point of an object other than EO type-2, the polarization matrix of the scattering point, i.e., $CPM\_{sp,i}$ is modelled by $α\_{i,1},α\_{i,2},β\_{i,1},β\_{i,2},$ and initial random phases $\left\{Φ\_{sp,i}^{θθ},Φ\_{sp,i}^{θϕ},Φ\_{sp,i}^{ϕθ},Φ\_{sp,i}^{ϕϕ}\right\}$, i.e., $CPM\_{sp,i}=\left[\begin{matrix}α\_{i,1}exp\left(jΦ\_{sp,i}^{θθ}\right)&β\_{i,1}exp\left(jΦ\_{sp,i}^{θϕ}\right)\\β\_{i,2}exp\left(jΦ\_{sp,i}^{ϕθ}\right)&α\_{i,2}exp\left(jΦ\_{sp,i}^{ϕϕ}\right)\end{matrix}\right]$

* + The initial random phase $\left\{Φ\_{sp,i}^{θθ},Φ\_{sp,i}^{θϕ},Φ\_{sp,i}^{ϕθ},Φ\_{sp,i}^{ϕϕ}\right\}$ is [uniformly distributed within $\left(-π,π\right)]$
	+ FFS correlation between $α\_{i,1},α\_{i,2},β\_{i,1},β\_{i,2}$
	+ FFS specular reflection
	+ FFS: CPM normalization

The following options are considered for further study, down select one option from the following

* Option 1: $α\_{i,1}=α\_{i,2}=1$, $β\_{i,1}=β\_{i,2}=\sqrt{κ\_{sp,i}^{-1}}$ is generated for path i, where $κ\_{sp,i}$ is XPR ratio
	+ $κ\_{sp,i}$ is randomly generated by log-normal distribution. FFS mean/variance of the distribution
* Option 2: $α\_{i,1}=1$, $α\_{i,2},β\_{i,1},β\_{i,2}$ are variables generated for path i
* Option 3: $α\_{i,1},α\_{i,2},β\_{i,1},β\_{i,2}$ are variables generated for path i
	+ $CPM\_{sp,i}$ defined in LCS
* Option 4: $α\_{i,1}=α\_{i,2}=1$, $β\_{i,1}=β\_{i,2}=0$ is generated for path i

Agreement

The finite size of the EO type-2 affects identification of specular reflection point. In the target channel, EO type-2 is modelled only if the specular reflection point is in the area of the EO type-2.

Agreement

Component B2 of RCS is upper bounded by kσ dB for the log-normal distribution, where σ is the standard deviation of B2 in dB. FFS the value of k.

Agreement

When the EO type-2 is modelled in the target channel, down select between the following options to determine the LOS condition of the Tx-target link and target-Rx link

* Option A: If type-2 EO is in the LOS ray of one link, the link is determined as NLOS condition, and otherwise use the LOS probability equation to determine the LOS/NLOS condition
	+ FFS changes to the LOS probability defined in existing TRs
	+ FFS details on blockage by EO type-2
* Option B: Use the LOS probability equation to determine the LOS/NLOS condition of one link, and then the impacts of type-2 EO is modeled by a blockage model

#### 2.1.2 Remaining Open issues

The following open issues need to be addressed:

* *ISAC deployment scenarios*
	+ Remaining issues on channel model calibration/evaluation parameters
	+ Calibration of the ISAC channel model
* *ISAC channel modelling*
	+ Physical object modelling
		- Collection on values for RCS model of UAV, human, vehicle, AGV, …
		- Polarization matrix of target
		- Details on modelling object with multiple scattering points
		- Correlation of RCS in adjacent incident/scattered angles
		- Bistatic RCS, forward RCS
	+ Channel model
		- Remaining details of basic ISAC channel model
		- Background channel for monostatic/bistatic sensing mode,
		- Exact sections in the existing TR as reference to generate target channel and target channel
		- Target channel modelling for target with multiple scattering points
		- Remaining details on EO type-2
		- Details on power normalization combining target channel and background channel
		- Absolute time of arrival
		- Forward scattering, blockage
	+ Further details on spatial consistency
		- Which links should spatial consistency apply, Tx-target link, target-Rx link and Tx-Rx link (i.e., background channel) of same or different Tx/target/Rx
		- Site specific or target specific correlation parameters including 3D spatial consistency
		- Consideration on EO

## 2.2 RAN2

#### 2.2.1 Agreements

#### 2.2.2 Remaining Open issues

## 2.3 RAN3

#### 2.3.1 Agreements

#### 2.3.2 Remaining Open issues

## 2.4 RAN4

#### 2.4.1 Agreements

#### 2.4.2 Remaining Open issues

## 2.5 RAN5

#### 2.5.1 Agreements

#### 2.5.2 Remaining Open issues

#### 2.5.3 Remaining Open issues with cross-WG dependencies

## 2.6 RAN6

#### 2.6.1 Agreements

#### 2.6.2 Remaining Open issues

## 3. Detailed progress in SA/CT WGs since last TSG meeting (for all involved WGs)

NOTE: This section only needs to be filled in for WI/SIs where there is a corresponding relevant WI/SI in SA/CT.

## 3.1 SAx/CTs

#### 3.1.1 Agreements with cross-TSG impacts

#### 3.1.2 Remaining Open issues with cross-TSG impacts

NOTE: This section should also flag any critical dependencies that need TSG attention.

## 4. References

NOTE: This can be e.g. a list of all related Tdocs in the affected WGs since last TSG, references to LSs, produced TRs/TSs, the work/study item description or status reports of previous TSGs.

**RAN1 #118bis**

R1-2408097 Updated work plan on channel modelling for ISAC Xiaomi, AT&T

R1-2407651 Deployment scenarios for ISAC channel model Huawei, HiSilicon

R1-2407717 Discussion on ISAC deployment scenarios Spreadtrum Communications

R1-2407741 Discussion on ISAC deployment scenarios China Telecom

R1-2407750 ISAC deployment scenarios Tejas Network Limited

R1-2407872 Views on Rel-19 ISAC deployment scenarios vivo

R1-2407916 Discussion on ISAC deployment scenarios CMCC, China Southern Power Grid

R1-2407980 Deployment scenarios and evaluation assumptions for ISAC channel model Xiaomi

R1-2408058 Discussion on ISAC deployment scenarios CATT, CICTCI

R1-2408092 Discussion on ISAC deployment scenarios and requirements EURECOM

R1-2408154 Discussion on ISAC deployment scenarios OPPO

R1-2408240 Deployment scenarios for ISAC study KRRI, Hanbat National University

R1-2408274 Discussion on ISAC deployment scenarios TOYOTA InfoTechnology Center

R1-2408303 Discussion on ISAC deployment scenarios LG Electronics

R1-2408315 Discussion on ISAC Deployment Scenarios Nokia, Nokia Shanghai Bell

R1-2408340 Discussion on ISAC Deployment Scenarios Ericsson

R1-2408386 Deployment scenarios for integrated sensing and communication with NR NVIDIA

R1-2408419 Considerations on ISAC deployment scenarios Sony

R1-2408482 Discussion on ISAC deployment scenarios Apple

R1-2408514 Discussion on ISAC deployment scenarios ZTE Corporation, Sanechips

R1-2408523 Discussion on ISAC deployment scenarios InterDigital, Inc.

R1-2408534 Discussion on ISAC deployment scenarios Panasonic

R1-2408657 Discussion on ISAC deployment scenarios Samsung

R1-2408710 Discussion on ISAC deployment scenario MediaTek Inc.

R1-2408720 Discussion on ISAC deployment scenarios Tiami Networks

R1-2408746 Discussion on ISAC deployment scenarios Lenovo

R1-2408755 Deployment Scenarios for ISAC Channel Modeling AT&T, FirstNet

R1-2408797 Study on deployment scenarios for ISAC channel modelling NTT DOCOMO, INC.

R1-2408809 Considerations on ISAC deployment scenarios CAICT

R1-2408861 Discussion on ISAC deployment scenarios Qualcomm Incorporated

R1-2408904 Evaluation Parameters for ISAC in Automotive Scenarios Continental Automotive

R1-2408760 FL Summary #1 on ISAC Deployment Scenarios Moderator (AT&T)

R1-2408761 FL Summary #2 on ISAC Deployment Scenarios Moderator (AT&T)

R1-2408762 FL Summary #3 on ISAC Deployment Scenarios Moderator (AT&T)

R1-2407652 Channel modelling for ISAC Huawei, HiSilicon

R1-2407718 Discussion on ISAC channel modeling Spreadtrum Communications

R1-2407742 Discussion on ISAC channel modelling China Telecom

R1-2407751 ISAC channel modelling Tejas Network Limited

R1-2407873 Views on Rel-19 ISAC channel modelling vivo, BUPT

R1-2407917 Discussion on channel modeling methodology for ISAC CMCC,BUPT,SEU, PML

R1-2408059 Discussion on ISAC channel modelling CATT, CICTCI

R1-2408093 Discussion on ISAC channel modeling EURECOM

R1-2408094 Discussion on ISAC channel model Xiaomi, BJTU, BUPT

R1-2408155 Study on ISAC channel modelling OPPO

R1-2408241 Channel modelling for ISAC study KRRI, Hanbat National University

R1-2408263 ISAC Channel Modeling and Measurement Validation BUPT, CMCC

R1-2408275 Discussion on ISAC channel modelling TOYOTA InfoTechnology Center

R1-2408285 Discussion on ISAC channel modeling Intel Corporation

R1-2408304 Discussion on ISAC channel modelling LG Electronics

R1-2408307 Discussions on ISAC Channel Modelling Lekha Wireless Solutions

R1-2408316 Discussion on ISAC channel modeling Nokia, Nokia Shanghai Bell

R1-2408341 Discussion on ISAC Channel Modelling Ericsson

R1-2408387 Channel modeling for integrated sensing and communication with NR NVIDIA

R1-2408420 Views on Channel Modelling for ISAC Sony

R1-2408483 Discussion on ISAC channel modelling Apple

R1-2408515 Discussion on channel modelling for ISAC ZTE Corporation, Sanechips

R1-2408524 Discussion on ISAC channel modeling InterDigital, Inc.

R1-2408658 Discussion on ISAC channel modelling Samsung

R1-2408711 Discussion on ISAC channel modelling MediaTek Inc.

R1-2408721 Discussion on ISAC Channel Modeling Tiami Networks

R1-2408724 Discussion on ISAC Channel Modeling NIST

R1-2408747 Discussion on Channel Modelling for ISAC Lenovo

R1-2408756 Discussions on ISAC Channel Modeling AT&T

R1-2408798 Discussion on ISAC channel modeling NTT DOCOMO, INC.

R1-2408810 Considerations on ISAC channel modelling CAICT

R1-2408862 Discussion on ISAC channel modelling Qualcomm Incorporated

R1-2408883 Discussion on ISAC Channel Modelling Panasonic

R1-2408985 Discussion on Channel Measurements and Modeling for Integrated Monostatic Sensing and Communication Southeast University, Purple Mountain Laboratories

R1-2408098 Summary #1 on ISAC channel modelling Moderator (Xiaomi)

R1-2408099 Summary #2 on ISAC channel modelling Moderator (Xiaomi)

R1-2408100 Summary #3 on ISAC channel modelling Moderator (Xiaomi)

R1-2408101 Summary #3 on ISAC channel modelling Moderator (Xiaomi)

R1-2409280 Summary #4 on ISAC channel modelling Moderator (Xiaomi)

**RAN1 #119**

R1-2409393 Deployment scenarios for ISAC channel model Huawei, HiSilicon

R1-2409471 Discussion on ISAC deployment scenarios and requirements EURECOM

R1-2409523 Discussion on ISAC deployment scenarios CMCC, China Southern Power Grid

R1-2409608 Discussion on ISAC deployment scenarios Samsung

R1-2409692 Views on Rel-19 ISAC deployment scenarios vivo

R1-2409717 Discussion on ISAC deployment scenarios TOYOTA InfoTechnology Center

R1-2409766 Discussion on ISAC Deployment Scenarios Nokia, Nokia Shanghai Bell

R1-2409776 Deployment scenarios for integrated sensing and communication with NR NVIDIA

R1-2409817 Discussion on ISAC deployment scenarios Apple

R1-2409836 Discussion on ISAC deployment scenarios LG Electronics

R1-2409846 Discussion on ISAC deployment scenarios InterDigital, Inc.

R1-2409907 Deployment scenarios and evaluation assumptions for ISAC channel model Xiaomi

R1-2409952 Discussion on ISAC deployment scenarios CATT, CICTCI

R1-2410006 Discussion on ISAC deployment scenarios China Telecom

R1-2410097 Discussion on ISAC deployment scenarios OPPO

R1-2410125 Discussion on ISAC Deployment Scenarios Ericsson

R1-2410162 ISAC deployment scenarios Tejas Networks Limited

R1-2410234 Considerations on ISAC deployment scenarios Sony

R1-2410322 Discussion on ISAC deployment scenarios Lenovo

R1-2410332 ISAC channel model calibration and scenario parameters AT&T, FirstNet

R1-2410369 Considerations on ISCA deployment scenarios CAICT

R1-2410400 Study on deployment scenarios for ISAC channel modelling NTT DOCOMO, INC.

R1-2410447 Discussion on ISAC deployment scenarios ZTE Corporation, Sanechips

R1-2410489 Discussion on ISAC deployment scenarios Qualcomm Incorporated

R1-2410524 Discussion on ISAC deployment scenario MediaTek Inc.

R1-2410626 Discussion on ISAC deployment scenarios Tiami Networks

R1-2410627 Discussion on ISAC channel modeling Tiami Networks

R1-2410337 FL Summary #1 on ISAC Deployment Scenarios Moderator (AT&T)

R1-2410338 FL Summary #2 on ISAC Deployment Scenarios Moderator (AT&T)

R1-2410339 FL Summary #3 on ISAC Deployment Scenarios Moderator (AT&T)

R1-2409394 Channel modelling for ISAC Huawei, HiSilicon

R1-2409472 Discussion on ISAC channel modeling EURECOM

R1-2409524 Discussion on channel modeling methodology for ISAC CMCC,BUPT,SEU, PML

R1-2409609 Discussion on ISAC channel modelling Samsung

R1-2409647 Discussion on ISAC channel modeling Spreadtrum, UNISOC

R1-2409693 Views on Rel-19 ISAC channel modelling vivo, BUPT

R1-2409718 Discussion on ISAC channel modelling TOYOTA InfoTechnology Center

R1-2409740 Discussion on ISAC channel modeling Intel Corporation

R1-2409767 Discussion on ISAC channel modeling Nokia, Nokia Shanghai Bell

R1-2409777 Channel modeling for integrated sensing and communication with NR NVIDIA

R1-2409818 Discussion on ISAC channel modelling Apple

R1-2409837 Discussion on ISAC channel modelling LG Electronics

R1-2409847 Discussion on ISAC channel modeling InterDigital, Inc.

R1-2409908 Discussion on ISAC channel model Xiaomi, BJTU, BUPT

R1-2409953 Discussion on ISAC channel modelling CATT, CICTCI

R1-2409977 Discussions on ISAC Channel Modelling Lekha Wireless Solutions

R1-2409992 ISAC Channel Modeling and Measurement Validation BUPT, CMCC, VIVO

R1-2410007 Discussion on ISAC channel modelling China Telecom

R1-2410098 Study on ISAC channel modelling OPPO

R1-2410126 Discussion on ISAC Channel Modelling Ericsson

R1-2410136 Discussion on ISAC channel modeling NIST

R1-2410163 ISAC channel modelling Tejas Networks Limited

R1-2410235 Views on Channel Modelling for ISAC Sony

R1-2410321 Discussion on Channel Modelling for ISAC Lenovo

R1-2410333 Discussions on ISAC Channel Modeling AT&T

R1-2410370 Considerations on ISAC channel modelling CAICT

R1-2410401 Discussion on ISAC channel modeling NTT DOCOMO, INC.

R1-2410448 Discussion on channel modelling for ISAC ZTE Corporation, Sanechips

R1-2410490 Discussion on ISAC channel modelling Qualcomm Incorporated

R1-2410525 Discussion on ISAC channel modelling MediaTek Inc.

R1-2410011 Summary #1 on ISAC channel modelling Moderator (Xiaomi)

R1-2410012 Summary #2 on ISAC channel modelling Moderator (Xiaomi)

R1-2410013 Summary #3 on ISAC channel modelling Moderator (Xiaomi)

R1-2410014 Summary #4 on ISAC channel modelling Moderator (Xiaomi)

 10.11.2023 minor adaptations for RAN #102

 02.08.2023 minor adaptations for RAN #101

 26.04.2023 minor adaptations for RAN #100

 01.02.2023 minor adaptations for RAN #99

 27.10.2022 minor adaptations for RAN #98e

 01.08.2022 minor adaptations for RAN #97e

 21.05.2022 minor adaptations for RAN #96

 10.01.2022 minor adaptations for RAN #95e

 04.10.2021 minor adaptations for RAN #94e

 08.08.2021 minor adaptations for RAN #93e

 17.05.2021 minor adaptations for RAN #92e

 28.01.2021 minor adaptations for RAN #91e

 09.11.2020 minor adaptations for RAN #90e

 31.08.2020 minor adaptations for RAN #89e

 20.04.2020 minor adaptations for RAN #88e

 18.02.2020 minor adaptations for RAN #87e

 14.11.2019 minor adaptations for RAN #86

 18.08.2019 minor adaptations for RAN #85

 12.05.2019 minor adaptations for RAN #84

 27.02.2019 minor adaptations for RAN #83

 21.11.2018 completion levels with colours added (for RAN #82)

v04.81 31.07.2018 simplification of template and addition of cross-TSG aspects (for RAN #81)

v04.80 21.05.2018 minor adaptations for RAN #80

v04.79 26.02.2018 minor adaptations for RAN #79

v04.78 18.11.2017 minor adaptations for RAN #78

v04.77 06.08.2017 minor adaptations for RAN #77

v04.76 15.05.2017 minor adaptations for RAN #76

v04.75 31.01.2017 minor adaptations for RAN #75

v04.74 28.10.2016 minor adaptations for RAN #74

v04.73 01.09.2016 adaptations for RAN #73 (time units in extra Excel table, RAN6 reporting included)

v04.72 26.05.2016 adaptations for RAN #72 (introduction of NR & GERAN TUs)

v04.71 10.02.2016 minor adaptations for RAN #71

v04.70 30.10.2015 minor adaptations for RAN #70

v04.69 12.08.2015 minor adaptations for RAN #69

v04.68 21.05.2015 minor adaptations for RAN #68

v04.67 01.02.2015 minor adaptations for RAN #67

v04.66 16.11.2014 minor adaptations for RAN #66

v04.65 16.08.2014 minor adaptations for RAN #65

v04.64 22.05.2014 minor adaptations for RAN #64

v04.63 24.01.2014 restructuring for RAN #63 to cover Core & Perf. in one doc file

v03.62 11.11.2013 section 1.2.3 adapted for RAN #62

v03 11.08.2013 section 1.2.3 added on time budget

v02 07.05.2010 history added, some spelling corrections

v01 13.11.2009 First version of the template