3GPP TSG RAN WG1 Meeting #120b **R1-2501839**
Wuhan, China, April 7th – 11th, 2025

Agenda Item: 9.7.1

Source: EURECOM

Title: Discussion on ISAC deployment scenarios and requirements

Document for: Discussion and decision

1. Introduction

According to the SI for Release 19 ISAC [1], the objective of this SI is as follows:

> 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.

The following agreements were made in RAN1#116:

> **Agreement**
>
> For progressing ISAC study, the following sensing targets and existing communication scenarios will be considered as a starting point:
>
> - Note1: the table below does not imply that the sensing target will be placed at positions defined for UEs and BSs in the scenarios in the right column.
> - Note2: the table below does not imply that UEs are necessarily placed at positions defined for UEs in the scenarios in the right column.
> - Note3: the existing communication scenarios are listed with the intent to use the evaluation parameters defined for those scenarios, as a starting point.

Sensing Targets	Scenarios
UAVs	RMa-AV, UMa-AV, UMi-AV (TR 36.777)
Humans indoors	InF, Indoor Office, [Indoor Room (TR 38.808)], [UMi, UMa]
Humans outdoors	UMi, UMa, [RMa]
Automotive vehicles (at least outdoors)	Highway, Urban grid, UMa, UMi, RMa
Automated guided vehicles (e.g. in indoor factories)	InF
Objects creating hazards on roads/railways (examples defined in TR 22.837)	Highway, Urban grid, HST

Agreement

For ISAC channel modelling, RAN1 uses the sensing related terminology as defined in TS22.137 or TR22.837 as a starting point for discussion purposes with the following definitions:

- Sensing transmitter: the TRP or a UE that sends out the sensing signal which the sensing service will use in its operation. A sensing transmitter can be located in the same or different TRP or a UE as the sensing receiver.
- Sensing receiver: the TRP or a UE that receives the sensing signal which the sensing service will use in its operation. A sensing receiver can be located in the same or different TRP or a UE as the sensing transmitter.
- Sensing target: target that need to be sensed by deriving characteristics of the objects within the environment from the sensing signal.
- Background environment: background (clutter and/or environmental objects) that are not the sensing target(s).
- Mono-static sensing: sensing where the sensing transmitter and sensing receiver are co-located in the same TRP or UE.
- Bi-static sensing: sensing where the sensing transmitter and sensing receiver are in different TRPs or UEs.
- Multi-static sensing: sensing where there are multiple sensing transmitters and/or multiple sensing receivers, for a sensing target.
- Sensing signal: Transmissions on the 3GPP radio interface that can be used for sensing purposes.

The following agreements were made in RAN1#116b:

Agreement

RAN1 agrees the following ISAC terminology with minor modifications as follows:

For ISAC channel modelling, RAN1 uses the sensing related terminology as defined in TS22.137 or TR22.837 as a starting point for discussion purposes with the following definitions:

1. Sensing transmitter: the TRP or a UE that sends out the sensing signal which the sensing service will use in its operation. A sensing transmitter can be located in the same or different TRP or a UE as the sensing receiver.
2. Sensing receiver: the TRP or a UE that receives the sensing signal which the sensing service will use in its operation. A sensing receiver can be located in the same or different TRP or a UE as the sensing transmitter.
3. Sensing target: target that need to be sensed by deriving characteristics of the objects within the environment from the sensing signal.
4. Background environment: background (clutter and/or environmental objects) that are not the sensing target(s).
5. Mono-static sensing: sensing where a sensing transmitter that transmits a sensing signal and a sensing receiver that receives the sensing signal are co-located in the same TRP or UE.
6. Bi-static sensing: sensing where a sensing transmitter that transmits a sensing signal and a sensing receiver that receives the sensing signal are not co-located in the same TRP or UE.
7. Multi-static sensing: sensing where there are multiple sensing transmitters and/or multiple sensing receivers, for a sensing target.
8. Sensing signal: Transmissions on the 3GPP radio interface that can be used for sensing purposes.

Agreement

Any TRP and/or UE location in the corresponding communication scenario can be selected as sensing transmitters and receivers locations. FFS: other possible sensing transmitters and receivers locations.

Agreement

The following table can be used by companies to propose values for each sensing target.

- Additional parameters/rows can be added if needed

Table x. Evaluation parameter template for sensing scenarios

Parameters	Value

Applicable communication scenarios		
Sensing transmitters and receivers properties		
Supported sensing modes		
Sensing target	Outdoor/indoor	
	3D mobility	
	3D distribution	
	Orientation	
	Physical characteristics (e.g., size)	
[Unintended/Environment objects]	Types	
	3D mobility	
	3D distribution	
	Orientation	
	Physical characteristics (e.g., size)	
[Sensing area]		
Minimum 3D distances between pairs of Tx/Rx/sensing target/[unintended objects]		

The following agreements were made in RAN1#117:

Agreement

For each of the sensing target deployment scenarios using the template agreed in RAN#116-bis, the following principles apply:

- For defining sensing Tx and sensing Rx properties (e.g., cell layout, BS antenna height, and minimum distance), scenario parameter values for the applicable communication scenarios in 38.901 are considered as a starting point. Updates to these evaluation parameter values for ISAC scenarios will consider the following:
    - aerial UEs parameter values as defined in TR 36.777
    - indoor room scenario parameter values defined in TR 38.808
    - automotive scenario parameter values as defined in TR 37.885, 38.859 for Urban grid/Highway
    - Minimum distances between Tx/Rx and target are not defined in the existing communications scenarios and shall be included in the sensing target deployment scenarios.
    - Note: Only deviation from the existing evaluation parameters in the applicable communication scenarios need to be explicitly defined in the ISAC scenario tables.
- For defining sensing target properties, as a baseline
    - Evaluation parameter values can be taken from additional TRs, e.g., TR 36.777, 37.885, 38.859, etc.
    - Size of sensing targets based on TR 22.837, 37.885 (e.g. for automotive), 38.901 (e.g. for AGV size), etc

Agreement

For ISAC deployment scenarios, carrier frequency, bandwidth, and SCS are not included in the evaluation parameters templates for sensing scenarios, but may be included in the evaluation/calibration phase.

Agreement

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

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

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 scenario 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.]
Supported sensing modes		[All 6 sensing modes]
Sensing target		
	Outdoor/indoor	Outdoor
	3D mobility	Horizontal velocity: Up to 160 km/h [FFS specific velocity(ies) or random distribution] [FFS vertical plane velocity]
	3D distribution	[Uniform between a minimum and maximum height] [Uniform in horizontal domain at a given height]
	Orientation	Random in horizontal domain
	Physical characteristics (e.g., size)	UAV object type(s) [FFS]
[Sensing area]		
Minimum 3D distances between pairs of Tx/Rx and		FFS

sensing target/[unintended objects]	
Minimum 3D distance between sensing targets	FFS
[Unintended/Environment objects, e.g., types, characteristics, mobility, distribution, etc.]	FFS

Agreement

RAN1 agrees to the following revised evaluation parameters values for the UAV sensing target scenarios:

Parameters	**Value**
Sensing transmitters and receivers properties	Rx/Tx locations are selected among the TRPs and UEs locations in the corresponding communication scenario Note 1: Other Rx/Tx properties (e.g. mobility) can also be taken from the corresponding communication scenario. Note 2: This may include aerial UEs as Rx/Tx that can be selected among locations in the UMi-AV, UMa-AV, RMa-AV communication scenarios

The following agreements were made in RAN1#118:

Agreement

General principles for all sensing target deployment scenarios should consider the following:

- "Sensing mode" is removed in the scenario tables, but may be included in the evaluation/calibration phase. Per the SI, all sensing modes are possible for the deployment scenarios.
- "Sensing area" may be addressed as part of the sensing target distribution and/or Tx/Rx characteristics and/or cell layout.

Agreement

For UAV sensing target scenarios, the following table is agreed for deployment scenario parameters/values using the agreements from RAN1#117 as a baseline.

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

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	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/h NOTE2: 3D mobility can be horizontal only or vertical only or a combination for each sensing target FFS: time-varying velocity.
	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 Vertical 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. Note2: 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. 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 target Option 2: 10 meters
[Unintended/Environment objects, e.g., types, characteristics, mobility, distribution, etc.]		FFS

Note: further down-selection between the options in the table is not precluded.

The following agreements were made in RAN1#118b:

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. NOTE2 FFS: 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 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
Minimum 3D distance between sensing targets		Option 1: At least larger than the physical size of a sensing target Option 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 Locations NOTE 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/h Option 2: 3km/h Option 3: Uniform distribution between 0km/h	Option 1: 0km/h Option 2: 3km/h Option 3: Uniform distribution between 0km/h and 10km/hr

		and 3km/hr	
Sensing target	Outdoor/indoor	Indoor	Outdoor
	3D mobility	Option 1: 0km/h Option 2: 3km/h Option 3: Uniform distribution between 0km/h and 3km/hr (horizontal plane with random direction straight-line trajectory)	Option 1: 0km/h Option 2: 3km/h Option 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	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/Rx Option 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/Rx Option 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 target Option 2: Fixed value, [x] m. value of x is FFS	Option 1: At least larger than the physical size of a sensing target Option 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 scenarios NOTE1		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 scenario Rx/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 deployment Option 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 TR38.901
Minimum 3D distance between sensing targets	Option A: At least larger than the physical size of a target Option 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 properties NOTE2	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 animals FFS: 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 1m Adult: 0.5m x 0.5m x 1.75m For animals: Size: 1.5m x 0.5m x 1 m FFS: 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 target Option 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 target Option 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.

The following agreements were made in RAN1#119:

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/h

		NOTE2: 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 alarm Vertical 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 target Option 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 target Option 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 Locations NOTE 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/h Option 2: 3km/h Option 3: Uniform distribution between 0km/h and 3km/hr	Option 1: 0km/h Option 2: 3km/h Option 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/h Option 2: 3km/h Option 3: Uniform distribution between 0km/h and 3km/hr (horizontal plane with random direction straight-line trajectory)	Option 1: 0km/h Option 2: 3km/h Option 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 point	~~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 point

	NOTE2: the sensing target is assumed in the far field of 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 target Option 2: Fixed value, [x] m. value of x is FFS	Option 1: At least larger than the physical size of a sensing target Option 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 scenarios NOTE1		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 scenario Rx/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 deployment Option 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 TR38.901

	NOTE: 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 target Option 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 properties	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.

NOTE2		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 animals FFS: 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 1m Adult: 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 on min TRP/UE distances defined in TR37.885 and TR38.802 and TR36.843 and TR38.859 NOTE: 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 target Option 2: Fixed value, [10] m. value of x is FFS
Environment objects, e.g., types, characteristics,		EO Type 2 for Urban Grid

mobility, distribution, etc.	- ~~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.

The following agreements were made in RAN1#120:

Agreement

For ISAC channel modelling calibration, RAN1 considers both large-scale and full-scale calibration to include parameters and values for at least the following:

- large scale parameters, where fast fading is not included
- full-scale calibration parameters, which includes fast fading.

- NOTE0: one part of calibration work does not include additional components and does not include spatial consistency
  - FFS: whether spatial consistency is specified as an additional component for ISAC CM
- NOTE1: additional calibrations including spatial consistency can also be considered case by case for different scenarios.
- NOTE2: Inclusion of EO in ISAC CM calibrations can also be considered case by case for different scenarios.

Agreement

Calibration of ISAC CM includes separate calibration of the target channel and of the background channel

- FFS: additional calibration for the combined channel (combination of target and background channel).

Agreement

For the purposes of large scale calibration for UAV sensing targets, the following calibration parameters are proposed below in Table x.

Table x. Simulation assumptions for large scale calibration for UAV sensing targets

Parameters	**Values**
Scenario	UMa-AV
Sensing mode	TRP monostatic, TRP-TRP bistatic, TRP-UE bistatic, UE-UE bistatic Note: further down-selection of the sensing modes for UAV sensing is not precluded
Sectorization	3 sectors per cell site: 30, 150 and 270 degrees
Carrier Frequency	FR1: 6 GHz FR2: 30 GHz
BS antenna configurations	Single dual-pol isotropic antenna
BS Tx power	FR1: 56dBm FR2: 41dBm
Bandwidth	FR1: 100MHz FR2: 400MHz
BS noise figure	FR1: 5dB FR2: 7dB
UT antenna configurations	(M,N,P,Mg,Ng;Mp,Np) = (1,1,2,1,1;1,1)
UT noise figure	FR1: 9dB FR2: 10dB
Sensing target distribution	1 target uniformly distributed (across multiple drops) within the center cell. Vertical distribution: Fixed height value of 200 m.
Component A of the RCS for each scattering point	a fixed value of A

Minimum 3D distances between pairs of Tx/Rx and sensing target	10 m
Wrapping Method	No wrapping method is used if interference is not modelled, otherwise geographical distance based wrapping
Metrics	Coupling loss (based on LOS pathloss) • FFS: how to select sensing Tx and Rx FFS: additional metrics, wideband SIR and SINR based on RSRP if interference is modelled.

In this contribution, the deployment scenarios and evaluation metrics of ISAC will be discussed.

2. Discussion

2.2.1 UAV use cases

The parameters of CM calibration for full calibration for UAV use cases are shown in Table 1.

Table 1. The parameters of CM calibration for full calibration for UAV use cases

Parameters	**Values**
Scenario	UMa-AV
Sensing mode	TRP bistatic/monostatic
Target type	Small-size UAV
Sectorization	3 sectors per site: 30, 150, 270 degrees
Carrier Frequency	FR1: 6 GHz; FR2: 30 GHz
BS antenna configurations	For FR1: (M,N,P,Mg,Ng;Mp,Np) = (8,8,2,1,1;2,8) (dH,dV) = (0.5, 0.8)λ, +45°/-45° polarization For FR2: (M,N,P,Mg,Ng;Mp,Np) = (4,16,2,2,2; 1,1) (d_H,d_V) = (0.5, 0.5)λ, (dH,g, dV,g) = (4.0, 2.0)λ, +45°/-45° polarization
BS Tx power	FR1: 56dBm FR2: 41dBm
Bandwidth	FR1: 100MHz FR2: 400MHz
BS noise figure	FR1: 5dB FR2: 7dB

UT antenna configurations	(M,N,P,Mg,Ng;Mp,Np) = (1,1,2,1,1;1,1)
UT noise figure	FR1:9dB FR2:10dB
Sensing target distribution	1 target uniformly distributed (across multiple drops) within the 3 sectors of the center cell. Vertical distribution: Fixed height value of 200 m.
Fast fading channel	Based on 36.777
(u, std) for XPR of target	(17, 3.4)
Component B1/B2 of bistatic RCS	Same values as monostatic (i.e., we temporally assume bistatic RCS is isotropic)
The power threshold for path dropping after concatenation for target channel	-40dB
The power threshold for removing clusters in step 6 in section 7.5, TR 38.901 for background channel	-25dB
Definition of Coupling loss	By definition, need to consider all direct and indirect paths. The following parameters are included in the calculation: • power scaling factor (pathloss, shadow fading, and RCS component A included) • for small scale RCS B1/B2 and power of rays in Tx-target/target-Rx links ($P^{k,p}_{n',m',n,m}$), Tx/Rx antenna pattern, 3 polarization matrixes, i.e., $\sqrt{P^{k,p}_{n',m',n,m}} \begin{bmatrix} F_{rx,u,\theta}\left(\theta^{k,p}_{rx,n',m',ZOA}, \phi^{k,p}_{rx,n',m',AOA}\right) \\ F_{rx,u,\phi}\left(\theta^{k,p}_{rx,n',m',ZOA}, \phi^{k,p}_{rx,n',m',AOA}\right) \end{bmatrix}^T CPM^{k,p}_{rx,n',m'} CPM^{k,p}_{n',m',n,m} CPM^{k,p}_{tx,n,m} \cdot \begin{bmatrix} F_{tx,s,\theta}\left(\theta^{k,p}_{tx,n,m,ZOD}, \phi^{k,p}_{tx,n,m,AOD}\right) \\ F_{tx,s,\phi}\left(\theta^{k,p}_{tx,n,m,ZOD}, \phi^{k,p}_{tx,n,m,AOD}\right) \end{bmatrix}$
Tx-Rx paring	Select 4 pairs with smallest power scaling factor.
Absolute delay	The model of UMa scenario defined in FR3 channel modeling.
Metrics	CDF of coupling loss CDF of Delay Spread and Angle Spread (ASD, ZSD, ASA, ZSA)

The updated parameters of CM calibration for large scale for UAV use cases are shown in Table 2.

Table 2. The parameters of CM calibration for large scale for UAV use cases

Parameters	**Values**
Target type	Small-size UAV
Definition of coupling loss	power scaling factor (pathloss, shadow fading, and RCS component A (-12.81 dBsm) included) $$L_{TX-SPST-RX} = PL_{dB}(d_1) + PL_{dB}(d_2) + 10lg\left(\frac{c^2}{4\pi f^2}\right) - 10lg(\sigma_{RCS,A}) + SF_{dB,1} + SF_{dB,2}$$
LOS condition, pathloss, SF	Generate the LOS condition, pathloss, SF for each of Tx-target and target-Rx links For monostatic, same LOS condition/pathloss/SF is determined for both Tx-target and target-Rx links
Sensing Tx/Rx selection	N=4 Tx-Rx pairs to be selected for the target in TRP mono-static and TRP-TRP bistatic

Proposal 1: The parameters of CM calibration for full calibration for UAV use cases are shown in Table 1.

Proposal 2: The updated parameters of CM calibration for large scale for UAV use cases are shown in Table 2.

2.2.2 Human indoor/outdoor use cases

The parameters of CM calibration for full calibration for human indoor/outdoor use cases are shown in Table 3.

Table 3. The parameters of CM calibration for full calibration for human indoor/outdoor use cases

Parameters	**Indoor values**	**Outdoor values**
Scenario	Indoor office 120m*50m*3m ISD: 20m	UMa, UMi
Sensing mode	All sensing modes	All sensing modes
Target type	Size (Length x Width x Height):	Size (Length x Width x Height):

	- Child: 0.2m x 0.3m x 1m - Adult Pedestrian: 0.5m x 0.5m x 1.75m	- Child: 0.2m x 0.3m x 1m - Adult Pedestrian: 0.5m x 0.5m x 1.75m
Sectorization	single sector per site	3 sectors per site
Carrier Frequency	FR1: 6 GHz; FR2: 30 GHz	FR1: 6 GHz; FR2: 30 GHz
BS antenna configurations	For FR1: (M,N,P,Mg,Ng;Mp,Np) = (4,4,2,1,1; 4,4) , (dH,dV) = (0.5, 0.5)λ, +45°/-45° polarization For FR2: (M,N,P,Mg,Ng;Mp,Np)= (16,8,2,1,1; 1,1) , (dH,dV) = (0.5, 0.5)λ, +45°/-45° polarization	[M,N,P,Mg,Ng]=[4,4,2,1,2], dv=dh=0.5λ, dvg=dhg=2.5λ
BS Tx power	FR1: 24dBm FR2: 23dBm	FR1: UMa: 49dBm; UMi: 44dBm FR2: UMa: 37dBm; UMi: 37dBm
Bandwidth	FR1: 100MHz FR2: 400MHz	FR1: 100MHz FR2: 400MHz
BS noise figure	FR1: 5dB FR2: 7dB	FR1: 5dB FR2: 7dB
UT antenna configurations	(M,N,P,Mg,Ng;Mp,Np) = (2,2,1,1,1;1,1)	(M,N,P,Mg,Ng;Mp,Np) = (2,2,1,1,1;1,1)
UT noise figure	FR1:9dB FR2:10dB	FR1:9dB FR2:10dB
Fast fading channel	Fast fading channel is modeled	Fast fading channel is modeled
Sensing target distribution	5 targets uniformly distributed over the horizontal area of the convex hull of the TRP deployment	5 sensing targets uniformly distributed within the center cell
Component B1/B2 of bistatic RCS	Same value as monostatic	Same value as monostatic
The power threshold for path dropping after concatenation for target channel	-40dB	-40dB

The power threshold for removing clusters in step 6 in section 7.5, TR 38.901 for background channel	-25dB	-25dB
Tx-Rx pairing	Select 4 Tx-Rx pairs with the smallest power scaling factor	Select 4 Tx-Rx pairs with the smallest power scaling factor
Metrics	CDF of coupling loss CDF of Delay Spread and Angle Spread (ASD, ZSD, ASA, ZSA)	CDF of coupling loss CDF of Delay Spread and Angle Spread (ASD, ZSD, ASA, ZSA)

Table 4. The parameters of CM calibration for large scale for human indoor/outdoor use cases

Parameters	**Indoor values**	**Outdoor values**
Scenario	Indoor office 120m*50m*3m ISD: 20m	UMa, UMi
Sensing mode	All sensing modes	All sensing modes
Target type	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
Sectorization	single sector per site	3 sectors per site
Carrier Frequency	FR1: 6 GHz; FR2: 30 GHz	FR1: 6 GHz; FR2: 30 GHz
BS antenna configurations	For FR1: (M,N,P,Mg,Ng;Mp,Np) = (4,4,2,1,1; 4,4) , (dH,dV) = (0.5, 0.5)λ, +45°/-45° polarization For FR2: (M,N,P,Mg,Ng;Mp,Np)= (16,8,2,1,1; 1,1) , (dH,dV) = (0.5, 0.5)λ, +45°/-45° polarization	[M,N,P,Mg,Ng]=[4,4,2,1,2], dv=dh=0.5λ, dvg=dhg=2.5λ
BS Tx power	FR1: 24dBm FR2: 23dBm	FR1: UMa: 49dBm; UMi: 44dBm FR2: UMa: 37dBm; UMi: 37dBm

Bandwidth	FR1: 100MHz FR2: 400MHz	FR1: 100MHz FR2: 400MHz
BS noise figure	FR1: 5dB FR2: 7dB	FR1: 5dB FR2: 7dB
UT antenna configurations	(M,N,P,Mg,Ng;Mp,Np) = (2,2,1,1,1;1,1)	(M,N,P,Mg,Ng;Mp,Np) = (2,2,1,1,1;1,1)
UT noise figure	FR1:9dB FR2:10dB	FR1:9dB FR2:10dB
Sensing target distribution	5 targets uniformly distributed over the horizontal area of the convex hull of the TRP deployment	5 sensing targets uniformly distributed within the center cell
Large-scale RCS for each scattering point	The mean value of target RCS (-1.37 dBsm for monostatic)	The mean value of target RCS (-1.37 dBsm for monostatic)
Minimum 3D distances between pairs of Tx/Rx and sensing target	TR 38.901 as a starting point	TR 38.901 as a starting point
Minimum 3D distance between sensing targets	At least larger than the physical size of a sensing target	At least larger than the physical size of a sensing target
Wrapping method	No wrapping method is used if interference is not modelled, otherwise geographical distance based wrapping	No wrapping method is used if interference is not modelled, otherwise geographical distance based wrapping
LOS condition, pathloss, SF	Generate the LOS condition, pathloss, SF for each of Tx-target and target-Rx links For monostatic, same LOS condition/pathloss/SF is determined for both Tx-target and target-Rx links	Generate the LOS condition, pathloss, SF for each of Tx-target and target-Rx links For monostatic, same LOS condition/pathloss/SF is determined for both Tx-target and target-Rx links
Definition of coupling loss	power scaling factor (pathloss, shadow fading, and RCS component A included)	power scaling factor (pathloss, shadow fading, and RCS component A included)

	$L_{TX-SPST-RX} = PL_{dB}(d_1) + PL_{dB}(d_2) + 10lg\left(\frac{c^2}{4\pi f^2}\right) - 10lg(\sigma_{RCS,A}) + SF_{dB,1} + SF_{dB,2}$	$L_{TX-SPST-RX} = PL_{dB}(d_1) + PL_{dB}(d_2) + 10lg\left(\frac{c^2}{4\pi f^2}\right) - 10lg(\sigma_{RCS,A}) + SF_{dB,1} + SF_{dB,2}$
Sensing Tx/Rx selection	4 Tx-Rx pairs with the smallest scaling factor to be selected for the target.	4 Tx-Rx pairs with the smallest scaling factor to be selected for the target.
Metrics	Coupling loss – serving cell (based on LOS pathloss) Geometry (based on LOS pathloss) with and without white noise.	Coupling loss – serving cell (based on LOS pathloss) Geometry (based on LOS pathloss) with and without white noise.

Proposal 3: The parameters of CM calibration for full calibration for human indoor/outdoor use cases are shown in Table 3.

Proposal 4: The parameters of CM calibration for large scale for human indoor/outdoor use cases are shown in Table 4.

2.2.3 Automotive vehicles use cases

The parameters of CM calibration for full calibration for Automotive vehicles use cases are shown in Table 5.

Table 5. The parameters of CM calibration for full calibration for Automotive vehicles use cases

Parameters	**Values**
Scenario	Urban grid, Highway
Sensing mode	TRP bistatic/monostatic, TRP-UE bistatic
Target type	Vehicle type 2
Sectorization	3 sectors per site, 30, 150 and 270 degrees
Carrier Frequency	FR1: 6 GHz FR2: 30 GHz
BS antenna configurations	Single dual-pol isotropic antenna
BS Tx power	FR1: 56dBm FR2: 41dBm
Bandwidth	FR1: 100MHz FR2: 400MHz
BS noise figure	FR1: 5dB

	FR2: 7dB
UT antenna configurations	(M,N,P,Mg,Ng;Mp,Np) = (1,1,2,1,1,1,1)
UT noise figure	FR1:9dB FR2:10dB
Sensing target distribution	Dropping option A in 37.885
Fast fading model	Based on 37.885
The power threshold for path dropping after concatenation for target channel	-40dB
The power threshold for removing clusters in step 6 in section 7.5, TR 38.901 for background channel	-25dB
Definition of Coupling loss	By definition, need to consider all direct and indirect paths. The following parameters are included in the calculation: • power scaling factor (pathloss, shadow fading, and RCS component A included) • for small scale RCS B1/B2 and power of rays in Tx-target/target-Rx links ($P^{k,p}_{n',m',n,m}$), Tx/Rx antenna pattern, 3 polarization matrixes, i.e., $\sqrt{P^{k,p}_{n',m',n,m}} \begin{bmatrix} F_{rx,u,\theta}\left(\theta^{k,p}_{rx,n',m',ZOA}, \phi^{k,p}_{rx,n',m',AOA}\right) \\ F_{rx,u,\phi}\left(\theta^{k,p}_{rx,n',m',ZOA}, \phi^{k,p}_{rx,n',m',AOA}\right) \end{bmatrix}^T CPM^{k,p}_{rx,n',m'} CPM^{k,p}_{n',m',n,m} CPM^{k,p}_{tx,n,m}$ $\cdot \begin{bmatrix} F_{tx,s,\theta}\left(\theta^{k,p}_{tx,n,m,ZOD}, \phi^{k,p}_{tx,n,m,AOD}\right) \\ F_{tx,s,\phi}\left(\theta^{k,p}_{tx,n,m,ZOD}, \phi^{k,p}_{tx,n,m,AOD}\right) \end{bmatrix}$
Tx-Rx pairing	For urban grid, select 4 Tx-Rx pairs with smallest power scaling factor. For Highway, select 1 Tx-Rx pairs with smallest power scaling factor.
Metrics	Coupling loss based on PL Wideband SIR and SINR based on geometry (based on pathloss)

The parameters of CM calibration for large scale for Automotive vehicles use cases are shown in Table 6.

Table 6. The parameters of CM calibration for large scale for Automotive vehicles use cases

Parameters	Values
Scenario	Urban grid, Highway
Sensing mode	TRP bistatic/monostatic, TRP-UE bistatic
Target type	Vehicle type 2
Sectorization	3 sectors per site, 30, 150 and 270 degrees
Carrier Frequency	FR1: 6 GHz FR2: 30 GHz
BS antenna configurations	Single dual-pol isotropic antenna
BS Tx power	FR1: 56dBm FR2: 41dBm
Bandwidth	FR1: 100MHz FR2: 400MHz
BS noise figure	FR1: 5dB FR2: 7dB
UT antenna configurations	(M,N,P,Mg,Ng;Mp,Np) = (1,1,2,1,1,1,1)
UT noise figure	FR1:9dB FR2:10dB
Sensing target distribution	Dropping option A in 37.885
Component A of RCS for each scattering point	The mean value of target RCS
Minimum 3D distances between pairs of Tx/Rx and sensing target	Min distances based on min. TRP/UE distances defined in TR37.885 as a starting point.
Minimum 3D distance between sensing targets	10 m
Wrapping Method	As defined in urban grid/highway scenario
LOS condition, pathloss, SF	Generate the LOS condition, pathloss, SF for each of Tx-target and target-Rx links For monostatic, same LOS condition/pathloss/SF is determined for both Tx-target and target-Rx links
Definition of Coupling loss	power scaling factor (pathloss, shadow fading, and RCS component A included) $L_{TX-SPST-RX} = PL_{dB}(d_1) + PL_{dB}(d_2) + 10lg\left(\frac{c^2}{4\pi f^2}\right) - 10lg(\sigma_{RCS,A}) + SF_{dB,1} + SF_{dB,2}$

Sensing Tx/Rx selection	For urban grid, 4 Tx-Rx pairs with the smallest power scaling factor to be selected for the target. For Highway, 1 Tx-Rx pair with the smallest power scaling factor to be selected for the target.
Metrics	Coupling loss based on PL Wideband SIR and SINR based on geometry (based on pathloss)

Proposal 5: The parameters of CM calibration for full calibration for Automotive vehicles use cases are shown in Table 5.

Proposal 6: The parameters of CM calibration for large scale for Automotive vehicles use cases are shown in Table 6.

2.2.4 AGV use cases

The parameters of CM calibration for full calibration for AGV use cases are shown in Table 7.

Table 7. The parameters of CM calibration for full calibration for AGV use cases

Parameters	**Values**
Scenario	Indoor factory
Sensing mode	TRP bistatic/monostatic
Target type	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
Sectorization	3 sectors per site, 30, 150 and 270 degrees
Carrier Frequency	FR1: 6 GHz FR2: 30 GHz
BS antenna configurations	(M,N,P,Mg,Ng;Mp,Np)=(16,16,1,1,1,1,1)
BS Tx power	24dBm
Bandwidth	FR1: 100MHz FR2: 400MHz
BS noise figure	FR1: 5dB FR2: 7dB
UT antenna configurations	(M,N,P,Mg,Ng;Mp,Np) = (1,1,2,1,1,1,1)

UT noise figure	FR1:9dB FR2:13dB
Sensing target distribution	5 targets uniformly distributed in the convex hull of the horizontal BS deployment
Fast fading channel	Fast fading channel is modeled
Component B1/B2 of bistatic RCS	Same values as monostatic
The power threshold for path dropping after concatenation for target channel	-40dB
The power threshold for removing clusters in step 6 in section 7.5, TR 38.901 for background channel	-25dB
Definition of Coupling loss	By definition, need to consider all direct and indirect paths. The following parameters are included in the calculation: • power scaling factor (pathloss, shadow fading, and RCS component A included) • for small scale RCS B1/B2 and power of rays in Tx-target/target-Rx links ($P^{k,p}_{n',m',n,m}$), Tx/Rx antenna pattern, 3 polarization matrixes, i.e., $\sqrt{P^{k,p}_{n',m',n,m}}\begin{bmatrix}F_{rx,u,\theta}\left(\theta^{k,p}_{rx,n',m',ZOA},\phi^{k,p}_{rx,n',m',AOA}\right)\\F_{rx,u,\phi}\left(\theta^{k,p}_{rx,n',m',ZOA},\phi^{k,p}_{rx,n',m',AOA}\right)\end{bmatrix}^T CPM^{k,p}_{rx,n',m'}CPM^{k,p}_{n',m',n,m}CPM^{k,p}_{tx,n,m}$ $\cdot\begin{bmatrix}F_{tx,s,\theta}\left(\theta^{k,p}_{tx,n,m,ZOD},\phi^{k,p}_{tx,n,m,AOD}\right)\\F_{tx,s,\phi}\left(\theta^{k,p}_{tx,n,m,ZOD},\phi^{k,p}_{tx,n,m,AOD}\right)\end{bmatrix}$
Tx-Rx pairing	select 4 Tx-Rx pairs with smallest power scaling factor
Metrics	CDF of coupling loss CDF of Delay Spread and Angle Spread (ASD, ZSD, ASA, ZSA)

The parameters of CM calibration for large scale for AGV use cases are shown in Table 8.

Table 8. The parameters of CM calibration for large scale for AGV use cases

Parameters	**Values**
Scenario	Indoor factory
Sensing mode	TRP bistatic/monostatic
Target type	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
Sectorization	3 sectors per site, 30, 150 and 270 degrees
Carrier Frequency	FR1: 6 GHz FR2: 30 GHz
BS antenna configurations	(M,N,P,Mg,Ng;Mp,Np)=(16,16,1,1,1,1,1)
BS Tx power	24dBm
Bandwidth	FR1: 100MHz FR2: 400MHz
BS noise figure	FR1: 5dB FR2: 7dB
UT antenna configurations	(M,N,P,Mg,Ng;Mp,Np) = (1,1,2,1,1,1,1)
UT noise figure	FR1:9dB FR2:13dB
Sensing target distribution	5 targets uniformly distributed in the convex hull of the horizontal BS deployment
Large-scale RCS for each scattering point	The mean value of target RCS
Minimum 3D distances between pairs of Tx/Rx and sensing target	0m
Wrapping Method	No
LOS condition, pathloss, SF	Generate the LOS condition, pathloss, SF for each of Tx-target and target-Rx links For monostatic, same LOS condition/pathloss/SF is determined for both Tx-target and target-Rx links
Definition of Coupling loss	power scaling factor (pathloss, shadow fading, and RCS component A included)

	$$L_{TX-SPST-RX} = PL_{dB}(d_1) + PL_{dB}(d_2) + 10\lg\left(\frac{c^2}{4\pi f^2}\right) - 10\lg(\sigma_{RCS,A}) + SF_{dB,1} + SF_{dB,2}$$
Sensing Tx/Rx selection	4 Tx-Rx pairs with the smallest scaling factor to be selected for the target.
Metrics	Coupling loss based on PL Wideband SIR and SINR

Proposal 7: The parameters of CM calibration for full calibration for AGV use cases are shown in Table 7.

Proposal 8: The parameters of CM calibration for large scale for AGV use cases are shown in Table 8.

2.2.5 Objects creating hazards on roads/railways use cases

The parameters of CM calibration for full calibration for objects creating hazards on roads/railways use cases are shown in Table 9.

Table 9. The parameters of CM calibration for full calibration for objects creating hazards on roads/railways use cases

Parameters	**Values**
Scenario	Highway
Sensing mode	All 6 sensing modes
Target type	For human/pedestrians: Child: 0.2m x 0.3m x 1m Adult: 0.5m x 0.5m x 1.75m For animals: 1.5m x 0.5m x 1 m
Sectorization	3 sectors per site, 30, 150 and 270 degrees
Carrier Frequency	FR1: 6 GHz FR2: 30 GHz
BS antenna configurations	(M,N,P,Mg,Ng;Mp,Np)=(16,16,1,1,1,1,1)
BS Tx power	FR1: 56dBm FR2: 41dBm
Bandwidth	FR1: 100MHz FR2: 400MHz

BS noise figure	FR1: 5dB FR2: 7dB
UT antenna configurations	(M,N,P,Mg,Ng;Mp,Np)=(2,2,1,1,1,1,1)
UT noise figure	FR1:9dB FR2:13dB
Sensing target distribution	Uniformly distributed in horizontal plane
Fast fading channel	Fast fading channel is modeled
The power threshold for path dropping after concatenation for target channel	-40dB
The power threshold for removing clusters in step 6 in section 7.5, TR 38.901 for background channel	-25dB
Definition of Coupling loss	By definition, need to consider all direct and indirect paths. The following parameters are included in the calculation: • power scaling factor (pathloss, shadow fading, and RCS component A included) • for small scale RCS B1/B2 and power of rays in Tx-target/target-Rx links ($P^{k,p}_{n',m',n,m}$), Tx/Rx antenna pattern, 3 polarization matrixes, i.e., $\sqrt{P^{k,p}_{n',m',n,m}} \begin{bmatrix} F_{rx,u,\theta}\left(\theta^{k,p}_{rx,n',m',ZOA}, \phi^{k,p}_{rx,n',m',AOA}\right) \\ F_{rx,u,\phi}\left(\theta^{k,p}_{rx,n',m',ZOA}, \phi^{k,p}_{rx,n',m',AOA}\right) \end{bmatrix}^T CPM^{k,p}_{rx,n',m'} CPM^{k,p}_{n',m',n,m} CPM^{k,p}_{tx,n,m}$ $\cdot \begin{bmatrix} F_{tx,s,\theta}\left(\theta^{k,p}_{tx,n,m,ZOD}, \phi^{k,p}_{tx,n,m,AOD}\right) \\ F_{tx,s,\phi}\left(\theta^{k,p}_{tx,n,m,ZOD}, \phi^{k,p}_{tx,n,m,AOD}\right) \end{bmatrix}$
Tx-Rx pairing	select 4 Tx-Rx pairs with smallest power scaling factor
Metrics	CDF of coupling loss

	CDF of Delay Spread and Angle Spread (ASD, ZSD, ASA, ZSA)

The parameters of CM calibration for large scale for objects creating hazards on roads/railways use cases are shown in Table 10.

Table 10. The parameters of CM calibration for large scale for objects creating hazards on roads/railways use cases

Parameters	**Values**
Scenario	Highway
Sensing mode	All 6 sensing modes
Sectorization	3 sectors per site, 30, 150 and 270 degrees
Target type	For human/pedestrians: Child: 0.2m x 0.3m x 1m Adult: 0.5m x 0.5m x 1.75m For animals: 1.5m x 0.5m x 1 m
Carrier Frequency	FR1: 6 GHz FR2: 30 GHz
BS antenna configurations	(M,N,P,Mg,Ng;Mp,Np)=(16,16,1,1,1,1,1)
BS Tx power	FR1: 56dBm FR2: 41dBm
Bandwidth	FR1: 100MHz FR2: 400MHz
BS noise figure	FR1: 5dB FR2: 7dB
UT antenna configurations	(M,N,P,Mg,Ng;Mp,Np)=(2,2,1,1,1,1,1)
UT noise figure	FR1:9dB FR2:13dB
Sensing target distribution	Uniformly distributed in horizontal plane
Sensing target mobility	10km/h
Large-scale RCS for each scattering point	Fixed value of A
Minimum 3D distances between pairs of Tx/Rx and sensing target	35m
LOS condition, pathloss, SF	Generate the LOS condition, pathloss, SF for each of Tx-target and target-Rx links

	For monostatic, same LOS condition/pathloss/SF is determined for both Tx-target and target-Rx links
Definition of Coupling loss	power scaling factor (pathloss, shadow fading, and RCS component A included) $$L_{TX-SPST-RX} = PL_{dB}(d_1) + PL_{dB}(d_2) + 10lg\left(\frac{c^2}{4\pi f^2}\right) - 10lg(\sigma_{RCS,A}) + SF_{dB,1} + SF_{dB,2}$$
Sensing Tx/Rx selection	4 Tx-Rx pairs with the smallest scaling factor to be selected for the target.
Metrics	CDF of coupling loss

Proposal 9: The parameters of CM calibration for full calibration for objects creating hazards on roads/railways use cases are shown in Table 9.

Proposal 10: The parameters of CM calibration for large scale for objects creating hazards on roads/railways use cases are shown in Table 10.

3. Conclusions

In this contribution, the following proposals are put forward:

Proposal 1: The parameters of CM calibration for full calibration for UAV use cases are shown in Table 1.

Proposal 2: The updated parameters of CM calibration for large scale for UAV use cases are shown in Table 2.

Proposal 3: The parameters of CM calibration for full calibration for human indoor/outdoor use cases are shown in Table 3.

Proposal 4: The parameters of CM calibration for large scale for human indoor/outdoor use cases are shown in Table 4.

Proposal 5: The parameters of CM calibration for full calibration for Automotive vehicles use cases are shown in Table 5.

Proposal 6: The parameters of CM calibration for large scale for Automotive vehicles use cases are shown in Table 6.

Proposal 7: The parameters of CM calibration for full calibration for AGV use cases are shown in Table 7.

Proposal 8: The parameters of CM calibration for large scale for AGV use cases are shown in Table 8.

Proposal 9: The parameters of CM calibration for full calibration for objects creating hazards on roads/railways use cases are shown in Table 9.

Proposal 10: The parameters of CM calibration for large scale for objects creating hazards on roads/railways use cases are shown in Table 10.

References

[1] RP-234069, "New SID: Study on Channel modelling for Integrated Sensing And Communication (ISAC) for NR", Nokia, Nokia Shanghai Bell, 3GPP TSG RAN meeting #102, Edinburgh, UK, 11th-15th December, 2023.

[2] TR 22.837, "Feasibility study on Integrated Sensing and Communication", V19.2.0, 3GPP, 2023.

[3] 3GPP RAN1 #116 Minutes report, Athens, Greece, 26th February – 1st March.

[4] 3GPP RAN1 #116b Minutes report, Changsha, China, 15th -19th April.

[5] 3GPP RAN1 #117 Minutes report, Fukuoka, Japan, 20th -24th May.

[6] 3GPP RAN1 #118 Minutes report, Maastritcht, Netherland, 19th -23rd August.

[7] 3GPP RAN1 #118b Minutes report, Hefei, China, 14th -18th October.

[8] 3GPP RAN1 #119 Minutes report, Orlando, US, 18th - 22nd November.

[9] 3GPP RAN1 #120 Minutes report, Athens, Greece, 17th – 21st February.