**3GPP TSG RAN meeting #108 RP-25xxxx**

**Prague, Czech Republic, June 9-13, 2025**

## Status Report to TSG

**Agenda item:** 9.2.2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **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_105/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:  100% | 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](mailto:liyingyang@xiaomi.com), [jerome.vogedes@att.com](mailto: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 #120bis, Wuhan, China, Apr. 7-11, 2025

*ISAC deployment scenarios*

Agreement

For the purposes of large scale calibration for UAV sensing targets, the following revised calibration parameters are proposed below in Table x. Note that the change bars are against the agreements from RAN1#120.

**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 |
| Target type | UAV of small size (0.3m x 0.4m x 0.2m) |
| Sectorization | Single 360-degree sector can be assumed |
| 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 | Single dual-pol isotropic antenna; (M,N,P,Mg,Ng;Mp,Np) = (1,1,2,1,1;1,1) |
| UT noise figure | FR1: 9dB  FR2: 10dB |
| UT height | 1.5m for terrestrial UTs, |
| UT Tx power | 23dBm |
| UT Distribution | • The overall number of UTs is 30 uniformly distributed in the center cell.  • All of the UTs are either terrestrial UTs or aerial UTs, all outdoors.  • Vertical distribution of aerial UE: Fixed height value of 200 m.  • FR1 is assumed for aerial UE. |
| Sensing target distribution | 1target 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 | -12.81 dBsm |
| 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 |
| Coupling loss for target channel | power scaling factor (pathloss, shadow fading, and RCS component A included): |
| Sensing Tx/Rx selection | Best N = 4 Tx-Rx pairs to be selected for the target.  NOTE1: Based on the Tx-Rx pairs with the smallest power scaling factor of the target channel. |
| Metrics | Coupling loss for target channel  Coupling loss for background channel (in case of monostatic sensing, this is the coupling loss between Tx and one reference point)  Note: CDFs can be separately generated for target channel, background channel |

Agreement

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

**Table x. Simulation assumptions for full calibration for UAV sensing targets**

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| Scenario | UMa-AV |
| Sensing mode | TRP monostatic, TRP-TRP bistatic, TRP-UE bistatic, UE-UE bistatic |
| Target type | UAV of small size (0.3m x 0.4m x 0.2m) |
| Sectorization | Single 360-degree sector can be assumed |
| 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 | Single dual-pol isotropic antenna; (M,N,P,Mg,Ng;Mp,Np) = (1,1,2,1,1;1,1) |
| UT noise figure | FR1: 9dB  FR2: 10dB |
| UT height | 1.5m for terrestrial UTs |
| UT Tx power | 23dBm |
| UT Distribution | * The overall number of UTs is 30 uniformly distributed in the center cell. * All of the UTs are either terrestrial UTs or aerial UTs, all outdoors. * Vertical distribution of aerial UE: Fixed height value of 200 m. * FR1 is assumed for aerial UE. |
| Sensing target distribution | 1target uniformly distributed (across multiple drops) within the center cell. Vertical distribution: Fixed height value of 200 m. |
| RCS for each scattering point | Component A: -12.81 dBsm  Component B1: 0 dB  Component B2: 3.74 dB for standard deviation  The same values are used for monostatic RCS and bistatic RCS |
| 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 |
| Fast fading model | TR 36.777 Annex B.1.3 |
| (u, std) for XPR of target | Mean 13.75 dB, deviation 7.07 dB |
| The power threshold for path dropping after concatenation for target channel | FFS |
| The power threshold for removing clusters in step 6 in section 7.5, TR 38.901 for background channel | FFS |
| Coupling loss for target channel | 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 (), Tx/Rx antenna pattern, 3 polarization matrixes, i.e., |
|  |
| Sensing Tx/Rx selection | Best N = 4 Tx-Rx pairs to be selected for the target.  NOTE1: Based on the Tx-Rx pairs with the smallest power scaling factor of the target channel. |
| Absolute delay | The model of UMa scenario defined in TR 38.901 7-24GHz channel modeling [ref] is reused for UMa-AV for all sensing modes. |
| Metrics | Coupling loss for target channel  Coupling loss for background channel (in case of monostatic sensing, this is the linear sum of coupling losses between Tx/Rx and all reference points)  Note: CDFs can be separately generated for target channel, background channel  CDF of Delay Spread and Angle Spread (ASD, ZSD, ASA, ZSA). Definition of Delay Spread is similar to the definition of angle spread in Annex A of TR 25.996,  Definition of Angle Spread can ref to Annex A of TR 25.996. |

Agreement

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

* + FFS: which type of UE is used for UT in different sensing mode
  + FFS: impact of spatial consistency, if any, in case of vehicle with 5 scattering points
  + FFS: cell layout for ISD = 250 m

**Table x. Simulation assumptions for large scale calibration for Automotive sensing targets**

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| Scenario | For FR1:  Urban Grid (ISD=500m, BS height=25m)  Highway (ISD=1732m, BS height=35m)  For FR2:  Urban Grid (ISD=250m, BS height=25m)  Highway (ISD=500m, BS height=35m) |
| Sensing mode | TRP monostatic, TRP-TRP bistatic, TRP-UE bistatic, UE-UE bistatic, UE monostatic |
| Target type | Vehicle type 2 [TR37.885] |
| Sectorization | Single 360-degree sector can be assumed |
| 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 | Single dual-pol isotropic antenna, (M,N,P,Mg,Ng;Mp,Np) = (1,1,2,1,1;1,1) |
| UT noise figure | FR1: 9dB  FR2: 10dB |
| UT height | 1.5m for pedestrian type UE  5m for RSU type UE  1.6m for vehicle type UE |
| UT Tx power | 23dBm |
| UT Distribution | Per TR37.885 |
| Sensing target distribution | Per TR37.885: - Option A - Vehicle type distribution: 100% vehicle type 2. - Clustered dropping is not used. - Highway: one target uniformly distributed (across multiple drops) within the simulation region. Vehicle speed is 140 km/h in all the lanes as baseline.  - Urban Grid: one target is uniformly distributed (across multiple drops) within the center road grid. Vehicle speed is 60 km/h in all the lanes as baseline.  NOTE: vehicle is dropped with 5 scattering points (front/left/right/back/roof) and each point has one location, or vehicle is dropped with 1 scattering points |
| Component A of the RCS for each scattering point | -20dBsm |
| Minimum 3D distances between pairs of Tx/Rx and sensing target | 10 m |
| Wrapping Method | As defined in urban grid/highway scenario |
| Coupling loss for target channel | Power scaling factor (pathloss, shadow fading, and RCS component A included) |
| Sensing Tx/Rx selection | Best *N*= Tx-Rx pairs to be selected for the target.  For urban grid *N* = 4  For Highway *N* = 4  NOTE: Based on the Tx-Rx pair with the smallest power scaling factor of the target channel. |
| Metrics | Coupling loss for target channel  Coupling loss for background channel (in case of monostatic sensing, this is the coupling loss between Tx and one reference point)  Note: CDFs can be separately generated for target channel, background channel |

*ISAC channel modelling*

Agreement

In order to generate Tx-target link, target-Rx link and the background channel, the above table on reference TRs (excluding the already agreed part) is adopted for the mapping between reference TRs and a pair of nodes (STX, SRX, target)

* + Note: continue discussion for updating the table with RSU type UE
  + FFS: the generation of background channel based on reference TRs is subject to the addition of low-energy clusters

|  |  |  |  |
| --- | --- | --- | --- |
| **Case** | **Node 1** | **Node 2** | **Existing TRs as starting point** |
| 1 | TRP | TRP | Highway   * TRP-UE link of scenario RMa in section 7 of TR 38.901 by setting hUE=35m for FR1 * TRP-TRP link of scenario UMa following the option based on TR 38.901 defined in section A.3 of TR 38.858   Urban grid   * TRP-TRP link of scenario UMa following the option based on TR 38.901 defined in section A.3 of TR 38.858   HST   * TRP-UE link of scenario RMa in section 7 of TR 38.901 by setting hUE=35m for FR1 * TRP-TRP link of scenario UMa in section A.3 of TR 38.858 for FR2 |
| 4 | TRP | aerial UE | UMa-AV, UMi-AV, and RMa-AV   * Reuse the channel model of scenario UMa-AV, UMi-AV, and RMa-AV of FR1 for FR2 |
| 5 | normal UE | normal UE | For pedestrian type UE:  Highway and Urban grid   * P2P link in section 6 of TR 37.885   HST   * TRP-UE link of scenario RMa in section 7 of TR 38.901 for FR1, e.g., hBS=1.5m, UE-UE link of scenario UMa following the option based on TR 38.901 defined in section A.3 of TR 38.858 for FR2 |
| 6 | normal UE | vehicle UE | UMi, UMa, RMa   * UE-UE link of scenario UMi, UMa following the option based on TR 38.901 defined in section A.3 of TR 38.858 * TRP-UE link of scenario RMa defined in section 7 of TR 38.901 by setting hBS =1.5m   For pedestrian type UE:  Highway and Urban grid   * V2P link in section 6 of TR 37.885 |
| 7 | normal UE | aerial UE | UMi-AV, UMa-AV, and RMa-AV   * TRP-aerial UE link of UMi-AV in Annex A and B of TR 36.777 by setting hBS =1.5m for FR1   + LOS probability is not reused, FFS new LOS probability   + FFS pathloss model, shadowing fading * Working assumption: Reuse the channel model of scenario UMa-AV, UMi-AV, and RMa-AV of FR1 for FR2   + The corresponding parameter values in FR2 are used |
| 8 | vehicle UE | vehicle UE | Highway and Urban grid   * V2V link of scenario Highway and Urban grid in section 6 of TR 37.885   UMi, UMa, and RMa   * UE-UE link of scenario UMi, UMa following the option based on TR 38.901 defined in section A.3 of TR 38.858 * TRP-UE link of scenario RMa defined in section 7 of TR 38.901 by setting hBS =1.5m |
| 9 | aerial UE | aerial UE | UMi-AV, UMa-AV, RMa-AV   * TRP-aerial UE link of UMi-AV in Annex A and B of TR 36.777 by setting height of TRP equal to the height of the first aerial UE for FR1   + LOS probability is not reused, FFS new LOS probability   + FFS pathloss model, shadowing fading, angular spread * Working assumption: Reuse the channel model of scenario UMa-AV, UMi-AV, and RMa-AV of FR1 for FR2   + The corresponding parameter values in FR2 are used |

Agreement

To generate the parameters (in the steps before concatenation), the large-scale parameters and the small-scale parameters used to generate the Tx-target link are respectively the same as that of the target-Rx link for monostatic sensing, where departure angle on one link and arrival angle on the other link are reciprocal.

* + FFS: whether this applies to initial phase

Agreement

Normalization on the product of three polarization matrixes of a direct/indirect path generated by stochastic cluster, i.e., *CPMtx,sp,rx= CPMsp,rx* . *CPMsp* . *CPMtx,sp* is supported

* + The scaling factor is

Agreement

Power normalization of target channel after path dropping of the target channel is not supported.

Agreement

On the monostatic RCS for human with RCS model 2

* The monostatic RCS for a scattering point of the target is generated by
  + The values/pattern A\*B1, i.e., is deterministic based on incident/scattered angles

Where,

* + FFS how many rows of the values/pattern A\*B1 are defined for the target
    - Note: each row has a defined applicable range of and
  + Note: whether the RCS is elevation angle dependent or dependent on both elevation and horizontal angles can be separately discussed

Agreement

The following mean and standard deviation values of XPR of targets are agreed for monostatic sensing and bistatic sensing as follows:

* UAV: (13.75, 7.07) dB
* Human: (19.81, 4.25) dB
* Vehicle: (21.12, 6.88) dB

Agreement

When spatial consistency is enabled, the 1-by-1 random coupling generated by concatenation Option 3 is not updated per simulation drop even if Tx, target, Rx positions change during simulation.

Agreement

The following working assumption is confirmed

|  |
| --- |
| Working assumption  Absolute delay model (referring to 7.6.9 in TR 38.901 as starting point) is a mandatory feature for both target channel and background channel for ISAC for UMi, UMa, InH, InF   * Related model referring to values from 7-24GHz study item |

Working assumption

For vehicle with single/multiple scattering points, the bistatic RCS is generated by

* The values/pattern of A\*B1 of bistatic RCS is given by:

where

* + is applied to the within 0~180 degrees. k1= 6 and k2=1.65. is the ~~absolute~~ bistatic angle between the incident ray and scattering ray within the plane of incident direction () and scattering direction ().
  + The angles of () are the projections of the bisector angle on the vertical plane and the horizontal plane, respectively.
    - FFS: RCS value when is 180 degrees
  + The effect of forward scattering is -Inf in Rel-19
  + 5 sets of parameters *Applicable Range of* and *Applicable Range of* are applicable as defined for the monostatic RCS of vehicle with single/multiple SPSTs
  + ~~FFS: how to avoid angular discontinuity~~
  + Continue study on a new formula for to resolve the issue of angular discontinuity.
    - The new formula should retain following property: the linear bistatic RCS for a vehicle with single scattering point is the sum of the bistatic RCS of the multiple scattering points of the vehicle
    - the following formula can be a reference for the study

Note: the working assumption agreed on Thursday was updated on Friday as follows: k1= 6 and k2=1.65

Agreement

On background channel for mono-static sensing, the following details are provided:

* reference points are dropped for one Tx, based on the Gamma distribution for distance and height of reference point.
* The LOS AOD between Tx and the first reference point, which is denoted as AOD1, is generated based on uniform distribution .
* The LOS AOD between Tx and the second reference point is AOD1 +
* The LOS AOD between Tx and the third reference point is AOD1 +
* The background channel is generated based on the channel generated as in existing TR between the real Tx and the reference point assuming NLOS condition.
* The antenna field pattern and array orientation of reference point are set same as Tx.
* Arrival angles for both azimuth and elevation and are set equal to departure angles
* The absolute delay model d3D and as agreed for bistatic sensing for the same sensing scenario applies. Down-select one option from the following:
* Option 0: no scaling factor is applied to d3D
* Option 1: An offset is applied to d3D, i.e., d3D-c1
* Option 2: A scaling factor d\_s is multiplied to d3D, i.e., d3D\*d\_s. d\_s is a value within range [0, 1].
* Note: The adjustment of absolute delay doesn’t impact the generation of NLOS clusters between the Tx and each reference point
* The mono-static background channel for the Tx would be sum of channels of the links between the Tx and all related reference points, which is
* FFS: Doppler frequency in background channel for monostatic sensing
* The rays in a stochastic cluster with ZOA at BS less than D degree are dropped
* D=[90] for RMa,
* D=[60] for UMa
* D=[50] for UMi
* Note: this threshold for ZOA is not applicable to other sensing scenarios

Agreement

To generate the background channel, the power threshold (-25 dB) for removing clusters in step 6 in section 7.5, TR 38.901 is reused.

Agreement

The ISAC background channel can be generated between a sensing Tx and a sensing Rx or RP (relevant for monostatic case) via the following steps:

* Step 1: generate a first set of clusters/rays according to TR 38.901(or other related TRs)
* Step 2: generate a second set of NLOS clusters/rays according to TR 38.901 (or other related TRs), where the power of the second set of clusters/rays should be scaled down such that
* is the power of the NLOS cluster with the strongest power from the first set.
* is the power of the n-th cluster from the second set.
* Where, N is the number of clusters, M is the number of rays within each cluster, value of G relates to power
  + *N*=360, *M*=1, *G* = -25dB, no further change from 38.901, 36.777, 38.858 (i.e., utilizing the same DS, ASA, ASD, ZSA, ZSD, , as used for the first step)
* The step 2 is an additional modeling component

Agreement

For human as a sensing target with a single scattering point, the height of the scattering point is 1.5 m.

Agreement

In sensing scenario UMi, UMa, RMa, if the height of a scattering point of target is less than 1.5m, for pathloss calculation, down-selection one of the options below:

* + Option 4: use in Table 7.4.1-1: Pathloss models in TR 38.901
  + Option 5: use hUT 1.5 m for pathloss calculation

Agreement

For sensing scenario UMi, UMa, RMa, UMi-AV, UMa-AV and RMa-AV, the height of a scattering point of a target is used to calculate the LOS probability and pathloss, regardless of the lower bound in the existing TRs that are referred to generate ISAC channel.

* + FFS for the case where the height of a scattering point of target is less than 1.5m in sensing scenario UMi, UMa, RMa

Agreement ([Post-120bis-ISAC-02])

On the monostatic RCS of UAV of large size,

* The values/pattern of component A\*B1 are generated by the following parameters

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  | *Applicable Range of* | *Applicable Range of* |
| *Left* | *90°* | *7.13°* | *90°* | *8.68°* | *7.43* | *14.30* | *[45°,135°]* | *[45°,135°]* |
| *Back* | *180°* | *10.09°* | *90°* | *11.43°* | *3.99* | *10.86* | *[45°,135°]* | *[135°,225°]* |
| *Right* | *270°* | *7.13°* | *90°* | *8.68°* | *7.43* | *14.30* | *[45°,135°]* | *[225°,315°]* |
| *Front* | *0°* | *14.19°* | *90°* | *16.53°* | *1.02* | *7.89* | *[45°,135°]* | *[-45°,45°]* |
| *Bottom* | */* | */* | *180°* | *4.93°* | *13.55* | *20.42* | *[135°,180°]* | *[0°,360°]* |
| *Roof* | */* | */* | *0°* | *4.93°* | *13.55* | *20.42* | *[0°,45°]* | *[0°,360°]* |

* + When is in the range [0°,45° ] or [135°,180°],
* The standard deviation of component B2 is 2.50 dB

Agreement ([Post-120bis-ISAC-02])

On the monostatic RCS of AGV with single scattering point,

* The values/pattern of component A\*B1 are generated by the following parameters

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  | *Applicable Range of* | *Applicable Range of* |
| *Front* | *0°* | *13.68°* | *90°* | *13.68°* | *13.02* | *23.29* | *[30°,180°]* | *[-45°,45°]* |
| *Left* | *90°* | *15.53°* | *75°* | *20.03°* | *7.33* | *17.60* | *[30°,180°]* | *[45°,135°]* |
| *Back* | *180°* | *12.49°* | *90°* | *11.89°* | *11.01* | *21.28* | *[30°,180°]* | *[135°,225°]* |
| *Right* | *270°* | *15.53°* | *75°* | *20.03°* | *7.33* | *17.60* | *[30°,180°]* | *[225°,315°]* |
| *Roof* | */* | */* | *0°* | *11.44°* | *11.79* | *22.06* | *[0°,30°]* | *[0°,360°]* |

* + When is in the range [0°,30° ),
* The standard deviation of component B2 is 2.51 dB

Agreement ([Post-120bis-ISAC-02])

The values of the parameters to generate background channel for TRP monostatic sensing for each sensing scenario are provided in the following table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Scenario | | TRP monostatic sensing | | | | |
| Uma /  Urban grid /  Highway(FR2) /  HST(FR2) | UMi | Rma /  Highway(FR1) /  HST(FR1) | Indoor office | Indoor Factory |
| Distribution of 2D distance between Tx and reference points |  | 10.3370 | 6.1996 | 6.2025 | 4.236 | 0.039836 |
|  | 0.1317 | 0.1558 | 0.0391 | 0.19255 | 0.179783 |
|  | 68.7778 | 15.2697 | 1.2940 | 4.99 | 1.130020 |
| Distribution of height of reference points |  | 16.2253 | 12.0487 | 0.0007 | 1.3293 | 0.283447 |
|  | 1.9218 | 2.3261 | 5.0146 | 0.1442 | 0.435965 |
|  | 2.6142 | 0.0157 | 0.0522 | -13.19 | -17.043530 |
| ~~scaling factor d\_s to d3D (if validated)~~ | |  |  |  |  |  |
| Threshold D for ZOA | | 80 | 50 | 90 | N/A | N/A |

Note 1: Distributions of height and distance of reference point are not subject to geographical constraints on UT given in TR 38.901 for the corresponding deployment scenario.

Note 2: The reference points for generating the TRP monostatic background channel have no mobility, i.e. 0 km/h.

Agreement ([Post-120bis-ISAC-02])

The values of the parameters to generate background channel for UT monostatic sensing for the following sensing scenarios are provided in the following table

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Scenario | | UT monostatic sensing | | | | |
| Uma /  Urban grid /  Highway(FR2) /  HST(FR2) | UMi | Rma /  Highway(FR1) /  HST(FR1) | Indoor office | Indoor Factory |
| Distribution of 2D distance between Tx and reference points |  | 2.9072 | 10.0220 | 10.2421 | 4.3733 | 0.231418 |
|  | 0.1031 | 1.2522 | 0.0526 | 0.4457 | 0.128133 |
|  | 3.8471 | 11.0040 | 3.3131 | 4.6302 | 2.004903 |
| Distribution of height of reference points |  | 1.6640 | 3.0487 | 0.3175 | 0.2974 | 0.462968 |
|  | 1.6215 | 1.9128 | 1.4150 | 0.4103 | 0.281526 |
|  | -1.4205 | 0.1785 | 1.5906 | 2.9711 | -16.921515 |
| ~~scaling factor d\_s to d3D (if validated)~~ | |  |  |  |  |  |
| Threshold D for ZOA | | 80 | 50 | 90 | N/A | N/A |

Note 1: Distributions of height and distance of reference point are not subject to geographical constraints on TRP given in TR 38.901 for the corresponding deployment scenario.

Note 2: The reference points for generating the UT monostatic background channel has the same velocity as UT.

Note 3: In the UT monostatic sensing in UMa and UMi scenario, the ZOD offset should be set as 0

Agreement ([Post-120bis-ISAC-02])

The values of the parameters to generate background channel for UT monostatic sensing for the following sensing scenarios are provided in the following table

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Scenario | | UT monostatic sensing | | |
| UMa-AV | UMi-AV | RMa-AV |
| Distribution of 2D distance between Tx and reference points |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| Distribution of height of reference points |  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| ~~scaling factor d\_s to d3D (if validated)~~ | |  |  |  |
| Threshold D for ZOA | |  |  |  |

Note 1: Distributions of height and distance of reference point are not subject to geographical constraints on TRP given in TR 38.901 for the corresponding deployment scenario.

Note 2: The reference points for generating the UT monostatic background channel has the same velocity as UT.

Note 3: In the UT monostatic sensing in UMa and UMi scenario, the ZOD offset should be set as 0

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*ISAC deployment scenarios*

**Agreement**

Updates to Table 7.9.1-1: Evaluation parameters for UAV sensing scenarios are as follows:

|  |  |
| --- | --- |
| **Parameters** | **Value** |
| Applicable communication scenarios | UMi, UMa, RMa, SMa  UMi-AV, UMa-AV, RMa-AV [36.777] |
| Unintended/Environment objects, e.g., types, characteristics, mobility, distribution, etc. | Can be considered in future evaluations |

NOTE1: calibration for the UAV scenario is performed for UMa-AV scenario, but UMi-AV, RMa-AV, UMi, UMa, RMa, SMa can be considered for future evaluations of the UAV sensing target scenarios.

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

**Conclusion**

Channel model for ISAC for SMa scenario will not be fully studied in Rel-19.

**Agreement**

Updates to Table 7.9.1-2: Evaluation parameters for Automotive sensing scenarios are as follows:

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| Applicable communication scenarios | Highway, Urban Grid.  UMi, UMa, RMa, SMa. NOTE1 |
| Environment Objects, e.g., types, characteristics, mobility, distribution, etc. | EO Type 2 for Urban Grid   * up to 4 walls modelled as EO type 2, per building of size 413m x 230m x 20m. Additional building sizes, building heights, materials, etc., can be considered in future evaluations |

NOTE1: calibration for the automotive scenario will be performed for Highway and Urban Grid scenarios. UMi, UMa, RMa, SMa and related calibration parameters can be considered for future evaluations of the automotive sensing target scenarios.

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

**Agreement**

Updates to Table 7.9.1-3: Evaluation parameters for Human (indoor and outdoor) sensing scenarios as follows:

|  |  |  |
| --- | --- | --- |
| **Parameters** | **Indoor Values** | **Outdoor Values** |
| Applicable communication scenarios NOTE1 | Indoor office, indoor factory  Indoor room [TR38.808] | UMi, UMa, RMa, SMa |
| Minimum 3D distance between sensing targets | Option 1: At least larger than the physical size of a sensing target  Option 2: Fixed value, 1 m. | Option 1: At least larger than the physical size of a sensing target  Option 2: Fixed value, 1 m. |
| Environment Objects, e.g., types, characteristics, mobility, distribution, etc. | Can be considered in future evaluations | Can be considered in future evaluations |

**Agreement**

Updates to Table 7.9.1-4: Evaluation parameters for Automated Guided Vehicles sensing scenarios as follows:

|  |  |  |
| --- | --- | --- |
| **Parameters** | | **Value** |
| Sensing Target | 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 * Material, Additional sizes, and AGV size distribution can be considered in future evaluations |
| Minimum 3D distance between sensing targets | | Option A: At least larger than the physical size of a target  Option B: Fixed value, 5 m. |
| Environment objects, e.g., types, characteristics, mobility, distribution, etc. | | Can be considered in future evaluations |

**Agreement**

Updates to Table 7.9.1-5: Evaluation parameters for objects creating hazards sensing scenarios as follows:

|  |  |  |
| --- | --- | --- |
| **Parameters** | | **Value** |
| Applicable communication scenarios NOTE1 | | Highway, Urban grid, HST (High Speed Train)  UMi, UMa, RMa, SMa |
| Sensing Target | 3D mobility | Horizontal velocity: up to 10 km/h for humans and animals  Additional velocities, trajectory can be considered in future evaluations |
| Environment objects, e.g., types, characteristics, mobility, distribution, etc. | | EO Type 2 for Urban Grid   * up to 4 walls modelled as EO type 2, per building of size 413m x 230m x 20m. Additional building sizes, building heights, materials, etc., can be considered in future evaluations |

NOTE1: calibration for objects creating hazards scenario can be performed for Highway and Urban Grid scenarios. UMi, UMa, RMa, SMa and HST and related calibration parameters can be considered for future evaluations of the objects creating hazards scenarios.

**Agreement**

Updates to Table 7.9.7.1-3. Simulation assumptions for large scale calibration for Automotive sensing targets as follows:

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| Scenario | For FR1:  Urban Grid (ISD=500m, BS height=25m)  Highway (ISD=1732m, BS height=35m)  For FR2:  Urban Grid (ISD=250m, BS height=25m)  Highway (ISD=500m, BS height=25m) |
| Component A of the RCS for each scattering point | 11.25 dBsm |
| Wrapping Method | No wrapping method is used if interference is not modelled, otherwise geographical distance based wrapping. |

**Agreement**

Clarification for metrics for Simulation assumptions for full calibration sensing targets as follows*:*

|  |  |
| --- | --- |
| 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 |
| Metrics | Coupling loss for target channel  Coupling loss for background channel (in case of monostatic sensing, this is the linear sum of coupling losses between Tx/Rx and all reference points)  Note: CDFs can be separately generated for target channel, background channel  CDF of Delay Spread and Angle Spread (ASD, ZSD, ASA, ZSA)  For monostatic sensing mode: delay spread and angle spread of the background channel is calculated separately for each reference point ~~based on paths from all reference points~~.  Definition of Delay Spread is similar to the definition of angle spread in Annex A of TR 25.996,  Definition of Angle Spread can ref to Annex A of TR 25.996. |

**Agreement**

Updates to Table 7.9.7.2-2: Simulation assumptions for full calibration for Human sensing targets as follows*:*

|  |  |  |
| --- | --- | --- |
| **Parameters** | **Indoor Values** | **Outdoor Values** |
| (u, std) for XPR of target | (19.81, 4.25) dB | (19.81, 4.25) dB |

**Agreement**

The following introductory text is added before each of the ISAC deployment scenarios;

1. ISAC-UAV

In the ISAC-UAV scenario, the sensing targets are outdoor UAVs below or above the buildings in urban or rural areas. Monostatic or bistatic sensing can be performed using TRPs and/or UEs, including UEs on other UAVs.

1. ISAC-Automotive

In the ISAC-Automotive scenario, the sensing targets are passenger vehicles or trucks and buses traveling on roads and streets in urban and rural areas. Monostatic or bistatic sensing can be performed using TRPs and/or UEs, including UEs on other vehicles and roadside UEs (RSU-type UEs).

1. ISAC-Human

In the ISAC-Human scenario, the sensing targets are children and adult persons in indoor (room, office, factory) and outdoor (urban, rural) locations. Monostatic or bistatic sensing can be performed using TRPs and/or UEs in the corresponding communication scenarios.

1. ISAC-AGV

In the ISAC-AGV scenario, the sensing targets are automated guided vehicles (AGVs) inside a factory. Monostatic or bistatic sensing can be performed using TRPs and/or UEs in the corresponding communication scenario.

1. ISAC-Objects creating hazards

In the ISAC-Objects creating hazards scenario, the sensing targets are adult humans and children and animals in communication scenarios involving vehicles or high-speed trains. Monostatic or bistatic sensing can be performed using TRPs and/or UEs, including UEs on other vehicles and roadside UEs (RSU-type UEs).

**Agreement**

Updates to 7.9.7.1-4: Simulation assumptions for large scale calibration for AGV sensing targets as follows*:*

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| Component A of the RCS for each scattering point | -4.25 dBsmNote: based on AGV option 1 |

**Agreement**

Updates to 7.9.7.2-4: Simulation assumptions for full calibration for AGV sensing targets as follows*:*

|  |  |
| --- | --- |
| **Parameters** | **Values** |
| (u, std) for XPR of target | (9.60, 6.85) dB |

**Agreement**

Resolve square brackets for Table 7.9.1-4: Evaluation parameters for Automated Guided Vehicles sensing scenarios:

|  |  |  |
| --- | --- | --- |
| Sensing Target | 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 |

*ISAC channel modelling*

**Agreement**

Confirm the following working assumption with updates in red.

Working assumption

For vehicle with single/multiple scattering points, the bistatic RCS is generated by

* The values/pattern of A\*B1 of bistatic RCS is given by:

where

* + is applied to the within 0~180 degrees. k1= 6 and k2=1.65. is the bistatic angle between the incident ray and scattering ray within the plane of incident direction () and scattering direction ().
  + The angles of () are the projections of the bisector angle on the vertical plane and the horizontal plane, respectively.
    - ~~FFS: RCS value when is 180 degrees~~
  + The effect of forward scattering is -Inf in Rel-19
  + 5 sets of parameters *Applicable Range of* and *Applicable Range of* are applicable as defined for the monostatic RCS of vehicle with single/multiple SPSTs
  + ~~Continue study on a new formula for to resolve the issue of angular discontinuity.~~ 
    - ~~The new formula should retain following property: the linear bistatic RCS for a vehicle with single scattering point is the sum of the bistatic RCS of the multiple scattering points of the vehicle~~
    - ~~the following formula can be a reference for the study~~

**Agreement**

The agreement on bistatic RCS for vehicle is reused for large size UAV and AGV.

* + For large size UAV, k₁=6.05 and k₂=1.33
  + For AGV, k₁=12 and k₂=1.45

**Agreement**

AGV can be modelled with multiple scattering points.

* The values/pattern of component A\*B1 are generated by the following parameters

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **in [**°**]** | **in [**°**]** | **in [**°**]** | **in [**°**]** |  |  | ***Range of*  in [**°**]** | ***Range of*  in [**°**]** |
| Front | 0° | 13.68° | 90° | 13.68° | 13.00 | 30.26 | [0,180] | [0,360] |
| Left | 90° | 15.53° | 75° | 20.03° | 7.27 | 24.53 | [0,180] | [0,360] |
| Back | 180° | 12.49° | 90° | 11.89° | 10.98 | 28.24 | [0,180] | [0,360] |
| Right | 270° | 15.53° | 75° | 20.03° | 7.27 | 24.53 | [0,180] | [0,360] |
| Roof | / | / | 0° | 11.44° | 11.77 | 29.03 | [0,180] | [0,360] |

* + Note: For the scattering point associated with roof of the AGV, .
  + Note: the measurements from companies are done by AGV option 1.

**Agreement**

* The bistatic RCS of UAV with small size is modelled as
  + The values/pattern of A\*B1 is given by
    - Component A, i.e., : same as component A of mono-static RCS for UAV of small size
    - dB, where is the bi-static angle between incident ray and scattered ray, is within 0 and 180 degree
    - The effect of forward scattering is -Inf in Rel-19
  + Component B2: same as component B2 of mono-static RCS for UAV of small size
* The bistatic RCS of Human with RCS model 1 is modelled as
  + The values/pattern of A\*B1 is given by
    - Component A, i.e., : same as component A of mono-static RCS for Human with RCS model 1
    - dB, where is the bi-static angle between incident ray and scattered ray, is within 0 and 180 degree
    - The effect of forward scattering is -Inf in Rel-19
  + Component B2: same as component B2 of mono-static RCS for Human with RCS model 1

**Agreement**

On the monostatic RCS of human with RCS model 2,

* The values/pattern of component A\*B1 are generated by the following parameters

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | in [°] | in [°] | in [°] | in [°] |  |  | *Range of*  in [°] | *Range of*  in [°] |
| Front | 0 | 216.65 | 90 | 55.7 | 2.14 | 7.7 | [0,180] | [-90, 90] |
| Back | 180 | 216.65 | 90 | 55.7 | 2.14 | 7.7 | [0,180] | [90,270] |

* The standard deviation of component B2 is 3.94 dB

**Agreement**

The agreement on bistatic RCS for vehicle with single scattering point is reused to model bistatic RCS of human with RCS model 2

* + k1=0.5714 and k2=0.1

**Agreement**

The following values of the RCS component A are applied to both monostatic and bistatic RCS of the target.

* + UAV with large size: -5.85 dBsm
  + Human with RCS model 2: -1.37 dBsm
    - Note: measurement is based on adult
  + Vehicle: 11.25 dBsm
    - Note: measurement is based on vehicle type 1 and 2
  + AGV: -4.25 dBsm
    - Note: measurement is based on AGV option 1

Note: component A on its own may not fully reflect the RCS in the target channel. This note will not be captured in the TR.

**Agreement**

The mean and standard deviation values of XPR of sensing target AGV for monostatic sensing and bistatic sensing are (9.60, 6.85) dB.

**Conclusion**

The component B2 of two different targets are generated independently.

**Conclusion**

The component XPR/initial random phase of two different targets are generated independently.

**Agreement**

In order to generate Tx-target link, target-Rx link and the background channel between a RSU-type UE and another node (TRP, pedestrian UE, vehicle UE, RSU-type UE), the following reference TRs are adopted

|  |  |  |  |
| --- | --- | --- | --- |
| **Case** | **Tx/Rx** | **Rx/Tx** | **Existing TRs as starting point** |
|  | TRP | RSU-type UE | Highway and Urban grid   * B2R link in section 6 of TR 37.885 |
|  | RSU-type UE | normal UE | Highway and Urban grid   * V2V link in section 6 of TR 37.885, with antenna height at RSU is 5m |
|  | RSU-type UE | RSU-type UE | Highway and Urban grid   * V2V link in section 6 of TR 37.885, with antenna height at RSU is 5m |
|  | RSU-type UE | vehicle UE | Highway and Urban grid   * V2V link in section 6 of TR 37.885, with antenna height at RSU is 5m |

**Agreement**

The initial random phase (generated in Step 10, section 7.5, TR38.901) is the same for the same ray in Tx-target link and target-Rx link of a target for monostatic sensing.

**Agreement**

For UMi-AV and RMa-AV with aerial UE as sensing transmitter or receiver, the values of parameters to generate background channel for UT monostatic sensing are provided in the following table

|  |  |  |  |
| --- | --- | --- | --- |
| Scenario | | UT monostatic sensing | |
| UMi-AV | RMa-AV |
| Distribution of 2D distance between Tx and reference points |  |  |  |
|  |  |  |
|  |  |  |
| Distribution of height of reference points |  |  |  |
|  |  |  |
|  |  |  |

Note 1: Distributions of height and distance of reference point are not subject to geographical constraints on TRP for the corresponding deployment scenario.

Note 2: The reference points for generating the UT monostatic background channel have the same velocity as UT.

Note 3: In the UT monostatic sensing in UMa and UMi scenario, the ZOD offset in the background channel should be set as 0

**Agreement**

To generate the background channel for TRP monostatic sensing and UT monostatic sensing, ‘ +’ is used to model the absolute delay between the Tx and each reference point.

**Agreement**

Power threshold for path dropping after concatenation is up to -40dB for target channel for option 3. Up to company to choose a value in the implementation.

Power threshold for path dropping after concatenation is up to -25dB for target channel for option 0. Up to company to choose a value in the implementation.

For calibrations for both option 0 and option 3, power threshold for path dropping after concatenation is -40dB for target channel.

**Agreement**

To generate the absolute delay model for sensing scenarios Urban grid, highway and HST, for both target channel and background channel

* For Urban grid, the values of parameters for of scenarios UMa are reused.
* For Highway, the values of parameters for of scenarios RMa and UMa are reused for FR1 and FR2 respectively.
* For HST, the values of parameters for of scenarios RMa and UMa are reused for FR1 and FR2 respectively.

Note: no measurements on of the 3 scenarios are submitted in Rel-19.

**Agreement**

Spatial consistency is not modelled for

* the links that are generated referring to channel models with parameter values of different communication scenarios
  + E.g., between TRP-target/UT link in one scenario and target/UT-UT link in another scenario
* the background channels for TRP monostatic sensing of different TRPs

**Agreement**

Spatial consistency is not modelled between TRP-target/UT link and target/UT-UT link for sensing scenario UMi, InH and InF.

**Agreement**

Spatial consistency is not modelled between TRP-TRP link and any other links for ISAC channel.

**Agreement**

Spatial consistency can be enabled for multiple scattering points of a target.

Spatial consistency, if enabled, for the links between BS/UT and multiple scattering points of a target are modelled as if multiple scattering points are multiple targets.

**Agreement**

The existing horizontal correlation distance in Table 7.6.3.1-2 in TR38.901 is used as the correlation distance for 3D spatial consistency for ISAC channel at least for UAV scenario, within same ‘Applicability range in terms of aerial UE height (defined in 36.777)’.

**Agreement**

EO type-2 can be modelled in NLOS condition.

**Agreement**

In sensing scenario UMi, UMa, if the height of a scattering point of target is less than 1.5m, for pathloss calculation,

* + use hUT 1.5 m for breakpoint distance (dBP) calculation
  + Note: hUT 1.5 m is only used for dBP calculation. The exact h\_UT of the scattering point is still used to determine all other parameters of ISAC channel, e.g., delay, AOD/ZOD/AOA/ZOA, etc.

**Agreement**

On background channel modelling,

* Spatial consistency is not supported for TRP monostatic sensing across different TRPs
* Spatial consistency is not supported for UE monostatic sensing across different UEs
* Spatial consistency is not supported across different Reference Points for same TRP for TRP monostatic sensing
* Spatial consistency is not supported across different Reference Points for same UE for UE monostatic sensing

**Agreement**

* RCS component B2 of different direct/indirect paths of a target in the target channel are generated independently.
* On the RCS component B2 of a direct/indirect path of a target in the target channel, the same value of B2 applies to a path before the value of B2 is updated.
  + Note: whether/how/when to update B2 can be discussed in evaluation phase or up to companies’ choices

**Agreement**

* XPR of different direct/indirect paths of a target in the target channel are generated independently.
* On the XPR of a direct/indirect path of a target in the target channel, the same value of XPR applies to a path before the value of XPR is updated.
  + Note: whether/how/when to update XPR can be discussed in evaluation phase or up to companies’ choices

**Agreement**

* Initial random phase of different direct/indirect paths of a target in the target channel are generated independently.
* On the initial random phase of a direct/indirect path of a target in the target channel, the same value of initial random phase applies to a path before the value of initial random phase is updated.
  + Note: whether/how/when to update initial random phase can be discussed in evaluation phase or up to companies’ choices

**Agreement**

The follow TP is used generate the power (except for the impact of polarization matrix of EO type-2) of the ray specular reflected by an EO type 2 in the STX-SPST link or SPST-SRX link.

|  |
| --- |
| 7.9.5.2 Type-2 environment object **< Unchanged text omitted >**   1. In Step 10 in Clause 7.9.4.1,   for a NLOS ray specularly reflected by a type-2 EO, if present, in the SPST-SRX link and the STX-SPST link is determined as follows.  - If the STX-SPST link is in LOS condition,  - If the STX-SPST link is not in LOS condition, , where is the pathloss of STX-SPST link assuming LOS condition.  - If the SPST-SRX link is in LOS condition,  - If the SPST-SRX link is not in LOS condition, , where is the pathloss of SPST-SRX link assuming LOS condition.  **< Unchanged text omitted >** |

**Agreement**

To generate the absolute delay model for sensing scenarios UMi-AV, UMa-AV and RMa-AV, for both target channel and background channel,

* For the TRP-TRP link and TRP- terrestrial UE link, the values of parameters for of scenarios UMi, UMa and RMa are respectively reused.
* For the terrestrial UE- terrestrial UE link, the values of parameters for of scenarios UMi are reused.
* For the TRP- aerial UE link, the values of parameters for of scenarios UMi, UMa and RMa are respectively reused.
* For the terrestrial UE- aerial UE link, the values of parameters for of scenarios UMi are reused.
* For the aerial UE- aerial UE link, the values of parameters for of scenarios UMi are reused.

Note: no measurements on of the scenarios UMi-AV, UMa-AV and RMa-AV are submitted in Rel-19.

**Agreement**

* Remove the brackets for first sub-bullet under Step 4 for Clause 7.9.4.2 in the CR to TR 38.901.
* On the absolute delay of the background channel for both TRP and UE monostatic sensing, three are independently generated and respectively applied to the 3 channels between the STX/SRX and the 3 RPs.

**Agreement**

To generate the channel between an aerial UE and a normal UE,

* The LOS probability is generated by:

|  |  |  |
| --- | --- | --- |
| Low-UAV | Mid-UAV | High-UAV |
| UMi in Table 7.4.2-1 in TR 38.901 for UMi-AV/UMa-AV/RMa-AV | UMi-AV in Table B-1 in TR 36.777 for BS to mid UAV region for UMi-AV/UMa-AV/[RMa-AV]  ~~RMa-AV in Table B-1 in TR 36.777 for BS to mid UAV region~~ | UMi-AV in Table B-1 in TR 36.777 for BS to [high] UAV region for UMi-AV/UMa-AV/[RMa-AV]  ~~RMa-AV in Table B-1 in TR 36.777 for BS to mid UAV region~~ |

* The pathloss and shadow fading are generated using TRP-aerial UE link of UMi-AV in Annex A and B of TR 36.777 by setting hBS =1.5m for FR1

Note:

* The height ranges of low-UAV, Mid-UAV and High-UAV are defined following the applicability range in terms of aerial UE height in Table B-1: LOS probability in TR 36.777
* The second height range for UMi-AV is further divided into 2 regions, i.e., [22.5, 100] and [100, 300] for mid-UAV and high-UAV, respectively.

**Conclusion**

No further study on power normalization of target channel and background channel of ISAC channel in Rel-19

* + Note: sub-section “7.9.5.3 Power normalization across target channel and background channel” in the TR remains as a placeholder with the following text.
    - To combine the target channel and the background channel, power normalization can be applied to keep the same/similar channel power as the background channel without sensing target.

**Agreement**

The polarization matrix of a direct/indirect path i of a scattering point of a target is defined in LCS.

**Agreement**

To generate the channel between a first aerial UE with height h1 and a second aerial UE with height h2, abs(h1-hBS) <= abs(h2-hBS),

* The LOS probability between the two aerial UEs is generated by:

|  |  |  |  |
| --- | --- | --- | --- |
|  | Low-UAV | Mid-UAV | High-UAV |
| Low-UAV | UMi in Table 7.4.2-1 in TR 38.901 for UMi-AV/UMa-AV/RMa-AV | UMi-AV in Table B-1 in TR 36.777 for BS to mid UAV region for UMi-AV/UMa-AV/[RMa-AV]  ~~RMa-AV in Table B-1 in TR 36.777 for BS to mid UAV region~~ | UMi-AV in Table B-1 in TR 36.777 for BS to [high] UAV region for UMi-AV/UMa-AV/[RMa-AV]  ~~RMa-AV in Table B-1 in TR 36.777 for BS to mid UAV region~~ |
| Mid-UAV | UMi-AV in Table B-1 in TR 36.777 for BS to mid UAV region for UMi-AV/UMa-AV/[RMa-AV]  ~~RMa-AV in Table B-1 in TR 36.777 for BS to mid UAV region~~ | UMa-AV in Table B-1 in TR 36.777 for BS to mid UAV region for UMi-AV/UMa-AV  RMa-AV in Table B-1 in TR 36.777 for BS to mid UAV region | 1 |
| High-UAV | UMi-AV in Table B-1 in TR 36.777 for BS to [high] UAV region for UMi-AV/UMa-AV/[RMa-AV]  ~~RMa-AV in Table B-1 in TR 36.777 for BS to mid UAV region~~ | 1 | 1 |

* The pathloss and shadow fading between two aerial UEs are generated using TRP-aerial UE link of UMi-AV in Annex A and B of TR 36.777 by setting height of TRP equal to the height of the first aerial UE.

Note:

* The height ranges of low-UAV, Mid-UAV and High-UAV are defined following the applicability range in terms of aerial UE height in Table B-1: LOS probability in TR 36.777
* The second height range for UMi-AV is further divided into 2 regions, i.e., [22.5, 100] and [100, 300] for mid-UAV and high-UAV, respectively.

**Agreement**

Update the agreements on LOS probability calculation for channel between an aerial UE and a normal UE as follows.

|  |  |  |
| --- | --- | --- |
| Low-UAV | Mid-UAV | High-UAV |
| UMi in Table 7.4.2-1 in TR 38.901 for UMi-AV/UMa-AV/RMa-AV | UMi-AV in Table B-1 in TR 36.777 for BS to mid UAV region for UMi-AV/UMa-AV~~/[RMa-AV]~~  RMa-AV in Table B-1 in TR 36.777 for BS to mid UAV region for RMa-AV | UMi-AV in Table B-1 in TR 36.777 for BS to high UAV region for UMi-AV/UMa-AV~~/[RMa-AV]~~  RMa-AV in Table B-1 in TR 36.777 for BS to high UAV region for RMa-AV |

**Agreement**

Update the agreements on LOS probability calculation for channel between two aerial UE as follows.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Low-UAV | Mid-UAV | High-UAV |
| Low-UAV | UMi in Table 7.4.2-1 in TR 38.901 for UMi-AV/UMa-AV/RMa-AV | UMi-AV in Table B-1 in TR 36.777 for BS to mid UAV region for UMi-AV/UMa-AV~~/[RMa-AV]~~  RMa-AV in Table B-1 in TR 36.777 for BS to mid UAV region for RMa-AV | UMi-AV in Table B-1 in TR 36.777 for BS to high UAV region for UMi-AV/UMa-AV~~/[RMa-AV]~~  RMa-AV in Table B-1 in TR 36.777 for BS to high UAV region for RMa-AV |
| Mid-UAV | UMi-AV in Table B-1 in TR 36.777 for BS to mid UAV region for UMi-AV/UMa-AV~~/[RMa-AV]~~  RMa-AV in Table B-1 in TR 36.777 for BS to mid UAV region for RMa-AV | UMa-AV in Table B-1 in TR 36.777 for BS to mid UAV region for UMi-AV/UMa-AV  RMa-AV in Table B-1 in TR 36.777 for BS to mid UAV region | 1 |
| High-UAV | UMi-AV in Table B-1 in TR 36.777 for BS to high UAV region for UMi-AV/UMa-AV~~/[RMa-AV]~~  RMa-AV in Table B-1 in TR 36.777 for BS to high UAV region for RMa-AV | 1 | 1 |

**Agreement**

To determine the LOS condition of any link in ISAC channel model, when EO type-2 is modelled, the following two options are agreed as solutions:

* Option A: If type-2 EO is in the LOS ray of the link, the LOS probability is p, p=0, and otherwise use the LOS probability equation defined in existing TRs to determine the LOS/NLOS condition
* Option C: Use the LOS probability equation to determine the LOS/NLOS condition of the link.

Note1: in which conditions/scenarios to use option A or option C can be determined in future evaluations.

Note2: as already agreed, monostatic background channel is always NLOS

**Agreement**

EO type-2 can be optionally modelled in background channel when EO type-2 is modelled in target channel.

**Conclusion**

Other than RCS for human, vehicle, AGV, UAV, no other RCS for other objects is introduced in Rel-19.

* Future studies are not precluded for adding RCS of other objects/sizes for modelling target or EO type-1, based on validation results from companies.

**Conclusion**

Delete subsection 7.9.6 from the draft CR. For ISAC, no enhancement to existing TR38.901 LLS channel model is introduced in Rel-19.

**Agreement**

* The existing blockage model A/B procedures can be reused to model the blocking effect due to a target as an optional feature
  + Applicable to the LOS/NLOS rays in the background channel of the target
  + Applicable to the LOS/NLOS rays in the Tx-target and target-Rx link of another target
* The location, orientation and size of the target as a blocker is known before applying the blockage model A/B.

**Agreement**

* The square brackets on formula 7.9.5-10 (copied below) in the draft CR are removed

The effective polarization matrix of the type-2 EO reflection path is given by

[ (7.9.5-10)]

* Encourage companies to check and compare with the results that can be obtained with Alt2 and Alt3 below. If problem is found, RAN1 will revise TR 38.901 by new CR.

Alt2

[ (7.9.5-10)]

With reusing the legacy transformation method for deriving and .

Alt3

[ (7.9.5-10)]

Where,

- . represents the normal vector of the incident plane. , in which and . represents the spherical basis vector of incident ray in vertical direction. represents the spherical basis vector of incident ray in horizontal direction. .

- . represents the polar basis vector of scattering ray in vertical direction. represents the polar basis vector of scattering ray in horizontal direction. . .

**Conclusion**

There is no consensus to introduce an exact formula for micro-Doppler in Rel-19. The placeholder in the channel impulse response is kept in the draft CR.

#### 2.1.2 Remaining Open issues

None

## 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 #120bis**

R1-2502552 Draft CR for TR 38.901 to introduce channel model for ISAC Xiaomi, AT&T

R1-2503072 Draft CR for TR 38.901 to introduce channel model for ISAC Xiaomi, AT&T

R1-2501817 Views on Rel-19 ISAC deployment scenarios vivo

R1-2501839 Discussion on ISAC deployment scenarios and requirements EURECOM

R1-2501926 Discussion on ISAC deployment scenarios InterDigital, Inc.

R1-2501935 Deployment scenarios for integrated sensing and communication with NR NVIDIA

R1-2502002 Discussion on ISAC deployment scenarios CATT, CICTCI

R1-2502029 Discussion on ISAC deployment scenarios China Telecom

R1-2502051 Discussion on ISAC Deployment Scenarios Nokia, Nokia Shanghai Bell

R1-2502054 Discussion on ISAC deployment scenarios Tiami Networks

R1-2502062 Discussion on ISAC deployment scenarios ZTE Corporation, Sanechips

R1-2502067 Discussion on ISAC deployment scenarios Panasonic

R1-2502170 Discussion on ISAC channel model calibration CMCC, China Southern Power Grid

R1-2502207 Deployment scenarios for ISAC channel model Huawei, HiSilicon

R1-2502285 Discussion on ISAC channel model calibration OPPO

R1-2502325 Discussion on ISAC deployment scenarios Sony

R1-2502378 Discussion on ISAC deployment scenarios Samsung

R1-2502416 Discussion on ISAC deployment scenarios CALTTA

R1-2502418 Discussion on ISAC channel calibration BUPT, CMCC

R1-2502451 Deployment scenarios and evaluation assumptions for ISAC channel model Xiaomi

R1-2502465 Discussion on ISAC deployment scenarios TOYOTA InfoTechnology Center

R1-2502588 Discussion on ISAC deployment scenarios Lenovo

R1-2502623 Discussion on ISAC deployment scenarios Apple

R1-2502714 Discussion on ISAC deployment scenario MediaTek Inc.

R1-2502725 Discussion on ISAC Deployment Scenarios Ericsson

R1-2502820 Discussion on ISAC deployment scenarios LG Electronics

R1-2502849 Discussion on ISAC deployment scenarios Qualcomm Incorporated

R1-2502922 Considerations on ISCA deployment scenarios CAICT

R1-2502731 FL Summary #1 on ISAC Scenarios and Calibrations Moderator (AT&T)

R1-2502732 FL Summary #2 on ISAC Scenarios and Calibrations Moderator (AT&T)

R1-2502733 FL Summary #3 on ISAC Scenarios and Calibrations Moderator (AT&T)

R1-2502734 FL Summary #4 on ISAC Scenarios and Calibrations Moderator (AT&T)

R1-2501818 Views on Rel-19 ISAC channel modelling vivo, BUPT

R1-2501840 Discussion on ISAC channel modeling EURECOM

R1-2501878 Discussion on ISAC channel modeling Spreadtrum, UNISOC

R1-2501927 Discussion on ISAC channel modeling InterDigital, Inc.

R1-2501933 Channel modelling for integrated sensing and communication with NR NVIDIA

R1-2502003 Discussion on ISAC channel modelling CATT, CICTCI

R1-2502030 Discussion on ISAC channel modelling China Telecom

R1-2502052 Discussion on ISAC channel modeling Nokia, Nokia Shanghai Bell

R1-2502055 Discussion on ISAC Channel Modeling Tiami Networks

R1-2502063 Joint views on mono-static background channel modeling ZTE Corporation, Sanechips, OPPO, BUPT, BJTU, CAICT, Xiaomi

R1-2502171 Discussion on channel modeling methodology for ISAC CMCC, BUPT, SEU, PML

R1-2502208 Channel modelling for ISAC Huawei, HiSilicon

R1-2502286 Study on ISAC channel modelling OPPO

R1-2502326 Discussion on Channel Modelling for ISAC Sony

R1-2502379 Discussion on ISAC channel modelling Samsung

R1-2502417 Discussion on channel modelling for ISAC CALTTA, ZTE Corporation, Sanechips

R1-2502419 ISAC Channel Modeling and Measurement Validation BUPT, CMCC, VIVO

R1-2502452 Discussion on ISAC channel model Xiaomi, BJTU, BUPT

R1-2502466 Discussion on ISAC channel modelling TOYOTA InfoTechnology Center

R1-2502565 Discussion on ISAC channel modelling Tejas Network Limited

R1-2502572 Discussion on ISAC Channel Modeling NIST

R1-2502587 Discussion on Channel Modelling for ISAC Lenovo

R1-2502624 Discussion on ISAC channel modelling Apple

R1-2502715 Discussion on ISAC channel modelling MediaTek Inc.

R1-2502726 Discussion on ISAC Channel Modelling Ericsson

R1-2502736 Discussions on ISAC Channel Modeling AT&T

R1-2502776 Discussion on ISAC Channel Modelling NTT DOCOMO, INC.

R1-2502814 Discussion on ISAC channel modelling Panasonic

R1-2502821 Discussion on ISAC channel modelling LG Electronics

R1-2502850 Discussion on ISAC channel modelling Qualcomm Incorporated

R1-2502923 Considerations on ISAC channel modelling CAICT

R1-2502553 Summary #1 on ISAC channel modelling Moderator (Xiaomi)

R1-2502554 Summary #2 on ISAC channel modelling Moderator (Xiaomi)

R1-2502555 Summary #3 on ISAC channel modelling Moderator (Xiaomi)

R1-2502556 Summary #4 on ISAC channel modelling Moderator (Xiaomi)

R1-2503146 Summary #4 on ISAC channel modelling Moderator (Xiaomi)

**RAN1 #121**

R1-2504160 Draft CR for TR 38.901 to introduce channel model for ISAC Xiaomi, AT&T

R1-2503247 Deployment scenarios for ISAC channel model Huawei, HiSilicon

R1-2503372 Views on Rel-19 ISAC deployment scenarios vivo

R1-2503445 Discussion on ISAC deployment scenarios and requirements EURECOM

R1-2503576 Discussion on ISAC deployment scenarios Samsung

R1-2503697 Discussion on ISAC deployment scenarios ZTE Corporation, Sanechips, CAICT

R1-2503752 Discussion on ISAC deployment scenarios InterDigital, Inc.

R1-2503760 Discussion on ISAC Deployment Scenarios SK Telecom

R1-2503803 Discussion on ISAC deployment scenarios CATT, CICTCI

R1-2503841 Discussion on full calibration of ISAC channel model CMCC

R1-2503858 Discussion on ISAC channel calibration BUPT, CMCC, X-Net

R1-2503892 Scenario and calibration discussion for ISAC CM Xiaomi

R1-2503954 Discussion on ISAC Deployment Scenarios Nokia, Nokia Shanghai Bell

R1-2503967 Discussion on ISAC deployment scenarios Tiami Networks

R1-2503992 Deployment scenarios for integrated sensing and communication with NR NVIDIA

R1-2504012 Discussion on ISAC Deployment Scenarios NIST

R1-2504053 Discussion on ISAC deployment scenarios China Telecom

R1-2504068 Remaining issues on ISAC deployment scenarios Sony

R1-2504126 Discussion on ISAC deployment scenarios CALTTA

R1-2504146 Discussion on calibration results ETRI

R1-2504220 Discussion on ISAC channel model calibration OPPO

R1-2504239 Discussion on ISAC deployment scenarios Lenovo

R1-2504268 Discussion on ISAC deployment scenario MediaTek Inc.

R1-2504336 Discussion on ISAC deployment scenarios and Calibration Apple

R1-2504367 ISAC scenarios and 7-24GHz alignment AT&T, FirstNet

R1-2504404 Discussion on ISAC deployment scenarios Qualcomm Incorporated

R1-2504454 Discussion on ISAC Deployment Scenarios Ericsson

R1-2504539 Discussion of calibration for UAV sensing targets ITRI, Tron Future Tech Inc.

R1-2504566 Discussion on ISAC deployment scenarios LG Electronics

R1-2504363 FL Summary #1 on ISAC Scenarios and Calibrations Moderator (AT&T)

R1-2504364 FL Summary #2 on ISAC Scenarios and Calibrations Moderator (AT&T)

R1-2504365 FL Summary #3 on ISAC Scenarios and Calibrations Moderator (AT&T)

R1-2504366 FL Summary #4 on ISAC Scenarios and Calibrations Moderator (AT&T)

R1-2503248 Channel modelling for ISAC Huawei, HiSilicon

R1-2503373 Views on Rel-19 ISAC channel modelling vivo, BUPT

R1-2503446 Discussion on ISAC channel modeling EURECOM

R1-2503525 Discussion on ISAC channel modeling Spreadtrum, UNISOC

R1-2503577 Discussion on ISAC channel modelling Samsung

R1-2503646 Discussion on ISAC channel modelling Pengcheng Laboratory

R1-2503698 Discussion on channel modelling for ISAC ZTE Corporation, Sanechips, CAICT

R1-2503720 Discussion on ISAC channel modelling Tejas Network Limited

R1-2503726 Discussion on ISAC channel modelling TOYOTA InfoTechnology Center

R1-2503753 Discussion on ISAC channel modeling InterDigital, Inc.

R1-2503761 Discussion on ISAC Channel Modeling SK Telecom

R1-2503804 Discussion on ISAC channel modelling CATT, CICTCI

R1-2503842 Discussion on ISAC channel modeling CMCC

R1-2503859 ISAC Channel Modeling and Measurement Validation BUPT, CMCC, VIVO, X-Net

R1-2503893 Discussion on ISAC channel model Xiaomi, BJTU, BUPT

R1-2503955 Discussion on ISAC channel modeling Nokia, Nokia Shanghai Bell

R1-2503969 Discussion on ISAC Channel Modeling Tiami Networks

R1-2503991 Channel modelling for integrated sensing and communication with NR NVIDIA

R1-2504013 Discussion on ISAC Channel Modeling NIST

R1-2504054 Discussion on ISAC channel modelling China Telecom

R1-2504069 Remaining issues on ISAC Channel Modeling Sony

R1-2504110 Discussion on ISAC Channel Modelling Panasonic

R1-2504119 Discussion on channel modelling for ISAC CALTTA

R1-2504159 Discussion on ISAC channel modelling Pengcheng Laboratory

R1-2504221 Study on ISAC channel modelling OPPO

R1-2504240 Discussion on Channel Modelling for ISAC Lenovo

R1-2504269 Discussion on ISAC channel modelling MediaTek Inc.

R1-2504337 Discussion on ISAC channel modelling Apple

R1-2504405 Discussion on ISAC channel modelling Qualcomm Incorporated

R1-2504455 Discussion on ISAC Channel Modelling Ericsson

R1-2504511 Discussion on ISAC Channel Modelling NTT DOCOMO, INC.

R1-2504567 Discussion on ISAC channel modelling LG Electronics

R1-2504161 Summary #1 on ISAC channel modelling Moderator (Xiaomi)

R1-2504162 Summary #2 on ISAC channel modelling Moderator (Xiaomi)

R1-2504163 Summary #3 on ISAC channel modelling Moderator (Xiaomi)

R1-2504164 Summary #4 on ISAC channel modelling Moderator (Xiaomi)

R1-2504165 Summary #5 on ISAC channel modelling Moderator (Xiaomi)

R1-2504945 Summary #6 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