与场景亲密接触
做方案创新专家

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RP-233047

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Agenda Item: 9.1.1.7

Considerations on Rel-19 ISAC

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Potential objectives for Rel-19 ISAC

- According to 3GPP RAN chair's summary in RP-232745, several potential objectives for Rel-19 ISAC SI have been proposed:

ISAC SI

- References: RWS-230488, RP-231540, RP-232617
- RAN to select a small number of ISAC use cases from TR22.837, and to identify appropriate corresponding information needed for the point below, i.e. scenarios, frequency ranges and sensing modes.
  - Also consider the ongoing SA1 TS22.137
- Potential objectives:
  1. A RAN1-led study objective to define channel modelling details for sensing using 38.901 (if applicable to the selected use cases) as a starting point, and taking into account relevant measurements, including:
     - a. modelling of sensing targets and background environment, including, for example (if needed by the selected use cases), radar cross-section (RCS), mobility and clutter/scattering patterns;
     - b. spatial consistency.

     ~~This objective to start after completion of the first (RAN-led) objective if not already done in SID.~~
  - Anything else?

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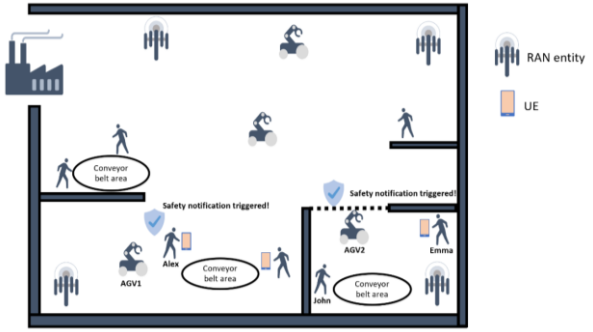
Priority use cases for ISAC in Rel-19

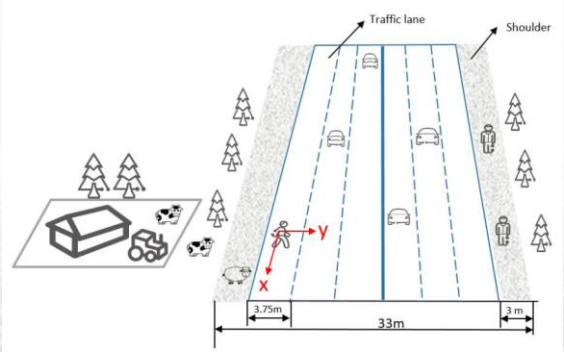
- 3GPP TR 22.837 provides 32 use cases, which could be classified into various scenarios and require different KPIs.

- **In Rel-19, we propose to select smart factory, UAV detection and smart transmission as priority use cases.**
  - Focus on positioning and detection use cases which facilitate taking Rel-16 /17 /18 positioning as a baseline.
  - These promising use cases could be implemented by gNB-based ISAC mode. They could be easily deployed in certain areas to provide sensing services if needed.
  - The high commercial value of the proposed use cases in e.g., low altitude economic and industry 4.0 drives the need for ISAC.



Use case 1: smart factory

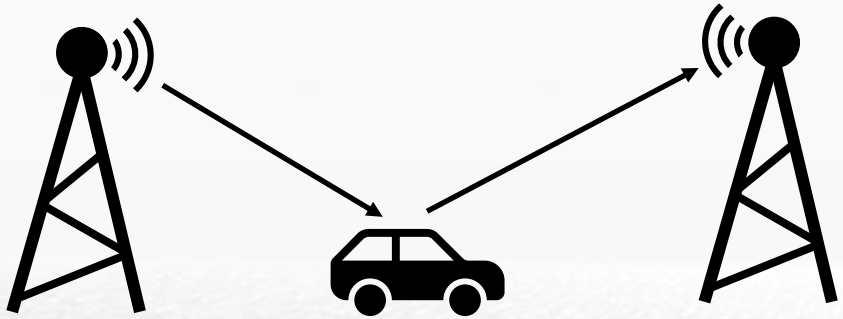
Use case 2: UAV detection



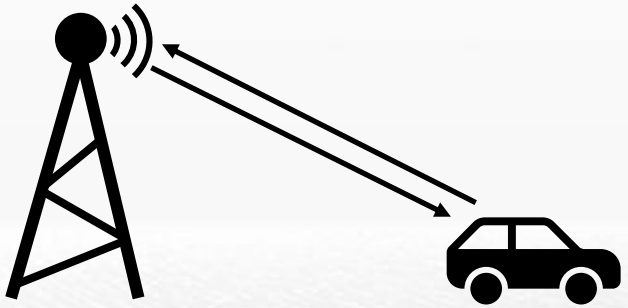
Use case 3: smart transmission

Sensing modes for ISAC in Rel-19

- **In Rel-19, we propose to prioritize the gNB-based sensing modes for the ISAC study.**
  - Due to high transmit power and large antenna array of gNB, wide-range sensing could be achieved by gNB-to-gNB bi-static mode or gNB mono-static mode.
  - gNB-based sensing modes could either reuse existing ubiquitous gNBs or require updating the RAN entities in certain ISAC-requested areas.
  - Noted: Mono-static gNB sensing requires full-duplex capability.



gNB-to-gNB bi-static mode



gNB mono-static mode

Channel model for ISAC in Rel-19

- **To evaluate the performance of ISAC solutions, a new channel model which characterizes the sensing target is required.**

- One feasible ISAC channel model is to concatenate two links related to the sensing target. This could be achieved by modifying current TR 38.901 model.
  - Link α: the sensing signal is transmitted from Tx to sensing target.

    Link β: the sensing signal is reflected/scattered from the sensing target to Rx.
  - Sensing signal is reflected by a target at different reflection points. These reflection points can be modeled as multiple ***reflecting antennas***. More study is needed on ***reflecting antennas*** modeling and **RCS** modeling of sensing objects.

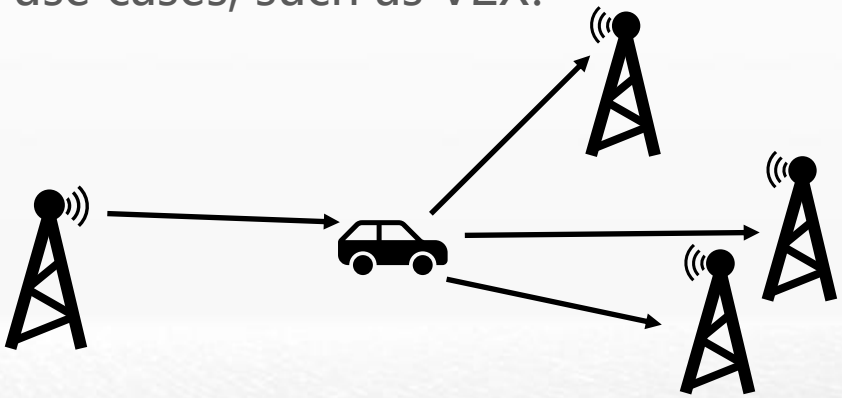
Concatenating links model

Channel model for ISAC in Rel-19

- Study on **channel spatial consistency** should be highlighted in order to extend the channel model to multi-gNB collaborative sensing scenario.
  - For example, the sensing channels of different Rx should be correlated to ensure the consistent sensing results across different Rx.

- **Moving target modeling** is required to support use cases in TR 22.837.
  - Mobility of sensing Tx or Rx is also considered in some use cases, such as V2X.

- **Self-interference modeling** is needed to evaluate the performance of mono-static sensing mode.



Multi-gNBs collaborative sensing model

Proposed scopes for Rel-19 ISAC

- **Use cases, KPIs and sensing modes:**
  - Identify prioritized use cases for ISAC in Rel-19 and the corresponding KPIs.
  - Identify prioritized sensing modes.
  - Identify spectrum allocation, e.g. FR1/FR2.

- **Performance evaluation:**
  - RAN1 starts SI on channel model as the basis for ISAC performance evaluation.
  - Study the physical layer design for ISAC and evaluate the performance.
  - Study synchronization mechanism in bi-static sensing mode.

- **Specification impact:**
  - Study the standardization impacts on sensing service interfaces, procedures, signaling and architectures.
  - Study the standardization impacts on the support for Multi-gNB collaborative sensing functions.
  - Study the standardization impacts on the support for sensing service continuity of moving objects.

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Thanks

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