Smarter technology for all

3GPP TSG RAN#93-e,
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RP-212467

Agenda Item:	9.0.2
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Document for:	Discussion

Motivation for introducing sensing in NR Rel-18

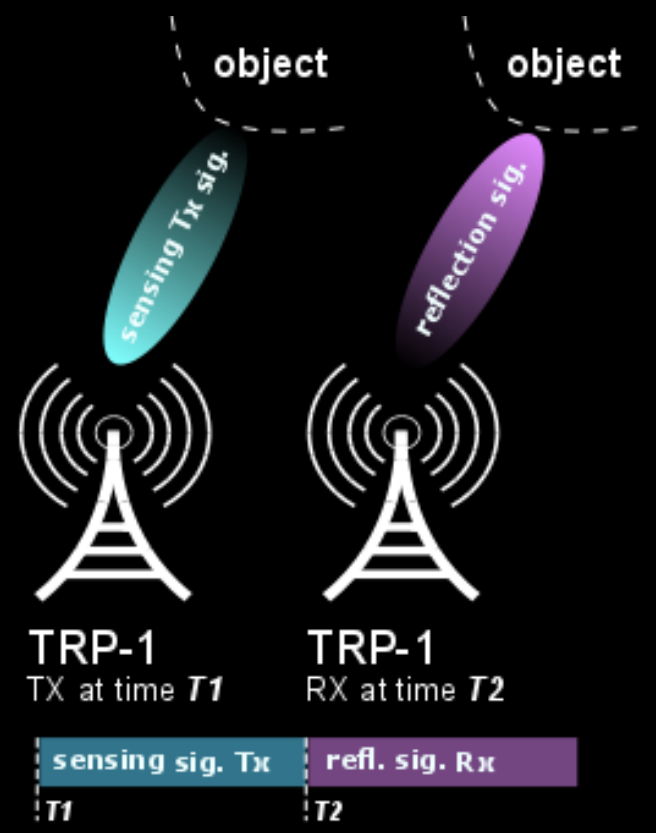
Introduction & Motivation

- In NR Rel-17, enhanced positioning specified for UE location with targeted sub-meter accuracy
  - However, positioning does not support detection/tracking or the objects

- In contrast, radio sensing can acquire knowledge of environment, e.g., object presence
  - transmission of sensing signal and reception of reflections/echoes to determine the presence of objects

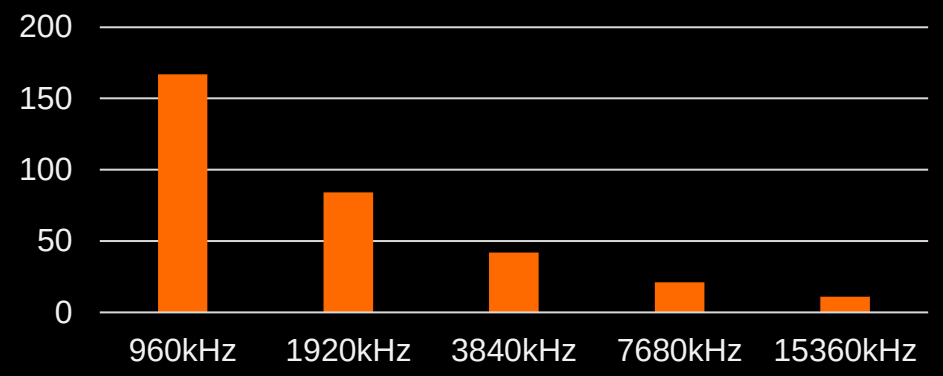
- Application of sensing for NR system performance enhancement by addressing beam blockage in URLLC scenarios is a motivation to introduce sensing in NR Rel-18.

Single Node Sensing



Transmission and reception of sensing signal via same node

- Key requirements for single node sensing:
  - **Higher SCS (shorter symbol duration)**
    - Shorter symbol durations needed to transmit and receive on different symbols to detect blockages at short range

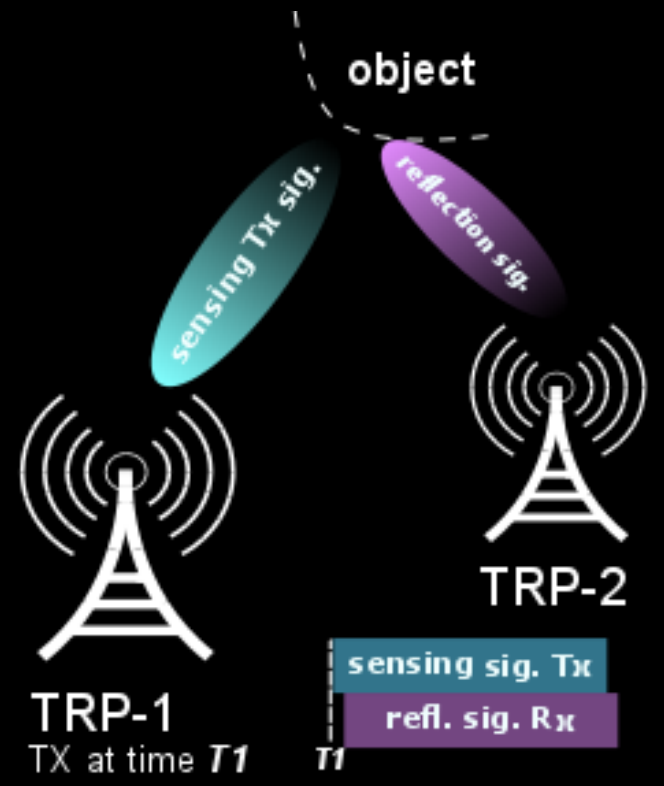


Minimum observable range* via sensing (m) vs. SCS (kHz)

  - **Otherwise, full-duplex operation** needed for same-symbol transmission and reception

**Observable range is the distance of the object from Tx TRP*

Multi-node Sensing



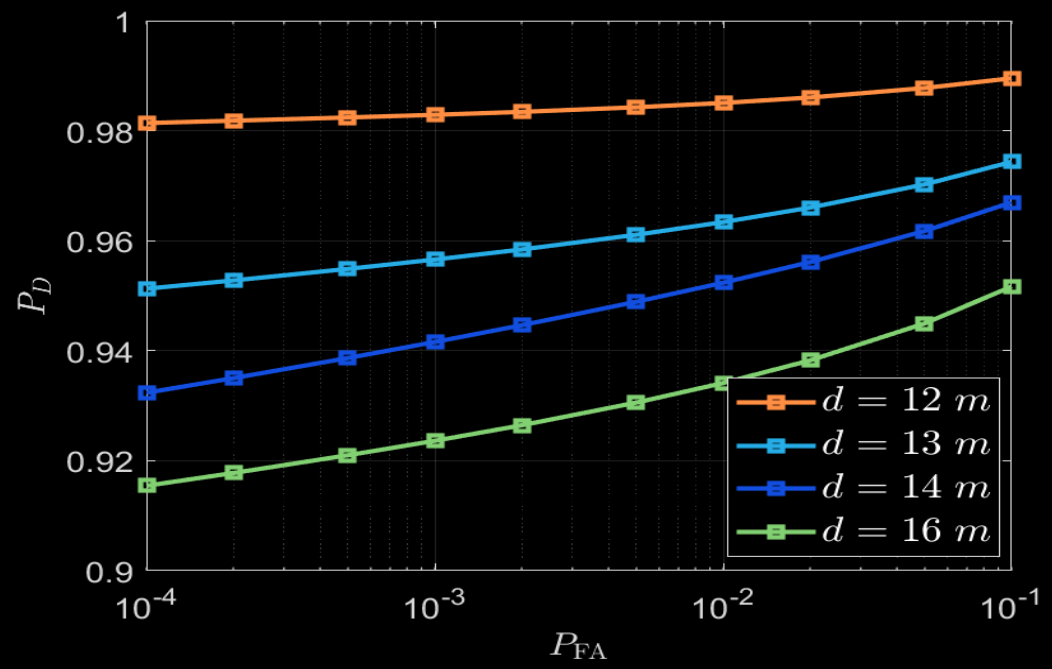
Transmission and reception of the sensing signal via different nodes

- Relaxing the duplexing limitation & SCS requirements for single node sensing
- Key requirements for multi node sensing:
  - **Coordination of TRPs** for sensing with avoidance of co-channel interference

Example Analysis for Multi-node Sensing

Object detection performance via sensing in an indoor factory scenario

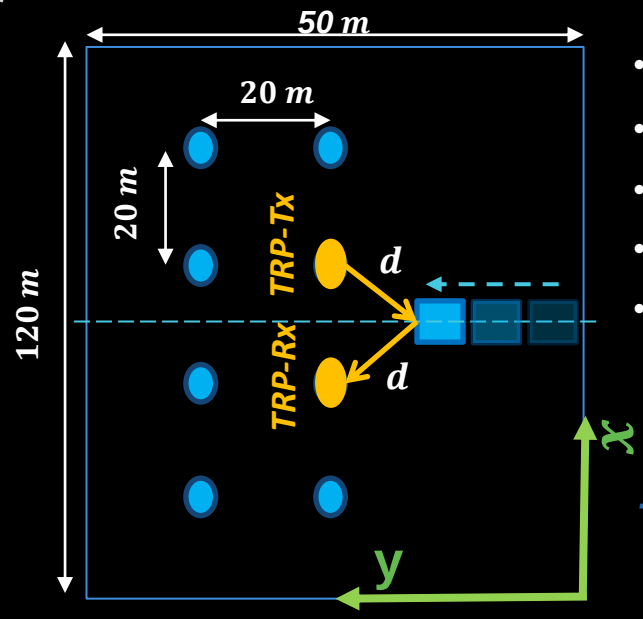
- **Detection performance (RoC)**



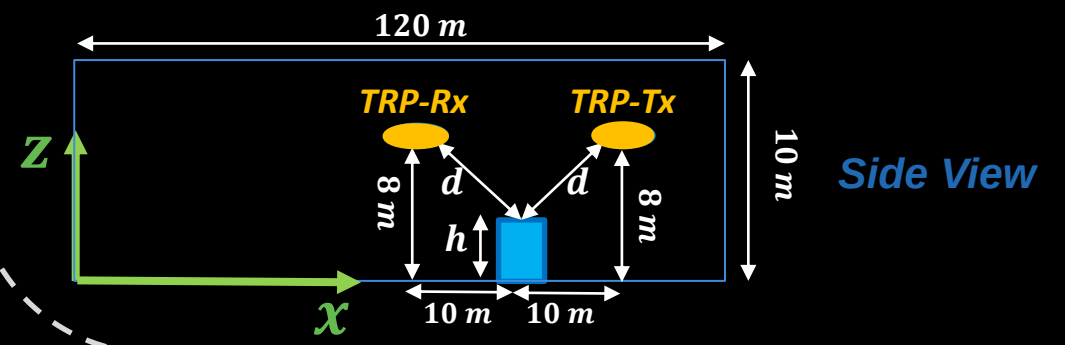
Detection probability vs. False alarm rate

- **Higher than 92% detection probability for FA rate of 0.001**
- **Achievable range resolution of 0.4 m**

- **Sensing Setup:**



- *Hall dimension: 120 x 50 x 10*
- *Object-TRP distance "d"*
- *Object height: h=2*
- *Inter-TRP distance = 20 m*
- *TRP height = 8 m*



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Proposal for Studying Sensing in NR Rel-18

- Identify, if current specification can support reliable detection/tracking of non-deterministic beam blockages at least for URLLC/IIoT scenarios
- Study feasibility and potential enhancements to support radio sensing methods, if current specification cannot support reliable detection

thanks.

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Appendix

Simulation Scenario & Assumptions

Simulation Assumptions: Indoor factory setup

Model Parameter	Value
Ch. Scenario:	InF-XH
Inter-TRP distance	20 m
Factory hall size	120 x 50 m x 10m
carrier frequency	28GHz
Tx & Rx array	[4 4 2 1 1] & [4 4 2 1 1];
Noise figure	7 dB
TRP Tx power	29,9 dBm (23 dBm per 80MHz)
BW	400MHz
SCS	120kHz
Sensing sig. length	1/2 sym
Sequence type	Zadoff-Chu