3GPP TSG RAN meeting #101
Bangalore, India, September 11-15, 2023

RP-231760

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Views on Channel Modeling and ISAC Studies in Rel-19

AI: 8A.2.11
Document for: Discussion

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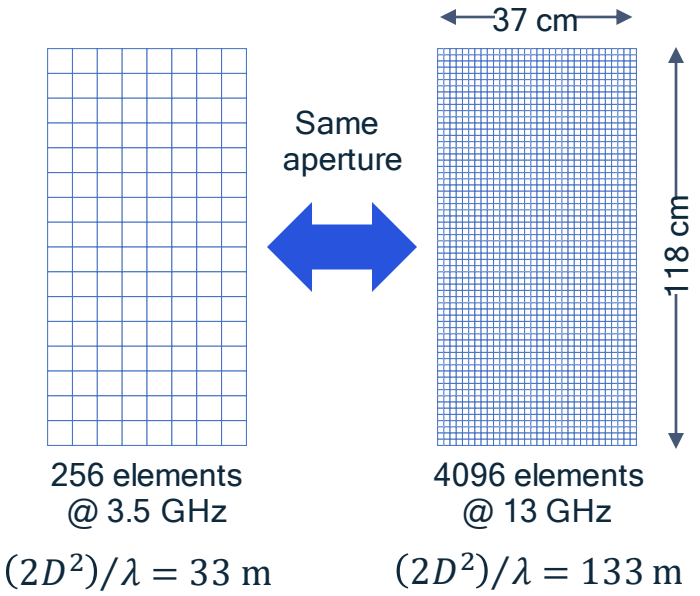
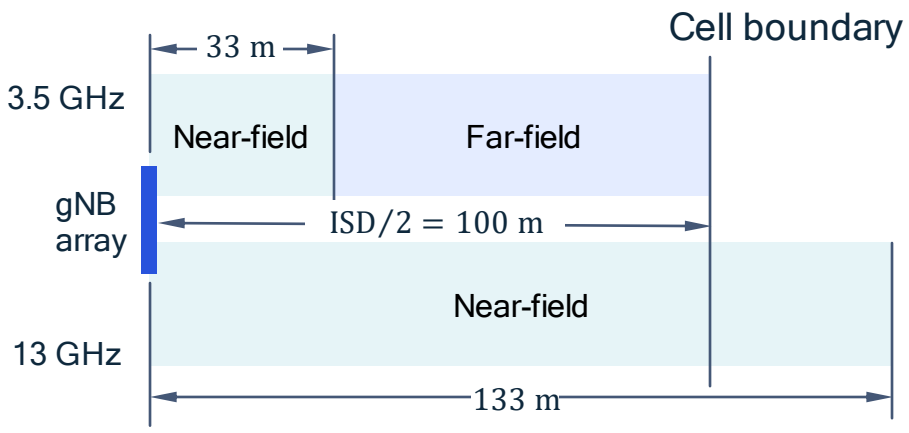
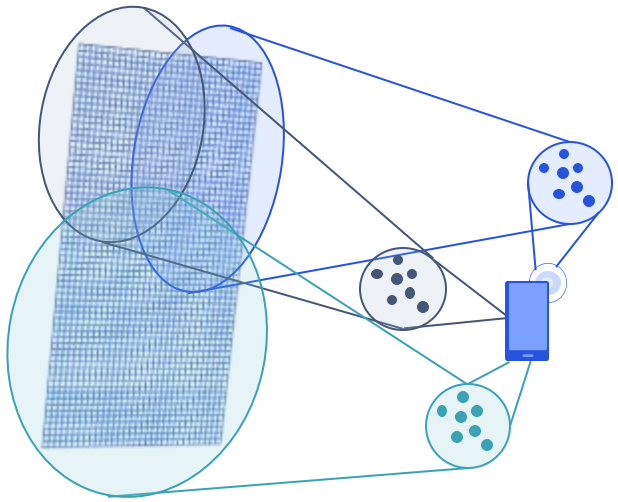
Upper mid-band - TR 38.901 may not meet the needs

- Although TR 38.901 supports frequencies from 0.5 GHz to 100 GHz, but it cannot meet the needs for these emerging new spectrums
  - 38.901 assumes plane wave propagation and stationarity.
  - Spherical wave propagation and non-stationarity in spatial-dimension may need to be modeled for upper mid-band and Sub-THz and/or large aperture size.





At 13 GHz, almost all UEs may be in near-field → plane wave assumption doesn't hold



For large apertures, a cluster may be associated with a subset of antennas

Integrated Sensing and Communications (ISAC)

Channel modeling and evaluation methodology

- Channel model enhancement (for indoor/outdoor and all frequency bands)
  - Sensing aims to infer properties of passive objects based on how they interact with RF signals
    - Explicit modeling of these interactions (e.g., reflection/absorption/diffraction/scattering) very limited in current TR38.901
      - Multipaths seen by different (Tx, Rx) nodes are not necessarily consistent with reflection from the same object(s)
    - For the sensing study and evaluations → critical to study approaches to remove these limitations
      - e.g., consider adding additional path(s) that are consistent with reflections from a specific object.
      - Consider statistical abstractions to capture the key properties of the interactions of the objects with RF signals
      - Help to limit excessively detailed (e.g., ray-tracing) modeling of RF propagation
      - e.g., capture only impact to timing, angle, and power of the reflected signal. Use statistical modeling for the variability in these parameters that is caused by the detailed shape of the object (e.g., statistical RCS model, or simplified object shape models)
- Evaluate missed/false detection probability & accuracy of position & velocity of detected object(s)
  - This captures the KPIs needed for a broad class of use cases discussed in the Rel-19 SA1 TR 22.837
  - Use cases needing further modeling such as micro-doppler signature detection or object shape detection could be treated as second priority
  - Study both monostatic and bistatic sensing
  - Sensing transmitters and receivers could be UE or gNB

ISAC

Other

- Sensing Waveform and Measurement Reporting
  - Treat PRS and SRS-for-positioning as baseline, and extend for sensing
    - Study sensing-specific enhancements to existing configuration, measurements and reporting for Rel-16/17/18 positioning
    - Study measurement and reporting enhancements to identify and estimate position and velocity of specific objects
    - Study of new sensing waveforms such as FMCW or lower PAPR waveforms could be lower priority
    - Study should include both in coverage and out of coverage operation

- Network architecture and procedures
  - Note: Network architecture is upto SA. RAN design is to be coordinated with SA design
  - Treat Rel-16/17/18 Positioning architecture and procedures as baseline, and study extensions for sensing

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Summary

- Channel modeling for new spectrum:
  - Study and characterize propagation and penetration loss based on measurements, if available.
  - Study channel model enhancements for new spectrum and new use cases
  - Develop extensions to current 38.901 models to support upper mid-band frequencies, spherical wave propagation, and non-stationarity in spatial-domain
    - Calibration of extended channel model
    - No fundamental changes to previous evaluations of FR1/FR2
- ISAC:
  - Study and develop extensions to current 38.901 models to support sensing evaluations by explicit modeling of interactions of RF signals with passive objects whose properties (e.g., location) are to be inferred by sensing
  - Evaluate sensing KPIs such as missed/false detection and accuracy of location of objects to be sensed, in indoor and outdoor scenarios for both UE and gNB based sensing
  - With Rel-16/17/18 Positioning as baseline for both lower and upper layer design, study extensions to allow reporting of sensing measurements and computation of sensing results for both in coverage and out of coverage scenarios

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Thank you

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