

Qualcomm

RWS-210021

3GPP TSG RAN Rel-18 workshop
Electronic Meeting, June 28 - July 2, 2021
Agenda Item: 4.2

On NR Positioning Evolution

Perspectives for Release 18

5G

Background

- **Rel-16 adds basic NR Positioning support**
 - Regulatory requirements were prioritized
 - Commercial requirements target was 3 - 10 m.

- **Rel-17 NR Positioning enhancements with commercial requirements in mind**
 - Commercial (IIoT) accuracy requirement target of < 1m (0.2m)
 - End-To-End Latency target of 100 ms and PHY-layer latency of 10 ms

Possible Further NR Positioning Enhancements

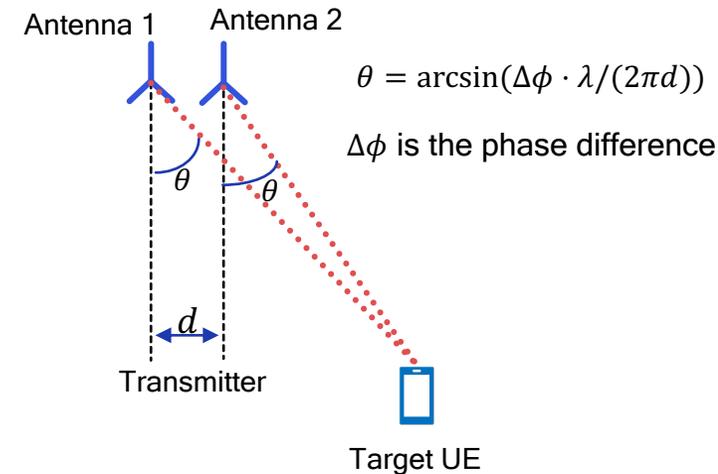
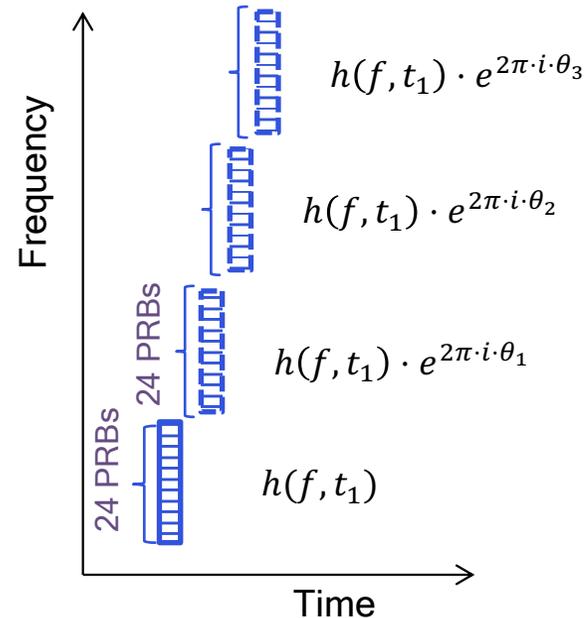
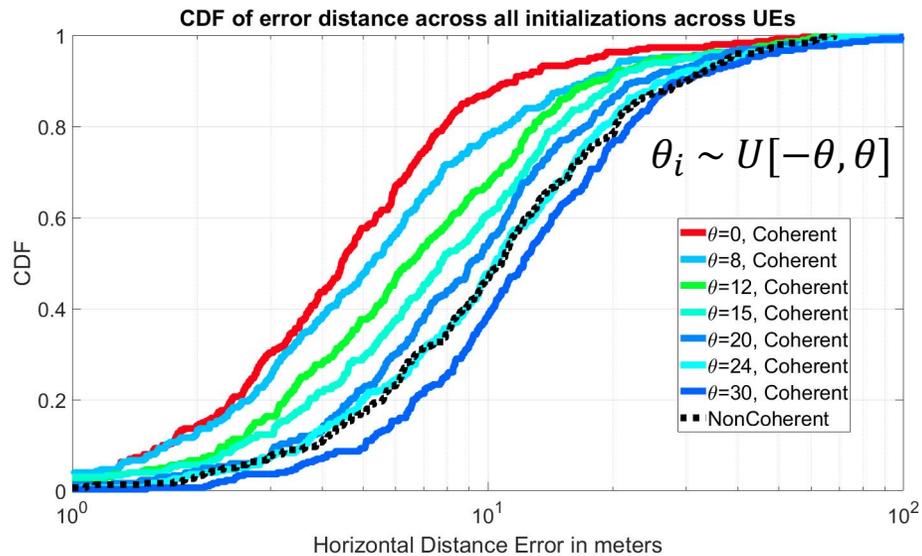
Areas for Further NR Positioning Evolution

- Narrowband Positioning
 - Suitable for Mid-Tier IOT/RedCap
 - IoT devices with low Bandwidth, low proc. Capabilities
- Enhancements to ensure competitiveness viz-a-viz competition (Accuracy/Bandwidth, Low-Power)
 - Competing technologies (eg UWB) offer positioning service with higher system bandwidth than NR Positioning
- Others

Narrowband Positioning for IoT

- RedCap will be completed in NR Rel-17 - opens up a new market of “mid tier IOT”
 - Supporting NR Positioning enhancements in NR Rel-18 would expand further the value of these IoT devices with low Bandwidth & low processing capabilities

- Narrowband Positioning
 - PRS Frequency Hopping & Coherent stitching
 - DL-AoD Enhancements (depending on Rel-17 outcome): Phase-Difference DL-AoD

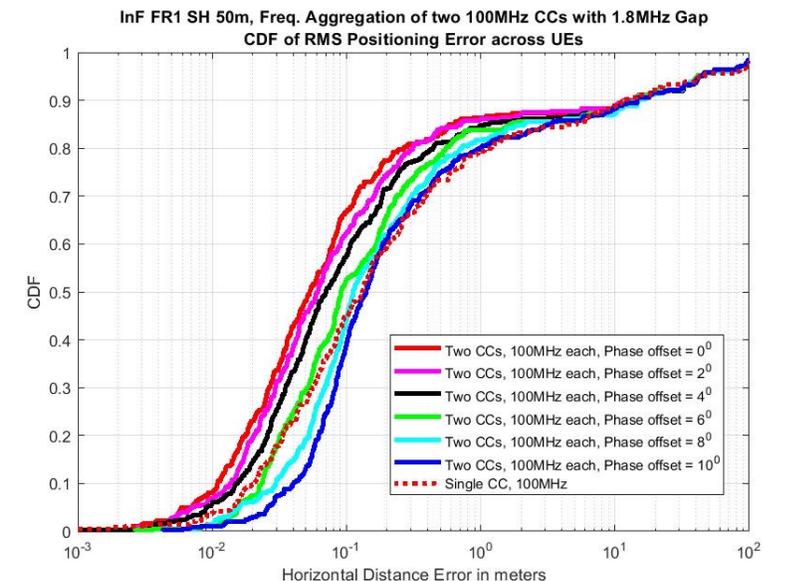
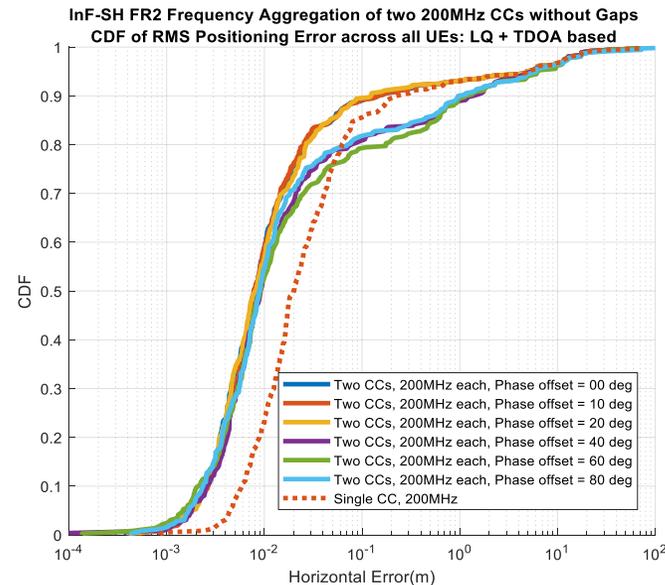
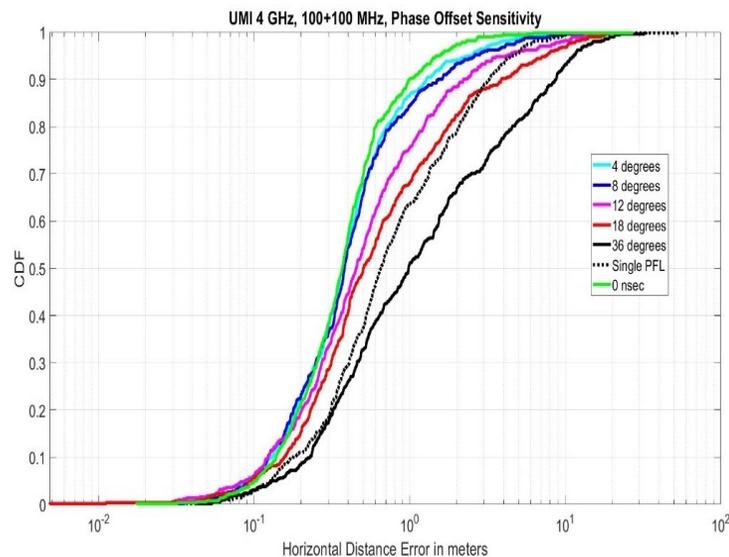


Accuracy Enhancements: Increased Bandwidth

- **PRS/SRS Bandwidth Aggregation**

- WiFi/UWB offers competitive positioning performance exploiting its large system bandwidth.
 - WiFi 6 can utilize up to 160MHz BW and it is expected that WiFi 7 will increase the supported BW to 320MHz.
 - Commercially available UWB based positioning utilizes at least 500MHz BW and higher in some scenarios.

In order to be competitive in scenarios where NR-based positioning and UWB/WiFi may have to compete, Rel-18 should support PRS/SRS Bandwidth Aggregation



Accuracy Enhancements: Views on Carrier phase Positioning

- Carrier phase positioning was proposed during earlier Positioning SIs as a timing-based method for improved positioning accuracy without the need of larger bandwidth
 - Such technique is being used in satellite systems (GNSS)
- Carrier phase positioning is less attractive to terrestrial deployments compared to satellite systems due to:
 - Increased Sensitivity to multipath environments
 - This is applicable to both outdoor, indoor, factory environments of interest
 - Strict requirements on network time/frequency synchronization
 - Implications to RF architectures/antennas/requirements for both UE & gNBs
 - Similar performance to other methods in LOS environments
- Before considering such enhancement, it should be better understood whether there exist any terrestrial environment or use case where accuracy benefits may be expected over the already defined methods & potential enhancements.

Device Efficient & Low-Power Positioning

- **RRC Idle/Inactive for DL&UL Positioning**

- Measurement Reporting
- SRS Transmission

- **DRX-Aware Positioning**

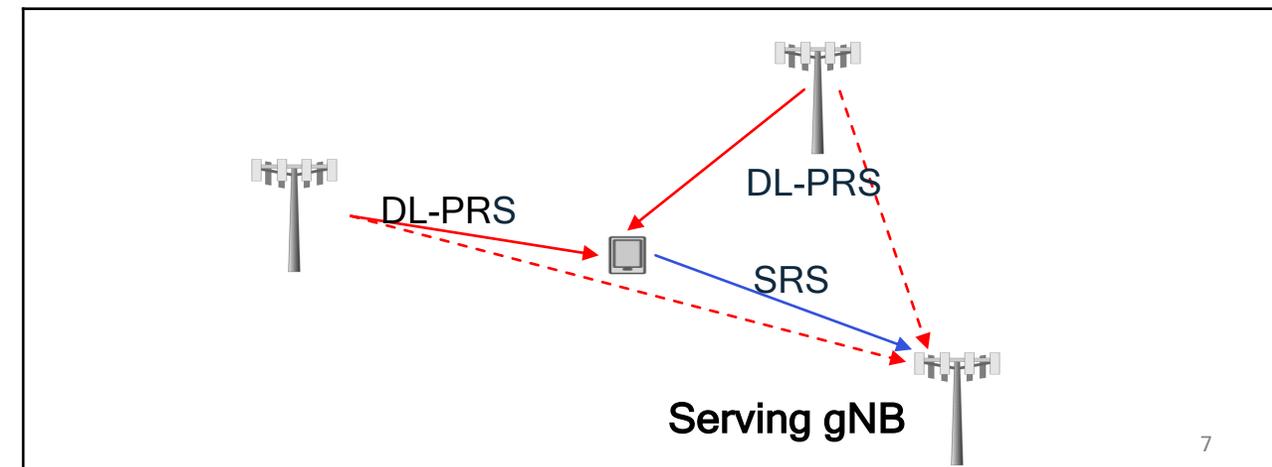
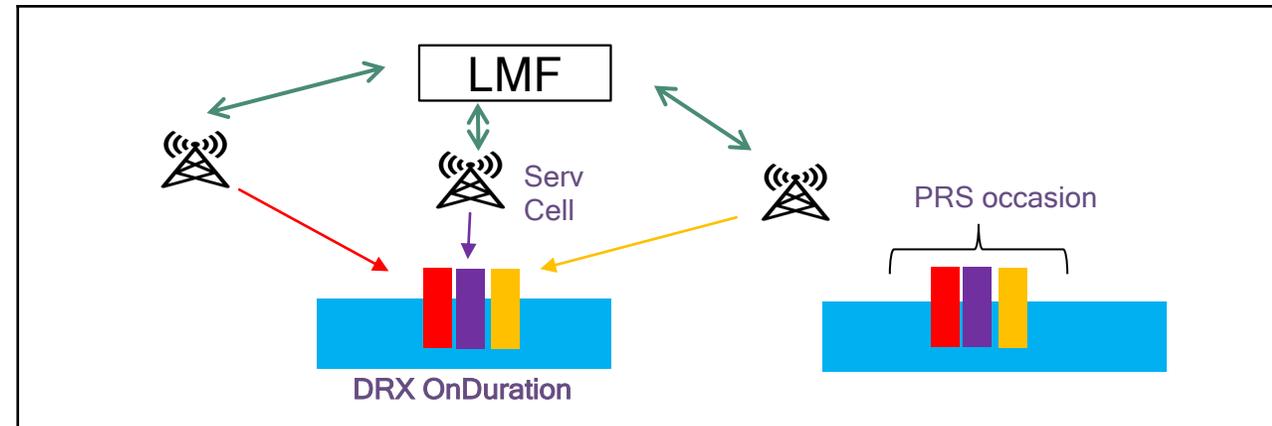
- Positioning accuracy and DRX power-savings trade-off
- Enable LMF to be aware of DRX configuration
- UE behavior transmit/receive PRS outside of DRX OnDuration/Active Time
- Relation to bandwidth aggregation, multiple DRX configs

- **Asynchronous Location without non-serving-cell SRS**

- Enable Network-Sync-robust positioning which use SRS to serving gNB only

From RAN1 SI Rel-17 Conclusions [38.857]:

- NR positioning for UEs in RRC_INACTIVE state is recommended for normative work, including
 - DL, UL and DL+UL positioning methods
 - UE-based and UE-assisted positioning solutions
 - Support of UE positioning measurements for UEs in RRC_inactive state
 - Options that can be considered include DL-PRS or DL-PRS and SSB
 - Support of gNB positioning measurements for UEs in RRC_inactive state



Others

Additional enhancements areas that could be considered

- Enable UE-based mode for all Rel-16 positioning methods
 - Can provide better accuracy, scalability & better latency long-term
- Positioning Enhancements for Unlicensed, including FR2x
- Architecture for low latency positioning
 - Location Server functionality in the RAN
- Joint Uu & sidelink positioning
 - If & when sidelink positioning is specified



Thank you!

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