RP-223007

Views on WI scope for Rel-18 Expanded and Improved NR Positioning

RAN Plenary #98-e

AT&T, FirstNet

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Background

Rel-17 completion and conclusions

- NR Positioning Enhancements Work Item
  - Completed June 2022
- Study on NR Positioning Enhancements (TR 38.857)
  - Several enhancements down-scoped due to limited TUs
- Study on scenarios and requirements of in-coverage, partial coverage, and out-of-coverage NR positioning use cases TR 38.845)

Rel-18 SI conclusions

- TR 38.859 Study on Expanded and Improved NR Positioning
- Recommendations for several enhancements, e.g., Sidelink Positioning, Positioning Integrity, RedCap Positioning, Low Power High Accuracy Positioning

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Proposed Objectives

General Objective

Motivation & justification:

- ✓ Based on the agreements in the TR 38.859 conclusions
- ✓ Enable V2X and public safety use cases as captured in TR38.845
- ✓ Enable IIoT and commercial use cases as captured in, e.g., TS22.261 and TS22.104

Proposed General Objective:

The objective of this work item is to specify the following solutions targeting use cases defined in TR.38.859, TR 38.845, TS 22.261 and TS 22.104: introduce support for sidelink ranging/positioning; introduce accuracy, power consumption improvements, and integrity for RAT-dependent positioning methods; and introduce support of positioning for RedCap UEs.

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1. Sidelink Positioning and Ranging

Motivation & justification:

- ✓ V2X and public safety use cases as captured in TR38.845
- ✓ IIoT and commercial use cases as captured in, e.g., TS22.261 and TS22.104
- ✓ For UEs in in-coverage, partial coverage, and out-of-coverage

Relevant TR 38.859 recommendations:

SL Positioning solutions

- Operation Scenarios: PC5-only-based positioning and Combination of Uu- and PC5-based positioning
- RTT-type solution(s) using SL, SL-AoA, and SL-TDOA and relevant measurement and configuration support
- Signalling and protocols between UEs and between UE and LMF (RAN2) to support the above

Bandwidth requirements for SL Positioning studied

- recommended that SL-PRS bandwidths of up to 100 MHz are supported for FR1

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1. Sidelink Positioning and Ranging

Proposed Objectives:

- Specify solutions for sidelink positioning and ranging considering the following: [RAN1, RAN2]
  - Scenarios/requirements
    - Coverage scenarios: in-coverage, partial-coverage and out-of-coverage
    - Use cases and requirements: V2X (TR38.845), public safety (TR38.845), commercial (TS22.261), IIoT (TS22.104)
    - Spectrum: ITS, licensed
  - Specify positioning methods (e.g., TDOA, RTT, AOA/D) including combination of SL positioning measurements with other RAT dependent positioning measurements (e.g., Uu-based measurements) [RAN1]
  - Specify sidelink positioning reference signals (SL-PRS) from physical layer perspective, including signal design, resource allocation, measurements, associated procedures, reusing existing reference signals, procedures, from sidelink communication and from positioning as much as possible [RAN1]
  - Specify positioning architecture and signaling procedures (e.g., configuration, measurement reporting, etc.) to enable sidelink positioning covering both UE-based and network-based positioning [RAN2, RAN3]

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2. Accuracy, Integrity & Power consumption improvements

Motivation & justification

- ✓ Rel-17/18 studies investigated higher accuracy, and lower latency location, high integrity and reliability requirements to enable new applications and industry verticals
- ✓ Integrity is a key requirement for mission critical/public safety use cases
- ✓ Target lower UE power consumption requirements to improve battery life

Relevant TR 38.859 recommendations:

Both UE-based and LMF-based integrity for RAT-Dependent Positioning Techniques are recommended for normative work.

PRS/SRS bandwidth aggregation across PFLs for positioning measurements is concluded as feasible from RRM perspective.

Existing DL PRS and UL SRS for positioning purpose are recommended as the reference signals to enable positioning based on NR carrier phase measurements for both UE-based and UE-assisted positioning, along with multipath mitigation

Additional recommendations for Low Power High Accuracy Positioning (LPHAP) such as, SRS for positioning in RRC_INACTIVE, alignment between DRX beyond 10.24s and PRS, DL Positioning in RRC_IDLE.

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2. Accuracy, Integrity & Power consumption improvements

Proposed Objectives:

- Specify solutions for UE-based and LMF-based Integrity for RAT-dependent positioning techniques [RAN2, RAN3]:
  - Specify procedures and signaling for determination of positioning integrity, including identification of error sources [RAN2]
  - As a starting point, align error sources and procedures for GNSS positioning integrity, where possible.
- Specify solutions for PRS/SRS bandwidth aggregation for intra-band carriers considering [RAN4]
- Specify solutions for accuracy improvements based on NR carrier phase measurements for both UE-based and UE-assisted positioning [RAN1, RAN2, RAN3, RAN4]
  - Define new NR carrier phase measurements using existing DL PRS and UL SRS [RAN1, RAN4]
  - Signaling to support NR carrier phase measurements [RAN2, RAN3]
  - Define multipath mitigation methods for the carrier phase positioning [RAN1]
- Specify solutions for Low Power High Accuracy Positioning (LPHAP) [RAN2, RAN3, RAN4]
  - Specify positioning enhancements for UEs in RRC_INACTIVE and/or RRC_IDLE state
    - DL PRS measurements in RRC_IDLE
    - SRS for positioning in RRC_INACTIVE
  - Alignment between DRX beyond 10.24s and PRS

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3. RedCap Positioning

Motivation & justification

Rel-17 has specified support for RedCap UEs with reduced bandwidth support and reduced complexity including reduced number of receive chains.

Wearables & sensors for public safety, IoT, commercial use cases could support NR positioning functionality.

However, there is a gap in that the core and performance requirements that have not been specified for the positioning related measurements performed by RedCap UEs

Relevant TR 38.859 recommendations:

For positioning of RedCap UEs, support of PRS frequency hopping and SRS frequency hopping is recommended for normative work.

- During the normative work, the complexity of the corresponding capabilities for RedCap UEs should be addressed for the introduction of appropriate capabilities for RedCap UEs.

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3. RedCap Positioning

Proposed Objectives:

- Specify positioning support for RedCap UEs [RAN1, RAN2, RAN4]
  - Define support for PRS frequency hopping and SRS frequency hopping [RAN1]
  - Define RedCap UE positioning capabilities [RAN2]
  - Evaluate positioning performance requirements considering positioning accuracy and latency for positioning procedures and measurements with RedCap UEs [RAN4]

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Other Aspects of WID

Objective of Performance part WI:

- Define corresponding performance requirements and test cases for expanded and improved NR positioning [RAN4]

Work Item Leadership:

Primary: RAN1

Secondary: RAN2, RAN3, RAN4

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Proposal summary & conclusions

Timeline and prioritization:

There is a critical industry need for improved positioning performance across many verticals

A Rel-18 Work Item should be approved at RAN#98 with normative work beginning 1Q23 with appropriate TU budget allocation (update endorsed RP-221925)

Proposed High Level Objectives for core part:

1. Specify solutions for sidelink positioning and ranging
2. Specify solutions for accuracy, Integrity & Power consumption improvements
3. Specify positioning support for RedCap UEs

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Thank you!

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