Qualcomm

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RP-212045

Views on Positioning Evolution for Rel-18

Moderator's Summary of the email discussion (RP-210660)

- **Study/specify solutions (including reference signals, measurements, procedures, etc) for sidelink positioning considering the following: [RAN1, RAN2]**
  - To include ranging (i.e. relative positioning) and absolute positioning
  - Coverage scenarios to cover: in-coverage, partial-coverage and out-of-coverage
  - Requirements: Based on requirements identified in TR38.845 and TS22.261 and TS22.104
  - Use cases: V2X (TR38.845), public safety (TR38.845), commercial (TS22.261), IIOT (TS22.104)
  - Note: The next phase of discussion will include selection of use cases to be used for evaluation and design. This does not restrict use of the solutions for other use cases.
  - Spectrum: ITS, licensed
  - Coordination with SA2 as required (e.g. architecture aspects)

- **Improved accuracy, integrity, and power efficiency:**
  - Study/Specify solutions for Integrity for RAT dependent positioning techniques [RAN2, RAN1, Coordination with SA2 as required]
  - Study/Specify solutions for accuracy improvement based on PRS/SRS bandwidth aggregation and NR carrier phase measurements [RAN1, RAN4, RAN2]
  - Study the requirements on LPHAP as developed by SA1 and evaluate whether existing RAN functionality can support these power consumption and positioning requirements. Based on the evaluation, identify potential enhancements to help address any limitations [RAN1, RAN2]

- **Define positioning support for RedCap UEs, considering the following:**
  - Evaluate performance of existing positioning procedures and measurements with RedCap UEs[RAN1, RAN4]
  - Based on the evaluation, identify potential enhancements to help address possible limitations associated with for RedCap UEs [RAN1, RAN2]
  - Define performance requirements for positioning by RedCap UEs [RAN4]

Example Area 1 - Sidelink Positioning

- For Sidelink positioning, besides the moderator's summary, we believe the following are also essential for Rel-18:
  - **Support for sending SL-PRS on unlicensed spectrum**
    - SL-PRS requires large bandwidth to achieve the required accuracy for V2X, as is clear from Rel-16 and Rel-17 Uu PRS studies that assumed BWs such as 100MHz for FR1 and 400MHz for FR2. Current ITS band allocations cannot provide such BW. Furthermore, no operator has shown a plan to allow licensed bands to be used for SL-PRS for V2X use cases.
    - 3GPP's design for Sidelink Positioning has to address the very important automotive market. Without support of SL-PRS over unlicensed band, the requirements identified in TR 38.845 for V2X cannot all be achieved.
    - Similar to Uu Positioning, control signaling (e.g., configuration information & reporting) should be able to use same or different spectrum as the SL-PRS
    - SL-PRS can reuse existing NR-U channel access, as it is not a full sidelink communication. No heavy workload for 3GPP.

  - **Support the positioning operation with LTE V2X (for carrying control signaling)**
    - Due to the deployment situation and spectrum allocation, LTE V2X is expected to be operational in a large part of the world for a long time.
    - To allow fast market access to the 3GPP Sidelink Positioning solution, it is essential to design the positioning operation to be compatible with all V2X technology, including LTE V2X.
    - This can be achieved with a RAT-independent control signaling protocol design, with no additional workload for 3GPP.

Example Area 2 – Improved Accuracy, Integrity, Power (I)

Improved Accuracy

- Moderator's summary on accuracy improvement is the following:
  - *Study/Specify solutions for accuracy improvement based on PRS/SRS bandwidth aggregation and NR carrier phase measurements [RAN1, RAN4, RAN2]*

- We are in favor of specifying PRS/SRS Bandwidth Aggregation in NR Rel-18.
  - 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.

  - Spectrum of Interest:
    - Licensed Bands Examples: 200 MHz in 3400 MHz – 3600 MHz, 160 MHz in 2496 MHz – 2690 MHz, 150 MHz in 3550 MHz – 3700 MHz CBRS (US). In FR2 bands (e.g. 28GHz and 39GHz), BW aggregation could for example allow an effective 800MHz PRS BW by aggregating two PRS of 400MHz BW.
    - Unlicensed Bands - 3GPP specification does not prevent/preclude PRS to be sent in unlicensed spectrum even in NR Rel-17, even if further enhancements of PRS operation in unlicensed have not been explicitly specified.

  - RAN1 has already studied this enhancement in TR38.857 and concluded that it is beneficial for the purpose of improving positioning accuracy.

Example Area 2 – Improved Accuracy, Integrity, Power (II)

Improved Accuracy

- Moderator's summary on accuracy improvement is the following:
  - *Study/Specify solutions for accuracy improvement based on PRS/SRS bandwidth aggregation and NR carrier phase measurements [RAN1, RAN4, RAN2]*
- We have concerns regarding including carrier phase measurements in the scope of NR Rel-18 for the following reasons:
  - Strict requirements on network time/frequency synchronization is assumed
  - Implications to RF architectures/antennas/requirements for both UE & gNBs need a lot of further study.
  - Increased Sensitivity to multipath environments
    - This is applicable to outdoor, indoor, and factory environments of interest
  - Similar performance to other methods in LOS environments when considering realistic implementation constraints
  - 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 under realistic assumptions on scenarios and antenna/RF architectures.

Example Area 2 – Improved Accuracy, Integrity, Power (III)

Improved Integrity

- Moderator's summary on Integrity for RAT dependent methods is the following:
  - *Study/Specify solutions for Integrity for RAT dependent positioning techniques [RAN2, RAN1, Coordination with SA2 as required]*

- We make the following remarks:
  - The scope remains too broad and vague and requires further refinement.
  - Rel-17 supports "GNSS positioning integrity determination" only, since the potential system threats/"feared events" and corresponding positioning integrity determination schemes are different for each RAT-Independent method (e.g., GNSS, Sensors, WLAN, etc.). Similarly, the "integrity solutions" for "RAT-dependent methods" may be different for each method (e.g., DL-TDOA, UL-TDOA, multi-RTT, E-CID, etc.).
  - The feasibility of integrity for UE-assisted mode is unclear, even for GNSS-only positioning in Rel-17, which is a technology for which integrity has been worked on for several years now.
  - There was no feasibility study for RAT dependent positioning integrity before (i.e., the Rel-17 TR 38.857 studied GNSS integrity only).
  - There should be an effort to reduce the scope regarding which RAT-dependent positioning methods and modes need to be considered in Rel-18.

Example Area 2 – Improved Accuracy, Integrity, Power (IV)

Improved Power

- Moderator's summary on power consumption improvements is the following:
  - *Study the requirements on LPHAP as developed by SA1 and evaluate whether existing RAN functionality can support these power consumption and positioning requirements. Based on the evaluation, identify potential enhancements to help address any limitations [RAN1, RAN2]*

- We make the following remarks:
  - The above scope remains too broad and vague and requires further refinement
  - There should be an effort to reduce the scope further regarding what enhancements are considered, given the long list of items that have been considered in this summary

  - Suggest to include it within the Redcap Positioning scope, or provide more specific areas for enhancement, such as the following, which may then be applicable to all device classes and not necessarily only to LPHAP:
    - Enhancements on RRC Idle/Inactive for DL&UL Positioning
    - DRX-Aware Positioning

Example Area 3 – RedCap Positioning

- Moderator's summary on RedCap Positioning is the following:
  - *Define positioning support for RedCap UEs, considering the following:*
    - *Evaluate performance of existing positioning procedures and measurements with RedCap UEs[RAN1, RAN4]*
    - *Based on the evaluation, identify potential enhancements to help address possible limitations associated with for RedCap UEs [RAN1, RAN2]*
    - *Define performance requirements for positioning by RedCap UEs [RAN4]*

- We are supportive of the suggested summary with the following note to be added:
  - Note: The scope of the evaluation and study of the potential enhancements should also include eRedcap features (e.g., 5 MHz BW support [if sought for RedCap evolution], relaxed timelines)

  - Example of potential enhancements:
    - PRS frequency hopping for increased timing resolution
    - Angular method Positioning Enhancements (e.g., DL-AoD Positioning) which are less sensitive to the small operational bandwidth of Redcap devices

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