

Discussion on RRM objective for NR CPP

Agenda Item:	9.3.1.9
Source:	Intel Corporation
Document for:	Discussion/Decision



Background

- At RAN #98e, the following objectives on introduction of NR DL and UL Carrier Phase Positioning (CPP) were approved as part of the new Rel-18 WI on Expanded and Improved NR Positioning:
 - *Specify physical layer measurements and signalling to support NR DL and UL carrier phase positioning for UE-based, UE-assisted, and NG-RAN node assisted positioning [RAN1, RAN2, RAN3, RAN4].*
 - *Existing DL PRS and UL SRS for positioning are used for NR carrier phase measurements.*
 - *Specify measurements that are limited to a single carrier/PFL.*
 - *Specify corresponding new core requirements, as well as identifying and specifying the impact on the existing RAN4 specification, including RRM measurements **without** measurement gaps in connected and inactive mode (including PRS measurement period/reporting) and procedures [RAN4].*
- The restriction to limiting the DL Carrier Phase (CP) measurements to the case without using Measurement Gaps (MGs) was primarily motivated to limit the RAN4 RRM workload compared to supporting DL CP measurements with and without MGs.
- However, as elaborated in the following, the restriction to the case without using MGs can be severely restrictive impacting the applicability and performance/UE power consumption for the feature.

Impact of limiting DL CP measurements to without MGs

- Since Rel-16 DL positioning methods involving measurements on DL PRS have been defined to use MGs.
 - This enables a decoupling of the frequency domain configuration for DL PRS and the active DL BWP of a UE as well as enables measurements of non-serving cells with potentially large Rx timing difference with respect to the serving cell's Rx time.
 - The decoupling of DL PRS location and bandwidth (BW) from that of active DL BWP enables configuration of much larger BW for DL PRS (that translates to higher positioning accuracy) compared to the BW necessary for DL communications, thereby avoiding unnecessary UE power consumption by having to configure a large active DL BWP only for DL PRS reception.
- In Rel-17, MG-less DL positioning methods were introduced via the introduction of Positioning Processing Windows (PPWs) to enable low latency positioning.
- With the current WID objective limiting NR DL CPP to without MGs, the DL PRS used for DL CP measurements needs to be confined to within a UE's active DL BWP
 - This implies that either the DL PRS BW may be constrained to within active DL BWP, potentially impacting positioning accuracy or result in increased UE power consumption if active DL BWP is configured to be larger than necessary for DL communications.
 - NOTE: For most practical implementation options involving CIR estimation, positioning accuracy of CPP can be expected to be a function of the DL PRS BW.
- In addition, there would also be an additional dependency on UE's and NW's support of PPWs for support of DL CPP as well as constraints on relative Rx time difference between TRPs for which a target UE may measure CPs.
 - It is currently expected that one of the most typical use of NR CPP would involve cases wherein the CP-related measurements are reported along with existing positioning methods, e.g., RSTD or UE Rx-Tx time difference for DL. Thus, it would be desirable to enable the DL CPP feature to be combined with the most typical configurations for existing DL positioning methods, which happens to be those assuming use of MGs.

Potential solutions

- To address the undesirable impact of the current WI objective for NR CPP, the following could be considered:
 - Alt 1: Limit the DL CP measurements to with MGs
 - Alt 2: The DL CP measurements are defined for both with and without MGs
- Considering that the original restriction was agreed in view of limiting RAN4 RRM workload and that Alt 2 can be seen as an up-scoping of the WI objective, Alt 1 is preferred.
 - This can also avoid potential new discussions in RAN4 on prioritization (if different from current PPW formulation) for DL CPP, especially if DL CPP may be introduced as a standalone positioning method.

Proposal

- To address the undesirable impact of the current WI objective for NR CPP when limited to MG-less operation, the following is adopted:
 - Alt 1: Limit the DL CP measurements to with MGs instead of w/o MGs
- Update the objective of NR CPP as follows:
 - *Specify physical layer measurements and signalling to support NR DL and UL carrier phase positioning for UE-based, UE-assisted, and NG-RAN node assisted positioning [RAN1, RAN2, RAN3, RAN4].*
 - *Existing DL PRS and UL SRS for positioning are used for NR carrier phase measurements.*
 - *Specify measurements that are limited to a single carrier/PFL.*
 - *Specify corresponding new core requirements, as well as identifying and specifying the impact on the existing RAN4 specification, including RRM measurements ~~without~~ measurement gaps in connected and inactive mode (including PRS measurement period/reporting) and procedures [RAN4].*
- A draft revised WID, capturing the above, is provided in RP-230328.

intel®