**3GPP TSG RAN WG1 Meeting #110bis-e R1-22xxxxx**

**e-meeting, Oct 10th – 19th, 2022**

**Source: Intel Corporation, CATT, Ericsson**

**Title: Post-meeting Comments to Draft TR 38.859 v020: Study on expanded and improved NR positioning**

**Agenda item: 9.5**

**Document for: Discussion**

# Introduction

A draft for TR 38.859: Study on expanded and improved NR positioning incorporating decisions until week #1 of RAN1 #110bis meeting are presented.

This document aims to collect any feedback to the draft TR shared in [DRAFT 3GPP\_TR\_38.859\_v0.2.0\_r6](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/9.5%28FS_NR_pos_enh2%29/post-110bis-e-02_TRreview/DRAFT%203GPP_TR_38.859_v0.2.0_r6.docx).

Please follow the naming convention in this example:

* *Post-meetingComments to draftTR38859v020-v000.docx*
* *Post-meetingComments to draftTR38859v020-v001-CompanyA.docx*
* *Post-meetingComments to draftTR38859v020-v002-CompanyA-CompanyB.docx*
* *Post-meetingComments to draftTR38859v020-v003-CompanyB-CompanyC.docx*

If needed, you may “lock” a spreadsheet file for 30 minutes by creating a checkout file, as in this example:

* Assume CompanyC wants to update *SLPosScenReq\_FLS-v002-CompanyA-CompanyB.docx*.
* CompanyC uploads an empty file named *SLPosScenReq\_FLS-v003-CompanyB-CompanyC.checkout*
* CompanyC checks that no one else has created a checkout file simultaneously, and if there is a collision, CompanyC tries to coordinate with the company who made the other checkout (see, e.g., contact list below).
* CompanyC then has 30 minutes to upload *SLPosScenReq\_FLS-v003-CompanyB-CompanyC.docx*
* If no update is uploaded in 30 minutes, other companies can ignore the checkout file.
* Note that the file timestamps on the server are in UTC time.

Please note that there is NO need to send an info email to the reflector just to inform that you have uploaded a new version of this document. Companies are invited to enter the contact info in the table below.

# Company views

Please provide any feedback to the latest version of the draft TR below.

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| Company | Comments |
| CATT | Very minor editorial comments related to CPP:6.3 NR Carrier Phase Positioning…For the purposes of discussion, for NR downlink and/or uplink carrier phase positioning, the carrier phase (CP) at a RF frequency at a receiver is a phase that is a function of the signal propagation time from a Tx antenna reference point of a transmitter (e.g., a TRP or a UE) to an Rx antenna reference point of the receiver (e.g., a UE or a TRP). The propagation time can be expressed in a fractional part of a cycle of the RF frequency and a number of integer cycles, but the CP may be independent of the number of integer cycles.…6.3.1 Potential Solutions for NR Carrier Phase Positioning…The use of positioning reference unit (PRU) to facilitate NR carrier phase positioning is studied. * For DL NR carrier phase positioning, a PRU works as a UE to receive the DL PRS reference signals and provide the DL carrier phase measurements to the LMF, where the double differential measurements can be obtained by the difference of the DL carrier phase measurements from the target UE and those from the PRU for eliminating the measurement errors.
* For UL NR carrier phase positioning, a PRU works as a UE to transmit the UL SRS signals for positioning purpose. The TRPs provide the UL carrier phase measurements obtained from the UL SRS signals of the target UE and of the PRU to the LMF, where the double differential measurements can be obtained by the difference of these UL carrier phase measurements for eliminating the measurement errors.

…6.3.2 Summary of Evaluations for NR Carrier Phase Positioning…The effectiveness of using double differential technique with PRU to eliminate the impact of the initial phases of the transmitter and the receiver on NR carrier phase positioning are evaluated in the study item. The evaluation results from the sources ([73], [75], [76], [77]) show that the initial phases of the transmitter and the receiver can be removed effectively by the double differential technique with the use of PRU:* Source [73] shows the positioning accuracy of <1cm (80%) for Inf-SH and < 1cm (50%) for Inf-DH can be reached when the PRU is located within a distance of 5m from the target UE.
* Source [75] shows the positioning accuracy of <1cm (80%) for Inf-SH and <1cm (50%) for Inf-DH can be reached under the condition that the PRU is located in a fixed location in LOS of the TRP.
* Source [77] shows that the accuracy of <1cm (50%) when the PRU is located within 1m of the target UE. However, the effectiveness reduces when the PRU is located away from the target UE because the channel conditions of the PRU is different from the target UE.
* Note: in the above results, all other error sources (except initial phase error) were not modelled.

The impact of the residual CFO at the transmitter and the receiver for NR carrier phase positioning are evaluated during the study item.* The evaluation results from the sources ([73], [76]) show that the impact of residual CFO on carrier phase positioning is negligible.
* The evaluation results from the source ([75]) show that the impact of the residual CFO on the performance of carrier phase positioning can be mitigated with the use of the double differential technique with a PRU that is located at a fixed location in LOS of the TRP.
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