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

**e-meeting, Oct 10th – 19th, 2022**

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

**Title: 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 [R1-2210233](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/R1-2210233.zip).

Please follow the naming convention in this example:

* *Comments to draftTR38859v020-v000.docx*
* *Comments to draftTR38859v020-v001-CompanyA.docx*
* *Comments to draftTR38859v020-v002-CompanyA-CompanyB.docx*
* *Comments 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 draft TR shared in [R1-2210233](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/R1-2210233.zip) below.

|  |  |
| --- | --- |
| Company | Comments |
| InterDigital | Thank you very much for capturing and compiling agreements. We may have more comments later but here are some comments related to 6.1.1.* Could we assume that all proposals that are relevant to studies will be removed from the final version of TRP, for example the paragraphs starting with “For timing-based positioning methods, the following error sources are studied:…”.

[moderator] In general, yes, unless it may be useful information for the TR to document what aspects/details were studied. However, for the particular example you cite, I believe we can remove eventually since the result of the identified error sources would be sufficient.* Could we assume that error sources with FFS be removed from Table 6.1.1-1 in the final version of TR if they are not resolved by the end of the study item? These are error sources under the study and only identified error sources should appear in Table 6.1.1-1.

[moderator] Yes, all “FFS”s would be removed in the final version of the TR. They are currently in place to ensure nothing significant is lost and for some cases, to keep the flow of the discussion/study considerations. * In Table 6.1.1-2, in the second column first row, could you change “Distribution for error model” to “Candidate(s) for distribution for error source” since more than one distribution were identified as a candidate for some error sources (e.g., inter-TRP sync error)

[moderator] Done.* Similarly, could you change the heading of Table 6.1.1-2 to “Identified candidates of distributions to model the errors due to different error sources”

[moderator] Done.* For Table 6.1.1-1, we should differentiate UE-based/assisted DL-TDOA or DL-AoD in the table. For example, for UE-assisted DL-TDOA, RSTD measurement is an error source. For UE-based DL-TDOA, TRP location or inter-TRP sync error are error sources.

[moderator] The table is put together based on the RAN1 agreements. However, they are already separated, right? Wouldn’t “UE-assisted DL-TDOA” be equivalent to “LMF-based DL-TDOA” in this context? * If it helps, in the FL’s summary (R1-2209460 or R1-2210428), Figure 1 illustrated association between error sources, different positioning methods and integrity mode. It can be used instead of Table 6.1.1-1, if the editor prefers.

[moderator] Thanks! Since we are still studying the error sources, it may be better to use an easily-editable table as against a figure at this point. Then, we can replace the table with your figure for the final version in November.  |
| CMCC | Thank you Debdeep for the efforts, some quick comments regarding LPHAP sections:1) Regarding the newly added agreement under Section 6.4.1 of enhancements on SRS, in my views, this is just an agreement for further study the potential solutions, and I’m not sure if it is needed to be captured in the TR. In the next meeting, if such enhancements are agreed to be recommended for normative work, then it can be captured under Section 6.4.3, no?[moderator] It has been captured to document which aspects have been studied. Certainly, the FFS bullets would be removed in the final November version. If in the end we have no recommendations or even observations (implying that the study was not conclusive) for these points, it can be removed in the final November version. Also, based on feedback from Nokia, now, a new subclause has been added. Perhaps we could also consider adding a sentence on the study of extending paging DRX cycles beyond 10.24s?2) Regarding the following two conclusions under Section 6.4.2:* Evaluations show that UE (re)entering RRC\_CONNECTED state to obtain SRS (re)configuration increases power consumption.
* Evaluations show that extending paging DRX cycles beyond 10.24s provides power saving gains with respect to that with the baseline DRX cycle of 1.28s and is beneficial towards meeting the device battery life requirement.

As these are intermediate conclusions to encourage companies to further provide additional results in the next meeting so that proper observations can be made, I don’t think these two conclusions should be captured in the TR.[moderator] OK, it was not clear 😊. Removed now.  |
| CATT | Thanks for the great effort. Some initial comments regarding carrier phase positioning in Section 6.3.1:1. Suggest moving the 1st sentence to the end of the Section.

[moderator] Done.1. Suggest adding the new agreement “For UL UE-assisted NR carrier phase positioning, at least conside the carrier phase measured from the UL SRS for positioning purpose…” after the paragraph “For UE-assisted NR carrier phase positioning, at least the following options are considered…”.

[moderator] Sure – the decisions since the weekend will be captured in the next iteration tomorrow. 1. Suggest change “For UE-assisted NR carrier phase positioning, at least the following options are considered…” to “For DL UE-assisted NR carrier phase positioning, at least the following options are considered…”, since we have use “For UL UE-assisted NR carrier phase positioning…” in another agreement.

[moderator] Done.1. Suggest moving the paragraph of “The impact of integer ambiguity on NR carrier phase positioning and potential solutions to resolve the integer ambiguity…” after the new “new agreement “For UL UE-assisted NR carrier phase positioning…”

[moderator] Done.1. Suggest adding a new paragraph to capture the new agreement “The impact of multipath/NLOS on NR carrier phase positioning is evaluated during the study item…”

[moderator] Sure – the decisions since the weekend will be captured in the next iteration tomorrow. 1. Suggest adding a new paragraph in Section 6.3.1, saying that “The potential Solutions for NR Carrier Phase Positioning are evaluated with the consideration of v*arious error sources, which include: Phase noise (FR2), carrier frequency offset (CFO)/Doppler, oscillator-drift, transmitter/receiver antenna reference point (ARP) location errors, transmitter/receiver initial phase error, antenna phase center offset (PCO) etc. More detailed evaluation methodology and assumptions are presented in Annex A.3.”*

[moderator] While it appears a bit redundant given the details as part of evaluation assumptions, it may be ok to capture it in 6.3.1. I have added the paragraph with some minor editorial adjustments.  |
| Nokia/NSB | Thanks, Debdeep for the great efforts to update the TR. A few comments from our side: * Is the plan to go back to the TR after next meeting and remove all the FFS point (not just “~~FFS~~” but the text that follows too e.g., “~~FFS: XYZ~~”? If so maybe we should just remove them all now? Our understanding is that the final TR should have FFS in it.

[moderator] Yes, indeed, the final post-RAN1 #111 version of the TR will not have any FFS (including corresponding texts). However, it would be good to keep them for now for couple of reasons:* They serve as a reminder for the group – that we should target to resolve these aspects from the perspective of the TR by November.
* For some decisions, helps maintain the continuity/context.

Again, to emphasize, they will all be removed with appropriate adjustments/updates regardless of whether they are resolved or abandoned or left for WI stage. * For table 6.1.1-2 we should highlight somehow that for inter-TRP synchronization error that these are "candidates for modelling”. The suggestion from IDC seems reasonable

[moderator] Done.* Should the agreement on frequent SRS configuration update be captured in 6.4.1 which is about use cases/requirements? Maybe a new sub-section is needed on studied enhancements which could bring some benefit to the TR in our view

[moderator] We could try that. A new sub-section is now added on “Potential enhancements for Low Power High Accuracy Positioning”. Perhaps we could also consider adding a sentence on the study of extending paging DRX cycles beyond 10.24s? |
| Qualcomm | Thank you Depdeep for all your work updating the TR.We noticed some agreements are not captured. Could you clarify if you plan on capturing them this meeting? For example:* RAN1 agreed to introduce a new SL PRS signal, but the TR only captures that RAN1 is studying existing or new signals. This is a general comment for agreements where RAN1 agreed to introduce/support something. Are such agreements expected to go in Section 5.4?

[moderator] Procedurally, we cannot capture introducing something for normative work as part of the study clauses. Note that, we are saying “New reference signal designs … are studied” (“existing or new signals” has been updated from the earlier meeting’s decision to reflect the recent agreement). Then, we would capture in Clause 5.4 w.r.t. spec impact, and also as recommendations as part of the Conclusion. The final decision on actual introduction of new features/designs would be subject to WI approval.* Will the agreed terminology eventually be captured in Section 3.1?

[moderator] Thanks for the catch! Somehow they got left out when translating from a temporary version I was working on earlier. Now added to Section 3.1.* The following two agreements:

**Agreement**Regarding Scheme 2 SL-PRS resource allocation, study at least the following aspects:* Resource selection mechanism for SL-PRS
* Inter-UE coordination
* Aspects for congestion control mechanisms for SL-PRS

**Agreement**Study power control mechanisms for SL-PRS transmission, including whether it is necessary.[moderator] Thanks! They are now added to Subclause 5.2.1.3. |
| Moderator | An updated version of the draft, incorporating updates in response to the suggestions received above, is now available as [DRAFT 3GPP\_TR\_38.859\_v0.2.0\_r1](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/9.5%28FS_NR_pos_enh2%29/TR38.859_review/DRAFT%203GPP_TR_38.859_v0.2.0_r1.docx) in the [Drafts folder](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/9.5%28FS_NR_pos_enh2%29/TR38.859_review).A further update to include the decisions since the weekend (including those approved by email) will be provided by around Wednesday GTW time. |
| CMCC2 | Thanks Debdeep for further revision and clarification.We are fine to add a new sub-section 6.4.2 to collect potential solutions to be studied, which is also aligned with other agenda items.Regarding the comment on adding a sentence on the study of extending paging DRX cycles beyond 10.24s, I think we can wait and see how the discussion on proposal 5.2 under LPHAP AI goes. If companies are fine with adding such bullet, then it will be captured as an agreement in this meeting to section 6.4.2. Otherwise, my understanding is that in the next meeting, we will definitely have corresponding observations on this, so I think we can wait till next meeting.  |
| Huawei, HiSilicon | Thanks the updated TR.Please find some comments:1. 5.2.1.3, when saying reservation of SL-PRS under option 2, the following agreement can be also captured:

***With regards to reservation of SL-PRS, it can be considered based on the Option 1 or Option 2 from the previous corresponding RAN1 #109 agreement.***[moderator] Agree; “reservation” is now added as “configuration/ activation/ deactivation/ triggering/ reservation” to the sentence preceding Options 1 and 2.1. 5.2.1.3, the paragraphs regarding measurements should be removed to 5.2.1.1?

[moderator] Done.1. Under 6.3.1, should capture the following agreement?:

***Agreement**** ***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 an Tx antenna reference point of a transmitter (e.g., a TRP or a UE) to a 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.***[moderator] Indeed! Now added, but to Clause 6.3.1. Duplicated “necessarily” in sentence *“It should be noted that the use of “carrier phase positioning” does not necessarily imply that it may necessarily be defined as a standalone positioning method.*” under 6.3.1?

[moderator] Fixed. Also, moved the sentence to the end of the subclause as it seems like a more appropriate location.1. The fonts in Table A.3-1 and in Table A.4-1 are not fully unified.

[moderator] Fixed. Also, fixed few other misaligned fonts across other tables. Thanks!1. The performance requirement in Table A.4-1 should be captured in the main body of the TR, e.g., 6.4

[moderator] Done; just left the last note in Table A.4-1 as it is essentially an assumption for evaluations that follow from the perf. requirements considered.  |
| InterDigital 2 | Thank you very much for the reply. Regarding the moderator’s question, [moderator] The table is put together based on the RAN1 agreements. However, they are already separated, right? Wouldn’t “UE-assisted DL-TDOA” be equivalent to “LMF-based DL-TDOA” in this context? Yes, error sources listed for LMF-based integrity mode are applicable to “UE-assisted DL TDOA”. As long as our understanding is aligned the current table is fine.We have one more comment. For LMF-based integrity mode, DL-AoD, “RSTD measurement” is listed as an error source. Do you know which agreement it came from? The relevant agreement is the following, but the agreement lists RSTD measurement as an error source for DL-TDOA.**Agreement*** For LMF-based positioning integrity mode, at least the followings are error sources for timing related measurements :
	+ RSTD measurement is an error source for DL-TDOA
	+ RTOA measurement is an error source for UL-TDOA
	+ UE Rx-Tx time difference measurement is an error source for Multi-RTT
	+ gNB Rx-Tx time difference measurement is an error source for Multi-RTT
* FFS : Model of the error source (e.g., distribution, mean and/or standard deviation for integrity overbounding model, range)
* Note : Definition of “LMF-based positioning integrity mode” can be found in Table 9.4.1.1.1 in TR 38.857

[moderator] Sorry, it was a copy-paste error; now fixed. |
| CATT | Thank Depdeep for updating the TR.**Comment 1:** Suggest capture the following agreement after the paragraph: “For DL UE-assisted NR carrier phase positioning, at least the following options are considered…”**Agreement**For UL UE-assisted NR carrier phase positioning, at least consider the carrier phase measured from the UL SRS for positioning purpose.* Note: The use of MIMO SRS for positioning purpose is transparent to UE.

**Comment 2:** Suggest capture the following agreement after the paragraph: “The impact of integer ambiguity on NR carrier phase positioning and …”**Agreement**Capture the following TP into TR 38.859 as a conclusion (for Section 6.3.1):* The impact of multipath/NLOS on NR carrier phase positioning is evaluated during the study item. Based on the study, it is concluded that multipath/NLOS deteriorates the performance of carrier phase positioning and it is necessary to consider multipath mitigation for NR carrier phase positioning.
* The evaluation results for the impact of the multipath/NLOS on NR carrier phase positioning will be presented in Section 6.3.2.

**Comment 3:** Suggest capture the following agreement in Table A.3-1: for the row of “Initial phase of a transmitter” and “Initial phase of a receiver”**Agreement**Add the following note to the previous agreement on error modelling of the initial phase:* Note: The initial phases of a transmitter for different carriers can be assumed to be independent of each other. Similarly, the initial phases of a receiver for different carriers can be assumed to be independent of each other.

[moderator] All added in revision r2.  |
| Ericsson | Thanks to the rapporteur for the tremendous effort. Below are some comments on the current TR version:1. General comment: Maybe a sentence in the evaluation clause should map to the evaluation methodology clause. For example, add that “The methodology for the evaluation of SL positioning can be found in annex A.1” in clause 5.3

[moderator] Done!SL positioning:1. Section 5.1 FR2 is agreed to be optional for SL positioning evaluation. Suggest to capture that FR2 was optional in the sentence.

[moderator] Done!1. In 5.2.1.1, the first sentence sais that the different methods “should be introduced”. Since SL-AOD is FFS, we prefer it is not included in the text yet.

[moderator] The text is changed from “should be introduced” to “are identified for possible introduction” since the former would not be appropriate to have in the study-related sections; we can capture those as part of recommendations in the Conclusions section. Then, the FFS point (on AoD) is left for now; as with other FFSs would be removed next meeting if not agreed.1. Very minor typo in the requirements, for relative speed: the shorthand for “hour “ is h, not hr. (the typo was present in the agreement).

[moderator] Fixed! 1. In the v2x set A and set B requirements, the “”and” should be replaced by “or” also for vertical accuracy.

[moderator] Fixed!1. Suggest to move the definition of SL-TDOA to the list of methods that should be introduced, as a sub-bullet.

[moderator] Done!1. Remove “at least” from the list of aspects considered page 16. It can be completed later on if needed.

[moderator] OK1. SL PRS is never mentioned prior to the first sentence in 5.2.1.2. suggest to flip the order of the first sentence on numerology and the next sentence, and mention that the new signal is herein refered as SL PRS.

[moderator] Done!1. I don’t think we have any agreement beside an FFS on “Resource allocation for SL-Positioning measurement reports are also included in the study.”, therefore, I suggest to remove it for now.

[moderator] To have consistent handling across different topics on FFS aspects, prefer to keep it for now. We can remove it if there is no other agreement on this aspect next meeting.1. For the SL measurement report, the list of potential element can be merged into the aspects studied, as a sub-bullet of the report content.

[moderator] Done!1. In my view the agreed wording on the consideration on flexibility, overhead, latency and reliability “as/if needed” is a bit strange and does not read well. I would suggest to remove “as / if needed” from the TR sentence, it is clear enough that we are considering the issues.

[moderator] Done!Integrity:1. Propose to remove FFS items in the TR.

[moderator] All FFS items will be cleaned up in Nov.1. Minor editorial comment. In some part of the TR we use Gaussian distribution, other we use Normal. If possible, would be good to refer to only one term.

[moderator] Good point; changed all to Gaussian dist.1. The following agreement seems to be missing :

**Agreement**Capture the following into the TRFor UE-based positioning integrity mode, potential specification impacts related to errors in assistance data (e.g., to inter-TRP synchronization error and TRP locations) are at least enhancements in assistance data sent from the LMF to the UE (e.g., inclusion of parameters related to the error sources)  * 1. Note : Definition of “UE-based positioning integrity mode” can be found in Table 9.4.1.1.1 in TR 38.857

[moderator] Captured in r2 of the Draft.LPHAP:1. Propose to remove FFS items in the TR.

[moderator] All FFS items will be cleaned up in Nov.1. The power model for ultra deep sleep should be captured somehow in order to understand the observation.

**Agreement**For the LPHAP study only:* For the power consumption model of the ultra-deep sleep type, adopt the following option (i.e. revision of option 1 from previous agreement):
	+ The relative power unit: 0.015
	+ Additional transition energy: 10000
		- Note: Power consumption analysis from individual companies with additional transition energy of 5000 can be optionally evaluated and captured in the TR.
	+ Total transition time: 400ms
* Note: Power consumption analysis from individual companies with Option 2 (revised from previous agreement) can be optionally evaluated and captured in the TR.
	+ Option 2 additional transition energy is revised from 450 to 480.
* Note: No new device type is expected based on ultra-deep sleep power modeling.

[moderator] They are captured in **Table A.4-4: Power consumption model for ultra-deep sleep state**.CPP:1. Propose to also include the note from the agreement that “ The use of MIMO SRS for positioning purpose is transparent to UE.” For the reference signal description in 1st paragraph of 6.3.1

[moderator] Added.Redcap Pos:1. Propose to move the first paragraph of 6.5.1 as the last paragraph of 6.5.1, or as part of the methodology annex.

[moderator] Moved to the end of 6.5.1. |
| Moderator | An updated version, including all decisions, relevant for the TR, up until Week #2 Tuesday GTW session are now captured in version [DRAFT 3GPP\_TR\_38.859\_v0.2.0\_r2](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/9.5%28FS_NR_pos_enh2%29/TR38.859_review/DRAFT%203GPP_TR_38.859_v0.2.0_r2.docx) in the [Drafts folder](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/9.5%28FS_NR_pos_enh2%29/TR38.859_review).Also, all comments received so far have been addressed in this version. |
| CATT | Thank Depdeep for updating the TR. Minor comments for CPP:1. At the end of the 1st paragraph, it has “Note that the use of MIMO SRS for positioning purpose is transparent to UE”. This seems to be duplicated. The same note is already included after “For UL UE-assisted NR carrier phase positioning, at least the…”

[moderator] This is added per request from Ericsson. We can remove the second occurrence. 1. Should “The study of the accuracy improvement based on NR carrier phase measurements included” be “The study of the accuracy improvement based on NR carrier phase measurements includes”?

[moderator] Yes, thanks! Fixed. |
| Moderator | An updated version, to incorporate the above suggestions from CATT for CPP is now available as DRAFT 3GPP\_TR\_38.859\_v0.2.0\_r3 in the [Drafts folder](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/9.5%28FS_NR_pos_enh2%29/TR38.859_review). |
| Huawei, HiSilicon | Thanks for the update. We have a couple of additional comments on r3 excluding those agreements made today.1. 5.2.1.3, we think that the following agreement could be captured.

**Agreement**From RAN1 perspective, the following cast types of SL-PRS transmission can be introduced for SL positioning: Unicast, Groupcast (not including many to one)* Broadcast (as a working assumption).
* FFS: Applicability of the above cast types

[moderator] Given the nature of this agreement and since it may not be possible to capture phrases like “from RAN1 perspective” in the TR, it’d be better to wait until next meeting to see if we can have a bit more “stable version” in Nov.  1. 6.3.1, we think that the Note in the agreement on MIMO-SRS could be added after “For UL UE-assisted NR carrier phase positioning, at least the carrier phase measured from the UL SRS for positioning purpose is considered.”, for example,

It is worth noting that the use of MIMO SRS for positioning purpose is transparent to the UE.[moderator] With a similar sentence added at the beginning of the subclause, we may not need to repeat again.“Existing DL PRS and UL SRS for positioning can be re-used as the reference signals to enable positioning based on NR carrier phase measurements for both UE-based and UE-assisted positioning. Whether to consider enhancements of the existing DL PRS and UL SRS for better positioning performance is to be studied further. Note that the use of MIMO SRS for positioning purpose is transparent to UE.”1. 6.3.1, the following paragraph is duplicated from the first paragraph in A.3.

NR carrier phase positioning performance is evaluated at least with the carrier phase measurements of a single measurement instance.[moderator] Thanks! The one in A.3 is now removed.1. 6.4.3, we noticed that some observations on LPHAP were deleted according to comments from the FL. We wonder whether the following conclusion should be captured or not (currently it is not captured in the TR)

**Conclusion*** Evaluations show that minimizing gaps between PRS/SRS/paging/reporting/synchronization RS reduces the power consumption;
* Note: This intermediate conclusion may be updated before capturing it in the TR if new/different evaluations are provided and to add information about the number of sources.

[moderator] Based on previous inputs from the FL, it would be better to leave it out to have consistent handling for all three intermediate conclusions. Let’s come back to these in Nov. 1. A.4, “Option 2” appearing in Note 3 of Table A.4-4 should be changed to “Mode B”.

[moderator] Thanks! One got left out 😊. Fixed now. |
| Moderator | An updated version, to incorporate the above suggestions from Huawei/HiSi and the decisions from Week #2 Wednesday GTW is now available as [DRAFT 3GPP\_TR\_38.859\_v0.2.0\_r4](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/9.5%28FS_NR_pos_enh2%29/TR38.859_review/DRAFT%203GPP_TR_38.859_v0.2.0_r4.docx) in the [Drafts folder](https://www.3gpp.org/ftp/tsg_ran/WG1_RL1/TSGR1_110b-e/Inbox/drafts/9.5%28FS_NR_pos_enh2%29/TR38.859_review). |