3GPP TSG-RAN WG1 Meeting #122 Tdoc R1-25xxxxx

Bengaluru, India, August 25th – 29th, 2025

Agenda Item: 8.1.2

Source: Moderator (Ericsson)

Title: Summary #1: maintenance of specification support for positioning accuracy enhancement

Document for: Discussion, Decision

# Introduction

This document summarizes the discussions during RAN1#122 for the agenda item 8.1.2, the maintenance of Rel-19 specification support for AI/ML positioning accuracy enhancement.

# TP to 38.215 on the measurement definitions

## Companies’ view from contribution

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| * ZTE Corporation, Sanechips (R1-2505484)   *Proposal 1: RAN1 endorses the definitions for “UL time domain channel timing (UL TDCT)” and “UL time domain channel timing-power (UL TDCTP)” in editor CR for TS 38.215* |
| * NEC (R1-2505925)   Proposal 5: The current specification in TS 38.215 sufficiently reflects RAN1’s agreement on enhanced measurement. No new discussion is needed on how to capture it. |
| * Samsung (R1-2505531)   TS 38.215 (V19.0.0)  5.2.9 UL SRS time domain channel timing (UL SRS-TDCT)   |  |  | | --- | --- | | **Definition** | UL SRS time domain channel timing (UL SRS-TDCT) is defined as values of timing information of the estimated channel response in time domain, , corresponding to the resource elements carrying sounding reference signals (SRS), the values are derived from consecutive time instances with timing granularity that start from the first detected path rounded down with timing granularity , where and are given by higher layers and is given in Clause 4.1 of [3, TS38.211], and *k* is the reporting granularity factor given by higher layer parameter *timingReportingGranularityFactor*. The values of timing information are selected such that they correspond to the time instances with the highest power values among the consecutive time instances where a power value for a time instance is determined as the power of linear average of the estimated channel response from resource elements carrying sounding reference signals (SRS) at time instance .  … | |

## 1st round discussion

NEC (R1-2505925) and ZTE (R1-2505484) contributions propose to confirm what is in existing specification, and therefore we do not see further action for the group. Samsung (R1-2505531) submitted a text proposal to update slightly TS 38.215 v19.0.0, see TP copied in section 2.1 above.

Please share your view whether Samsung TP can be endorsed. And if not, what further updates are needed. Note that Samsung (R1-2505531) has provided other information necessary for CR: reason for change, summary of change, consequences if not approved. Please provide feedback if anything needs to be revised there, if the TP is endorsed.

**Proposal 2.2**

Endorse the text proposal to TS 38.215 v19.0.0 in R1-2505531.

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| **Company** | **Comments** |
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# TP to 38.214: Update PRU description

## Companies’ view from contribution

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| * Samsung (R1-2505531)   Observation 1: the PRU in AI pos should not be tied with CPP method.   |  |  | | --- | --- | | **Suggested text proposal** | TS 38.214 (V19.0.0)  5.1.6.5 PRS reception procedure  ================= text omitted===============================  Within each window indicated by *NR-DL-PRS-MeasurementTimeWindowsConfig*, the UE expects that the indicated DL PRS resource sets across all *dl-PRS-IDs* are from one DL PRS positioning frequency layer, and that the number of indicated DL PRS resource sets associated with each *dl-PRS-ID* are the same.  The UE may be provided with *NR-PRU-DL-Info* which contains DL RSTD, DL PRS-RSRP, and/or DL PRS-RSRPP measurement(s) performed by a positioning reference unit (PRU) [20, TS 38.305], the timestamps associated with the measurements, and the location information of the PRU.  ================= text omitted=============================== | |

## 1st round discussion

Samsung (R1-2505531) submitted a text proposal to TS 38.214 v19.0.0 section 5.1.6.5, see TP copied in section 3.1 above.

Please share your view whether Samsung TP can be endorsed. And if not, what further updates are needed. Note that Samsung (R1-2505531) has provided other information necessary for CR: reason for change, summary of change, consequences if not approved. Please provide feedback if anything needs to be revised there, if the TP is endorsed.

**Proposal 3.2**

Endorse the text proposal to TS 38.214 v19.0.0 in R1-2505531.

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| **Company** | **Comments** |
| HW/HiSi | The motivation for the suggested text addition within the section on PRS reception procedure in 38.214 is unclear. Note that RAN2 is also discussing about the provision of PRU information in their running CR of 37.355, i.e., also for Case 1. |
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# Higher layer parameters

## LPP parameters

### Companies’ view from contribution

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| * InterDigital, Inc. (R1-2505829)   Proposal 1: Info #1 ~ Info #15 in Table 8.12.2.1.0-1 in 38.305 should be provided in assistance information in LPP for Case 1 AIML based positioning and TRP locations can be indicated explicitly or implicitly.  Proposal 2: For Case 1 AIML based positioning, include an associated ID in assistance information in TS 37.355.  Observation 1: There is no need to specify reporting of Part B for Case 3b as reporting of the ground truth and associated timestamp for Case 3b is already supported by the UE based positioning methods in TS 37.355.  Proposal 3: For Case 3b, there is no impact to RRC parameters related to the content of the UE report when the UE reports the ground truth to the LMF. |
| * NTT DOCOMO, INC. (R1-2506270)   Proposal 1: For assistance data Info #1 ~ Info #15 and associated ID for Info #7, the current description should be kept for providing clear, unambiguous input to RAN2/RAN3.  Proposal 2: Location info from UE to LMF for label data of Case 3b and time stamp of label data of Case 3b from UE to LMF can be removed. |
| * Ericsson (R1-2505178)   Observation 1 Info #7 can be provided explicitly (as in legacy UE-based DL-TDOA) or implicitly via Associated ID.  Proposal 1 Endorse #3 (Assistance data Info #1 ~ Info #15) and #4 (Associated ID for Info #7) in higher layer parameter list to RAN2.  Proposal 2 Do not include #5 (Location info from UE to LMF for label data of Case 3b) and #6 (Time stamp of label data of Case 3b from UE to LMF) in higher layer parameter list to RAN2. |
| * Huawei, HiSilicon (R1-2505203)   Proposal 5: For the confirmed working assumption from RAN1#121, for crystal clear interpretation:  • For AI/ML based positioning Case 1, regarding info #7 in the assistance information from legacy UE-based DL-TDOA, it can be provided ~~as~~ in legacy UE-based DL-TDOA or implicitly. |

### 1st round discussion

Related to the open LPP parameters, one issue is the proper interpretation of explicit/implicit signaling of Info #7. Huawei/HiSilicon suggested to update the endorsed WA as follows:

“For AI/ML based positioning Case 1, regarding info #7 in the assistance information from legacy UE-based DL-TDOA, it can be provided ~~as~~ in legacy UE-based DL-TDOA or implicitly.”

In FL understanding, the above change is different from the intention of the endorsed WA.

* The endorsed WA means that Info #7 can be sent explicitly for Case 1. Such explicit indication is sent in the same manner as legacy UE-based DL-TDOA. Legacy UE-based DL-TDOA does not need to be activated simultaneously with Case 1.
* The updated version by Huawei/HiSilicon means that legacy UE-based DL-TDOA needs to be activated simultaneously with Case 1, so that Info #7 is sent as part of legacy UE-based DL-TDOA, and UE can use it for Case 1 as well.

In the following, we can collect companies’ views on whether the update by Huawei/HiSilicon can be accepted.

**Question 1: whether to update the endorsed WA as follows:**

**“For AI/ML based positioning Case 1, regarding info #7 in the assistance information from legacy UE-based DL-TDOA, it can be provided ~~as~~ in legacy UE-based DL-TDOA or implicitly.”**

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| **Company** | **Comments** |
| HW/HiSi | In legacy, explicit indication of the TRP locations is needed as the input to calculate the UE location. For Case 1, however, the model input is the fingerprint of the measurement, and hence, the actual TRP locations, i.e., Info #7, are not explicitly needed for determining the UE location.  Some companies stated that the TRP locations may be needed to generate a label for monitoring at the UE, but that does not imply it is for Case 1. To generate a label for monitoring, Info #7 can be provided in the assistance data of legacy UE-based DL-TDOA positioning method, i.e., not for Case 1.  However, this does not mean that legacy UE-based DL-TDOA positioning method needs to be activated simultaneously with Case 1. On the contrary, this means that legacy UE-based DL-TDOA positioning method does not need to be activated simultaneously with Case 1, as the generation of a label at the UE is not a pre-requisite for Case 1.  For Case 1, Info #7 can be provided implicitly with the associated ID. |
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To support implicit indication of Info #7, the IE for Associated ID should be included in higher layer parameter list to RAN2. Thus the following is proposed.

**Proposal 4.1.2-1**

Include the IE for Associated ID (i.e., implicit indication of Info #7) in higher layer parameter list to RAN2.

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| **Company** | **Comments** |
| HW/HiSi | Ok, but suggest the following change:  **Suggested Proposal 4.1.2-1**  For Case 1, include the ~~IE for~~ Associated ID (i.e., implicit indication of Info #7) and its description from the RAN1#121 agreement in higher layer parameter list to RAN2. |
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For Info #1 ~ Info #15, based on RAN1 agreements and companies input in their contribution, the IE should be included in higher layer parameter list to RAN2.

**Proposal 4.1.2-2**

Include the IE for assistance data of Info #1 ~ Info #15 in higher layer parameter list to RAN2.

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| **Company** | **Comments** |
| HW/HiSi | Info #7 is not explicitly provided for Case 1. Info #7 can only be provided implicitly for Case 1, i.e., with the associated ID.  The implicit indication of Info #7 is already captured in the previous proposal, so we suggest the following update to the proposal:  **Suggested Proposal 4.1.2-2**  For Case 1, include the ~~IE for~~ assistance data of Info #1 to Info #6 and Info #8 to Info #15 in higher layer parameter list to RAN2. |
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Regarding location info and its time stamp from UE to LMF for label data of Case 3b, InterDigital (R1-2505829), NTT DOCOMO (R1-2506270) and Ericsson (R1-2505178) explained that they are not needed. Thus the following is proposed.

**Proposal 4.1.2-3**

Do not include the IE (Location info from UE to LMF for label data of Case 3b) and the IE (Time stamp of label data of Case 3b from UE to LMF) in higher layer parameter list to RAN2.

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| **Company** | **Comments** |
| HW/HiSi | Ok, but suggest the following update:  **Suggested Proposal 4.1.2-3**  For Case 3b, do not include the ~~IE (~~Location info from UE to LMF for label data ~~of Case 3b)~~ and the ~~IE (~~Time stamp of label data ~~of Case 3b~~ from UE to LMF~~)~~ in higher layer parameter list to RAN2. |
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## NRPPa parameters

### Companies’ view from contribution

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| * NTT DOCOMO, INC. (R1-2506270)   Proposal 3: It is necessary to support new IE for request and report for Rel-19 enhanced channel measurement. |
| * NEC (R1-2505925)   Proposal 3: Introduce a new indicator to specify whether legacy measurement or enhanced measurement should be reported from gNB to LMF. How to signal this indicator is up to RAN3 work.  − If this indicator is absent, dedicated behavior should be specified — for example, the gNB reports legacy measurement.  Proposal 4: When enhanced measurement is required by LMF, introduce a new indicator to specify whether timing information or paired timing information and power information should be reported from gNB. How to signal this indicator is up to RAN3 work.  − If this indicator is absent, dedicated behavior should be specified — for example, the gNB reports timing information in enhanced measurement. |
| * Ericsson (R1-2505178)   Proposal 3 Endorse #3A (Rel-19 enhanced measurement) with updated description (UL SRS-TDCT, UL SRS-TDCP) in higher layer parameter list to RAN3. |

### 1st round discussion

Based on input in NTT DOCOMO (R1-2506270), NEC (R1-2505925) and Ericsson (R1-2505178), the IE for Rel-19 enhanced measurement is needed so that gNB can send the measurement (UL SRS-TDCT, UL SRS-TDCP) to LMF.

**Proposal 4.2.2**

Include the IE for Rel-19 enhanced measurement (i.e., UL SRS-TDCT, UL SRS-TDCP in 38.215) in higher layer parameter list to RAN3.

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| **Company** | **Comments** |
| HW/HiSi | The purpose of this proposal/parameter is unclear. RAN3 is already discussing the reporting of the Rel-19 enhanced measurement, including the use of the new definitions. |
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# Model input: Report format for sample-based measurement

## Companies’ view from contribution

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| * Apple (R1-2505873)   **Proposal 2**: For channel measurement type B, RAN1 to Report the timing information for each of the Nt' samples (similar to reporting path timing of measurement type A). i.e. Legacy method |
| * CMCC (R1-2506075)   Proposal 1: For AI/ML based positioning, for channel measurement type (B) Rel-19 enhanced measurement in Case 3b, Supported method2, e.g., path-based-like measurement reporting without bitmap. |
| * OPPO (R1-2505732)   *Proposal 1: For channel measurement type (B), method 2 is used for reporting the timing information of the Nt' values:*   * *Method 2: Report the timing information for each of the Nt' samples (similar to reporting path timing of measurement type (A)).* |

## 1st round discussion

Three companies proposed to discuss the report format of channel measurement type B (i.e., sample-based measurement). This topic was discussed in RAN1#120bis and RAN1#121. In the end, no decision was made in RAN1#121, and the understanding was that RAN3 can decide the reporting format when capturing channel measurement type B in TS 38.455.

In FL’s view, this issue has been extensively discussed in previous RAN1 meetings. It is not an essential correction for RAN1 while maintenance should only address essential corrections. It can be left for RAN3 to resolve, which was the status at the end of RAN1#121.

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| **Company** | **Comments** |
| HW/HiSi | As mentioned above, RAN3 is already discussing the reporting of the Rel-19 enhanced measurement, so this can be left up to RAN3. |
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# Model output

## Companies’ view from contribution

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| * Huawei, HiSilicon (R1-2505203)   Proposal 1: For Case 3a, preclude the reporting of gNB Rx-Tx time difference based on model output. |

## 1st round discussion

On Case 3a for gNB Rx-Tx time difference, RAN1#116 made the following agreement:

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| **Agreement**  For AI/ML assisted positioning Case 3a, at least LOS/NLOS indicator and/or timing information are supported for reporting.   * If LOS/NLOS indicator is reported, the indicator can be reported as soft indicator or hard indicator as defined in 38.214. * If timing information is reported, the timing information at least can be reported via UL RTOA or gNB Rx-Tx time difference as defined in 38.215. * Note: details of the report are pending further discussion. |

The above agreement explicitly stated that gNB Rx-Tx time difference can be reported based on model output. Thus Huawei/HiSilicon proposal requires a change to RAN1#116 agreement.

In FL’s view, Huawei/HiSilicon proposal is not an essential correction, and it is difficult to see why the previous RAN1 agreement should be reversed at maintenance phase.

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| **Company** | **Comments** |
| HW/HiSi | In our view, it is not clear how the gNB can generate a Rel-19 gNB Rx-Tx time difference without knowing the Tx time of the SRS at the UE and even if the gNB assumes a Tx time of the SRS, it is actually different from the actual Tx time of the SRS.  In addition, the RAN1#116 agreement above was made at the very beginning of the WI phase, when the second priority Case 2a was still part of the WI scope. In the RAN#107 plenary meeting, the second priority cases were removed from the WI objectives and thus, it is unclear how can the Rel-19 gNB Rx-Tx time difference be used if in Rel-19 there is no support for UE Rx-Tx time difference based on model output at the UE (i.e., based on Case 2a).  Thus, for Case 3a, the reporting of gNB Rx-Tx time difference based on model output should be precluded. |
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# Training data collection

## Case 1: time stamp of Part B

### Companies’ view from contribution

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| * CATT, CICTCI (R1-2505313)   Proposal 1: For AI/ML based positioning in Case 1, if Part B is sent via LPP from LMF to UE, the time stamp of Part B follows the legacy IE *measurementReferenceTime-r16*, i.e., it is up to LMF to make a choice between the following two:   * + NR-TimeStamp   + UTCTime |
| * Apple (R1-2505873)   *Proposal 4: For AI/ML based positioning in Case 1, if Part B is sent via LPP from LMF to UE, the time stamp of Part B follows the legacy IE measurementReferenceTime-r16, i.e., it is up to LMF to make a choice between the following two:*   * *NR-TimeStamp* * *UTCTime* |
| * Huawei, HiSilicon (R1-2505203)   Proposal 4: For Case 1 data collection, when Part A is generated by the UE and Part B is delivered from LMF to UE, to enable the pairing of Part A and Part B at UE side, the LMF indicates to the UE the anticipated time stamp in which Part B is expected to be generated.  • The UE can perform channel measurement to derive and store Part A according to the anticipated time instance for Part B, and pair Part A with Part B after Part B is delivered. |

### 1st round discussion

In the final FL summary of RAN1#121 (R1-2504955), the following was captured to reflect companies’ input on the time stamp of Part B when Part B is sent from network to UE.

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|  | **Time stamp of Part B** |
| **Case 1** | **Addressed by RAN2, reuse LCS procedure and time stamp thereof** |

The corresponding RAN2 agreement is the following made in RAN2#130:

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| LCM for UE-sided model for Positioning use case:   * A target UE can obtain the "ground-truth label" information via existing MO-LR procedures. No additional RAN2 specification impacts are foreseen |

Thus, FL understanding is that this issue is already addressed by RAN2, and no further action is needed in RAN1. In the following, we can collect companies’ view on this issue just to be sure.

**Question: Whether it is essential that RAN1 discuss the time stamp of Part B when Part B is sent from network to UE?**

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| **Company** | **Comments** |
| HW/HiSi | In our view, it would be beneficial for the UE and LMF to align the anticipated time stamp of the Part B to be delivered by the LMF, since the UE cannot predict when will the LMF generate Part B before the UE receives the delivered Part B. As one option, the UE needs to store all past measurements during the data collection phase (without knowing if it can pair them later), but it incurs higher complexity on storage. As another option, after the reception of Part B (generated at time T0, but received at time T1, where T1 is later than T0) the UE generates Part A (at a later time instance T2, where T2 is later than T1), then the Part B is outdated and the Part A (at T2) and Part B (at T0) cannot be paired. To avoid this, the LMF and UE can align the anticipated time stamp of the Part B before the Part B is delivered. |
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## Other

### Companies’ view from contribution

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| * Huawei, HiSilicon (R1-2505203)   Proposal 2: For Case 3a, the format for the timing information generated from LMF can correspond to the UL RTOA/ToF between the TRP and the PRU/UE.  • Note: the purpose of the provided timing information is not specified.  Proposal 3: For Case 3a data collection, when Part A is generated by the gNB/TRP and Part B is delivered from LMF to gNB/TRP, to enable the pairing of Part A and Part B at gNB side, the LMF indicates to the gNB the anticipated time stamp in which Part B is expected to be generated.  • The gNB can perform channel measurement to derive and store Part A according to the anticipated time instance for Part B, and pair Part A with Part B after Part B is delivered. |
| * Sharp (R1-2506247)   Proposal 1: For training data collection of AI/ML based positioning Case 1, 3a and 3b, if Part A and Part B are generated by different entities,   * Validity duration of Part B can be optionally reported, where a time duration is optionally included in Part B. If the ending time stamp is included,   + The time stamp is interpreted as a starting time stamp.   + The {ground truth label, quality indicator of the ground truth label} in Part B is valid for the time duration.   Proposal 2: For AI/ML based positioning Case 1, for training data collection, support to introduce quality criteria in the request message for Part B.  Proposal 3: For AI/ML based positioning Case 3b, for training data collection, support to introduce quality criteria in the request message for Part B.  Proposal 4: For AI/ML based positioning Case 3b, for training data collection, support to introduce quality criteria in the request message for Part A reusing legacy quality indicator. |
| * OPPO (R1-2505732)   Proposal 3: Regarding the training data collection at UE side for Case 1  • Reuse the legacy LPP signaling to configures UE with the corresponding positioning RS for UE-side data collection.  • The format/content of collected data are up to implementation of UE and no specification is needed in 3GPP.  Proposal 4: From RAN1 perspective, for Case 3b measurements,  • The existing procedures can be reused in terms of SRS configuration.  • These measurements can be used for multiple aspects related to case 3b, e.g. training data collection, monitoring, or inference procedures.  Proposal 5: For training data collection of AI/ML based positioning Case 3a/3b, if Part A and Part B are generated by different entities, for pairing between a Part A entry and a Part B entry, the following can be optionally reported in addition to the time stamp of Part A and the time stamp of Part B.  • The validity duration between time stamp of Part A and time stamp of Part B.  Proposal 6: For Case 1, if Part A and Part B are generated by different entities, for pairing between a Part A entry and a Part B entry, the followings are needed:  • The time stamp of Part A and the time stamp of Part B.  • The validity duration between time stamp of Part A and time stamp of Part B. |

### 1st round discussion

For training data collection, companies provided proposals on several issues. Most of these issues were discussed in previous meetings and no agreement could be made.

In FL view, they are not essential corrections while maintenance should only address essential corrections. To be sure, in the following, we can collect companies’ views on whether these issues raised by companies are essential to be addressed by RAN1.

Related to proposal in Huawei, HiSilicon (R1-2505203):

**Question 1: For training data collection of Case 3a, whether it is essential that RAN1 treat the issue of anticipated time stamp?**

* See proposal in Huawei, HiSilicon (R1-2505203)

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| **Company** | **Comments** |
| HW/HiSi | Similarly as discussed for Case 1, it would be beneficial for the gNB and LMF to align the anticipated time stamp of the Part B to be delivered by the LMF, since the gNB cannot predict when will the LMF generate Part B before the gNB receives the delivered Part B. As shown in the figure below, if Part B is generated before Part A is collected, the provided Part B is outdated which impairs the pairing of Part A and Part B at the gNB.    Thus, it would be beneficial for the gNB and LMF to align the anticipated time stamp of the Part B to be delivered by the LMF, e.g., as depicted in the figure below: |
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Related to proposals in Sharp (R1-2506247) and OPPO (R1-2505732):

**Question 2: For training data collection of Case 1/3a/3b, if Part A and Part B are generated by different entities, whether it is essential to discuss validity duration of Part B?**

* See proposals in Sharp (R1-2506247) and OPPO (R1-2505732)

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| **Company** | **Comments** |
| HW/HiSi | In our view, it is not clear how can the LMF determine that the generated Part B is valid for a (future) time duration, since that depends on UE/PRU mobility. Moreover, the overhead of delivering multiple Part B each with a time stamp will not cause much overhead issue to NRPPa. |
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Related to proposals in Sharp (R1-2506247):

**Question 3: For training data collection of Case 1/3b, whether it is essential to introduce quality criteria in the request message of Part A or Part B?**

* See proposals in Sharp (R1-2506247)

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| **Company** | **Comments** |
| HW/HiSi | Only for Case 3b, the gNB delivers Part A to the LMF for which there is no overhead issue and it can be left up to LMF implementation the use of a received Part A.  For the delivery of Part B from the LMF for Case 1 and Case 3b, it is not clear how can the LMF guarantee to generate a Part B requested with a certain quality.  Thus, we see no need to introduce quality criteria in the request of Part A or Part B. |
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# Model monitoring

## Companies’ view from contribution

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| * vivo (R1-2505368)   Proposal 1: For Rel-19 AI/ML based positioning Case1, the specification should allow for UE requesting the expected PRU information for model monitoring Option A-3, at least including:  • The expected channel measurement type, including sample-based channel measurement and path-based channel measurement  • The expected number of PRUs.  Proposal 2: For model monitoring Option A-3, LMF should provide the PRU information that UE requested as much as possible. |
| * Nokia (R1-2505800)   Proposal 1: For model performance monitoring Option A-3 of AI/ML positioning Case 1, allow UE to request and obtain network side condition information (e.g., associated ID) associated with the PRU measurements from LMF.  Proposal 2: For Case 1, LMF may provide UE with certain conditions to trigger performance monitoring via LPP Provide Assistance Data message. These conditions may include channel conditions (e.g., DL-PRS RSRP), and change of network-side (additional) conditions between training and inference, such as assistance data validity area and Associated-ID. |
| * CMCC (R1-2506075)   Proposal 2: For the content of monitoring outcome, in addition to above indication, the reason why the AI model fails to work should also be considered for reporting.  Proposal 3: Regarding the timing of the target UE reporting the monitoring outcome, both UE-initiated reporting and LMF-requested reporting can be supported, and LMF configured event-triggered reporting can also be discussed. |
| * Huawei, HiSilicon (R1-2505203)   Proposal 6: For performance monitoring of AI/ML positioning Case 3a, the report of a measured or non-measured result can be used to imply the monitoring outcome activation/fallback between LMF and gNB.  • When NG-RAN node performs monitoring metric calculation, gNB can report LMF with measured result (implying fallback) or non-measured result (implying activation). |

## 1st round discussion

Regarding the issues of Option A-3 pointed out by vivo and Nokia, the relevant agreement is copied below.

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| Agreement (RAN1#116bis)  For model performance monitoring of AI/ML positioning Case 1, for model performance monitoring metric calculation in label-based model monitoring, study the feasibility, benefits, and potential specification impact of the following options with regard to how to generate information on ground truth label:   * Option A. The target UE side performs monitoring metric calculation.   + Option A-1. At least information on ground truth label of the target UE is generated by LMF and provided to the target UE.     - In one example, target UE and/or gNB sends measurement (e.g., legacy measurement) to LMF so that LMF can derive the information on ground truth label.   + Option A-2. At least position calculation assistance data (e.g., existing information for UE-based positioning method) is provided from LMF to the target UE.   + Option A-3. Reuse Rel-18 assistance data transfer framework from LMF to the target UE, where the PRU measurement (e.g., legacy measurement) and the corresponding PRU location are sent via LMF to the target UE.   + Option A-4. PRU measurement (and the corresponding PRU location if not already known at the UE-side) are sent from PRU to the target UE side ~~(e.g., target UE, OTT server)~~.     - Note: Option A-4 can be realized by implementation in a manner transparent to specification if the PRU sends information to the target UE side in a proprietary method. * Option B. The LMF performs monitoring metric calculation.   + Option B-1. at least inference result (i.e., the model output corresponding to target UE’s channel measurement) of the target UE is sent by the target UE to LMF.   + Option B-2. PRU’s channel measurement is sent via LMF to the target UE, and the inference result (i.e., the model output corresponding to PRU’s channel measurement) is sent by the target UE to LMF.   Note: exact method to perform the monitoring metric calculation is up to implementation.  Note: Other options are not precluded. |

In RAN1#120bis, Option A-1/2/3 were discussed and informally concluded. It is understood that the agreement of RAN1#119 was sufficient, i.e., Option A-1/2/3 are supported; the existing signaling can be reused, and no further discussion is needed.

In the following, we can collect companies’ views on whether Option A-3 requires further signalling as proposed by vivo (R1-2505368) and Nokia (R1-2505800).

**Question 1: For model performance monitoring Option A-3 of Case 1, whether it is essential that new signalling should be introduced?**

* vivo (R1-2505368): UE request the expected PRU information (the expected channel measurement type, the expected number of PRUs);
* Nokia (R1-2505800): UE request and obtain network side condition information (e.g., associated ID) associated with the PRU measurements; LMF provide UE with certain conditions to trigger performance monitoring via LPP Provide Assistance Data message.

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| **Company** | **Comments** |
| HW/HiSi | Regarding the request of the expected channel measurement type, the Rel-19 enhanced measurement has been introduced for Case 3b and not for measurements at the PRU/UE, i.e., for Case 1. Thus, forwarded PRU measurement are only legacy-based.  About the expected number of PRUs: this is currently being discussed in RAN2, so it can be left up to RAN2 to discuss.  Regarding the associated ID associated with PRU measurements, we understand the motivation and hence, this issue could be discussed further but not just restricted to monitoring, as it can also be beneficial for training. In any case, the purpose of the delivered PRU measurements does not need to be specified.  On the provision by the LMF of trigger conditions for performance monitoring at the UE, we believe that the UE-side which hosts the model is better aware when to trigger monitoring, in contrast to the LMF which is not aware of the model at the UE-side. |
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CMCC (R1-2506075) proposed to discuss further:

* the content of monitoring outcome: the reason why the AI model fails to work should also be considered for reporting;
* trigger of UE reporting the monitoring outcome: UE-initiated reporting, LMF-requested reporting, LMF configured event-triggered reporting.

These issues have been discussed in previous meetings, and no agreement could be reached. In FL view, they are not essential corrections while maintenance should only address essential corrections. To be sure, in the following, we can collect companies’ views.

**Question 2: Related to UE reporting monitoring outcome of Case 1, whether it is essential to discuss further (a) content of monitoring outcome; (b) trigger for UE reporting the monitoring outcome?**

* See proposals in CMCC (R1-2506075)

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| **Company** | **Comments** |
| HW/HiSi | As the LMF is not aware of the UE-sided model, we wonder how can the LMF make use of the provided information.  Regarding the trigger for UE reporting the monitoring outcome, as discussed in our previous reply above, the UE-side is better suited to know when to trigger the monitoring instead of being configured by the LMF. |
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Related to proposal in Huawei, HiSilicon (R1-2505203):

**Question 3: For performance monitoring of AI/ML positioning Case 3a, whether it is essential to discuss the report of a measured or non-measured result can be used to imply activation/fallback between LMF and gNB?**

* Huawei/HiSilicon (R1-2505203): When NG-RAN node performs monitoring metric calculation, gNB can report LMF with measured result (implying fallback) or non-measured result (implying activation).

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| **Company** | **Comments** |
| HW/HiSi | In contrast to Case 1, the outcome of the monitoring has not been discussed for Case 3a. In our view, in case the monitoring decision, from the gNB’s perspective, is to recommend to fallback to a legacy positioning method, the gNB will not follow the LMF request to report a Case 3a result and the gNB reports instead a measured result (e.g., it reports measured UL RTOA). On the other hand, in case the monitoring decision is to keep the model activated, the gNB reports the Case 3a result as requested by the LMF. |
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# Ensure consistency between training and inference

## Companies’ view from contribution

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| * Qualcomm Incorporated (R1-2506173)   **Proposal 1: In AI/ML positioning Case 1, for associated ID related to AD info#7 (TRP locations), add the following (red text) to the agreement:**  Agreement (RAN1#121)  **For AI/ML based positioning Case 1, regarding Info #7 in the assistance information from legacy UE-based DL-TDOA,**   * **If implicitly provided, the implicit indication of Info #7 is via associated ID.**   + **For given TRP(s), same associated ID implies that geographical coordinates of the TRP(s) can be understood as consistent by the UE.**   + **The associated ID is not expected to provide the real value of Info #7 (i.e., geographical coordinates of the TRP(s) are not disclosed).**   + **an associated ID is configured per-cell (e.g., NCGI-r15)**     - **UE does not expect to receive different values of associated ID for TRPs belonging to the same NCGI-r15**   + **Associated ID can be realized by an identifier of N bits (e.g., 8 bits)**   + **Associated ID can have a corresponding validity timestamp (e.g., IE *UTCTime* in TS 37.355) that indicates the first time the associated ID become valid**   + **Associated ID can have a corresponding validity margin (e.g., IEs *horizontal-r18*, *vertical-r18*, *units-r18* in TS 37.355) that indicates bound on changes to TRP locations before considering another associated ID** |
| * Nokia (R1-2505800)   Proposal 3: Regardless of the time, the UE receives the same associated ID for a configuration of TRPs, UE will assume similar geographical locations for the configured set of TRPs.  Proposal 4: RAN1 follows the same approach as DL-TDOA (Inclusion of Associated-ID) for DL-AoD as part of assistance data for consistency checking in Case 1.  Proposal 5: When requesting assistance data for Case 1, UE may indicate its preference between implicit and explicit types of TRP location information. Similarly, LMF may indicate available types of TRP location information that UE may request.  Proposal 6: When requesting assistance data for Case 1, UE can indicate the TRP location information type (i.e., implicit vs explicit) and the corresponding value it previously acquired, such as during training data collection. This is particularly relevant if the LMF is currently supplying different types of TRP location information. Consequently, the LMF can communicate whether the TRP location information remains consistent with what was provided earlier.  Content of Associated-ID  Proposal 7: For the case Associated-ID represents a validity area, the identifier of N bits of Associated-ID message for Info#7 is composed at least by: statistical information of changes in TRP location, level of changes of TRP location, and additional indication of TRPs muted during the generation of the Associated-ID.  Proposal 8: For the case Associated-ID represents a set of TRPs or Cell-IDs, the identifier of N bits of Associated-ID message is composed at least by: statistical information of changes in TRP location and level of changes of TRP location.  Proposal 9: For consistency checking in Case 1, Associated-ID or implicit Info#7, the identifier of N bits represents a time information for which TRP locations remains changed (or alternatively, unchanged), such as via a timestamp or an ID representing the last time when the location of TRP(s) changed.  Proposal 10: Associated-ID or implicit Info#7 represents relative location information of the TRP(s), either: a) with respect to a specific reference location unknown to the UEs; or b) relative locations of the TRPs with respect to each other.  Proposal 11: UE may request notifications from the network that are indicative of any changes (or no changes) to certain network-side conditions that the UE is interested in. |
| * NEC (R1-2505925)   Proposal 1: The assistance information for ensuring consistency between training and inference should be signaled associated with the signal for generating measurement for model inference.  Proposal 2: Regarding how to signal the assistance information for ensuring consistency,  − if the Info #7 is provided in implicit way, a new signal about associated ID should be embedded in the IE for generating the measurement for model inference.  − for other Info and Info #7 when provided explicitly, the existing LPP message can be reused and should be embedded in the IE for generating the measurement for model inference. |
| * OPPO (R1-2505732)   *Proposal 2: For AI/ML based positioning Case 1, all assistance information from legacy UE-based DL-AOD, other than Info #7, can be provided from LMF to UE.*   * *For Info #7, the agreement reached for legacy UE-based DL-TDOA method is reused.* |
| * Huawei, HiSilicon (R1-2505203)   Proposal 5: For the confirmed working assumption from RAN1#121, for crystal clear interpretation:  • For AI/ML based positioning Case 1, regarding info #7 in the assistance information from legacy UE-based DL-TDOA, it can be provided ~~as~~ in legacy UE-based DL-TDOA or implicitly. |

## 1st round discussion

Qualcomm (R1-2506173) suggested providing more info related to Associated ID: validity timestamp, validity margin. In the following, we can collect companies’ views on whether it is essential to address the issues raised by Qualcomm.

**Question 1: whether it is essential to provide the validity timestamp and validity margin of Associated ID?**

* Qualcomm (R1-2506173):
  + **Associated ID can have a corresponding validity timestamp (e.g., IE *UTCTime* in TS 37.355) that indicates the first time the associated ID become valid**
  + **Associated ID can have a corresponding validity margin (e.g., IEs *horizontal-r18*, *vertical-r18*, *units-r18* in TS 37.355) that indicates bound on changes to TRP locations before considering another associated ID**

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| **Company** | **Comments** |
| HW/HiSi | A time stamp does not need to be associated with the associated ID. It does not matter to the UE when a change has occurred if the associated ID is used to check for consistency.  Consider the example below. If the UE trains at the red point with associated ID #1 and then leaves and comes back at the blue point, it knows there was a change as the indicated associated ID provided after time T2 is associated ID #2.  If the UE trains at the red point with associated ID #1 and then leaves and comes back at the green point, it does not see a change as the indicated associated ID provided after time T3 is the same associated ID, i.e., associated ID #1. Indicating the time T3 is not needed for consistency. On the contrary, it may only introduce confusion/ambiguity at the UE.    If the intention to include the time stamp is to allow changing the associated ID over time, e.g.., associated ID #1 means something between T1-T2 that is different than the associated ID #1 after T3, then consistency cannot be ensured with the associated ID and hence, the purpose of the associated ID becomes unclear.  Regarding the validity margin, it is not clear how can this be employed. If a new associated ID is indicated to the UE as a result of a small change, the UE can verify this on its own without any additional information. |
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Nokia (R1-2505800) suggested defining the detailed composition for the N bits of Associated ID:

* Proposal 7: For the case Associated-ID represents a validity area, the identifier of N bits of Associated-ID message for Info#7 is composed at least by: statistical information of changes in TRP location, level of changes of TRP location, and additional indication of TRPs muted during the generation of the Associated-ID.
* Proposal 8: For the case Associated-ID represents a set of TRPs or Cell-IDs, the identifier of N bits of Associated-ID message is composed at least by: statistical information of changes in TRP location and level of changes of TRP location.
* Proposal 9: For consistency checking in Case 1, Associated-ID or implicit Info#7, the identifier of N bits represents a time information for which TRP locations remains changed (or alternatively, unchanged), such as via a timestamp or an ID representing the last time when the location of TRP(s) changed.
* Proposal 10: Associated-ID or implicit Info#7 represents relative location information of the TRP(s), either: a) with respect to a specific reference location unknown to the UEs; or b) relative locations of the TRPs with respect to each other.
* Proposal 11: UE may request notifications from the network that are indicative of any changes (or no changes) to certain network-side conditions that the UE is interested in.

**Question 2: whether it is essential to define the detailed composition for the N bits of Associated ID?**

* See proposals in Nokia (R1-2505800)

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| **Company** | **Comments** |
| HW/HiSi | The definition of the associated ID has already been discussed and agreed at the RAN1#121 meeting and hence, we do not see any need to further discuss its definition. |
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Nokia (R1-2505800) and NEC (R1-2505925) discussed how to provide Info #7 explicitly/implicitly, e.g.,

* Nokia: UE may indicate its preference between implicit and explicit types; LMF may indicate available types of TRP location information that UE may request.
* NEC: a new signal about associated ID should be embedded in the IE for generating the measurement for model inference

In FL view, they are not essential corrections while maintenance should only address essential corrections. To be sure, in the following, we can collect companies’ views on whether to discuss how to provide Info #7 explicitly/implicitly, as suggested by Nokia (R1-2505800) and NEC (R1-2505925).

**Question 3: whether it is essential that RAN1 discuss how to provide Info #7 explicitly/implicitly?**

* See proposals in Nokia (R1-2505800) and NEC (R1-2505925)

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| **Company** | **Comments** |
| HW/HiSi | As discussed above, for Case 1, the TRP locations can only be requested and provided implicitly and not explicitly. |
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OPPO (R1-2505732) and Nokia (R1-2505800) proposed to provide all assistance information from legacy UE-based DL-AOD. This issue was extensively discussed in previous RAN1 meetings and no consensus was possible. In FL view, this issue is not essential, and it is not beneficial to repeat the same debate again.

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| **Company** | **Comments** |
| HW/HiSi | For Case 1, there is no need to provide the assistance information for UE-based DL-AOD from LMF to UE, since the assistance information provided for UE-based DL-TDOA suffices for ensuring training and inference consistency. |
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# UE feature, UE capability

## Companies’ view from contribution

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| * Qualcomm Incorporated (R1-2506173)   Proposal 2: In AI/ML positioning Case 1, introduce UE features for the following configurations:   * Operation outside MG and in PPW * Operation with low latency MG activation * Operation in IDLE and INACTIVE states * Operation with PRS bandwidth aggregation * PRS TEG association information * LOS/NLOS indicator assistance   Proposal 3: In AI/ML positioning Case 1, for any configuration in Proposal 2, if no corresponding UE feature is introduced, conclude that UE, in Rel-19 AI/ML positioning Case 1, is not expected to support the feature. |
| • CMCC (R1-2506075)  Proposal 4: It is necessary to distinguished AI based positioning from legacy UE positioning as a new UE capability.  Proposal 5: For UE-side AI based positioning, a new UE capability for the number of PRS resources should be defined. |
| * Google (R1-2505253)   Proposal 1: Support the APU framework for UE-side AI/ML based poisoning   * Support the UE to report which APU pool the AI/ML based positioning occupies * Support the UE to report the number of APUs for an inference operation for AI/ML based positioning * The priority for AI/ML based positioning is lower than the priority for CSI report |

## 1st round discussion

Three companies have proposals on UE feature, UE capability, and APU reporting. FL’s understanding is that these issues should be treated in agenda item 9.1 (“UE features for AI/ML for NR Air Interface”). Therefore there is no need to treat these proposals in agenda item 8.1.2.

Please share your view if you disagree with the above, i.e., if you believe that these proposals need to be treated in 8.1.2 (not 9.1).

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| **Company** | **Comments** |
| HW/HiSi | It is also our understanding that these proposals should be discussed in the agenda item 9.1. |
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# Proposals for online sessions

## Proposals for Monday online session

## Proposals for Tuesday online session

## Proposals for Wednesday online session

## Proposals for Thursday online session

# References

1. R1-2505178 Remaining Issues of AI/ML for Positioning Accuracy Enhancement Ericsson Telecom S.A. de C.V.
2. R1-2505203 Maintenance of Rel-19 AI/ML for positioning accuracy enhancement Huawei, HiSilicon
3. R1-2505253 AI/ML based Positioning Google
4. R1-2505313 Remaining issues on AI/ML-based positioning CATT, CICTCI
5. R1-2505368 Maintenance on specification support for positioning accuracy enhancement vivo
6. R1-2505484 Discussion on maintenance of AI positioning enhancement ZTE Corporation, Sanechips
7. R1-2505531 Remaining issues on AI/ML based positioning Samsung
8. R1-2505732 On specification for AI/ML-based positioning accuracy enhancements OPPO
9. R1-2505800 Maintenance on AI/ML Positioning Accuracy Enhancement Nokia
10. R1-2505829 Remaining issues on AI/ML based positioning InterDigital, Inc.
11. R1-2505873 Remaining issues on Specification support for positioning accuracy enhancement Apple
12. R1-2505925 Remaining issues on AIML based positioning accuracy enhancement NEC
13. R1-2506075 Maintenance of specification support for positioning accuracy enhancement CMCC
14. R1-2506173 Specification support for AI-ML-based positioning accuracy enhancement Qualcomm Incorporated
15. R1-2506247 Remaining issues on specification support for AI/ML based positioning accuracy enhancements Sharp
16. R1-2506270 Maintenance on AI/ML for positioning accuracy enhancement NTT DOCOMO, INC.