3GPP TSG-RAN WG2 Meeting #130 R2-25xxxxx

St Julian’s, Malta, May 19 - 23, 2025

Agenda Item: 8.1.1

Source: Qualcomm Incorporated (Rapporteur)

Title: LPP open issues for feature "AI/ML for NR air interface"

Document for: Discussion, Decision

# Introduction

This document includes a list of open issues according to the following email discussion:

* [POST129bis][015][AI PHY] 37.355 Running CR (Qualcomm)

 Intended outcome:

1. Update CR based on agreements from RAN2#129bis
2. List of remaining open issues

 Deadline: Long

Companies are invited to provide feedback on open issue list by: **2nd May 2025**

# Open issues for specification 37.355 (LPP)

### Common NR Positioning Information Elements (Clause 6.4.3)

**Open issue LPP-1:****Applicability of *dl-PRS-ResourcePrioritySubset***

**Issue description:**

The IE *NR-DL-PRS-Info* also includes method specific information (for DL-AoD). If DL-PRS assistance data are needed for NR AI/ML positioning, it needs to be clarified that the *dl-PRS-ResourcePrioritySubset* is not applicable to NR AI/ML positioning.

**Status in running CR:**

Captured as "Editor's Note".

**Relevant Agreements:**

From RAN1#119 (see Annex in LPP running CR [1] for the full list of RAN1 and RAN2 agreements for Case 1):

|  |
| --- |
| **Agreement**For AI/ML based positioning Case 1, all assistance information from legacy UE-based DL-TDOA, other than info #7, can be provided from LMF to UE. For info #7, RAN1 study, if necessary, choose one alternative from the following:[…] |

**Proposed resolution:**

Given that all assistance information for UE-based DL-TDOA (other than info #7) are applicable to NR AI/ML positioning Case 1, the IE *NR-DL-PRS-Info* is also applicable. This implies that the *dl-PRS-ResourcePrioritySubset*(which provides a priority for measurement reporting in UE-assisted DL-AoD) is not applicable to NR AI/ML positioning Case 1.

**Proposal 1: The field *dl-PRS-ResourcePrioritySubset* in IE *NR-DL-PRS-Info* should be ignored for NR AI/ML positioning. Remove corresponding 'Editor's Note' from the running CR.**

Companies are invited to provide feedback regarding the above open issue and proposed resolution:

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree to proposal?** | **Other comments** |
| Huawei, HiSilicon | Yes, but | We understand that the dl-PRS-ResourcePrioritySubset is only applicable for DL-AoD, and we have not discussed whether it can also be used for AI/ML based positioning method.**We suggest to make it FFS for now, and companies can have more time to check.** |
| ZTE | Yes | This IE is introduced for DL-AoD. Suggest to ignore the IE for AI pos |
| Lenovo | Yes |  |
| Nokia | Yes | From RAN2 point of view, the proposal 1 here and the TP in the running LPP CR are correct. Introduction of dl-PRS-ResourcePrioritySubset for AI/ML positioning requires agreement in RAN1 first since they define the behaviour in 38.214. This can be discussed directly in RAN1 without capturing an FFS in 37.355. If RAN1 agrees, we can update RAN2 spec to align with 38.214. |
| Xiaomi | Yes |  |
| LG | Yes | The dl-PRS-ResourcePrioritySubset was introduced specifically for DL-AoD, where the UE selects a subset of PRS resources based on directional relevance. In contrast, DL-TDoA relies on comprehensive timing measurements from all available PRS resources, making prioritization less meaningful. But it is not yet fully clear whether they strictly follow the DL-TDoA structure or could be extended to include other types such as DL-AoD.Regardless, this IE is relevant only for UE-assisted positioning, where the UE reports measurement results and LMF may prioritize certain PRS resources to optimize reporting overhead. In UE-based positioning, including R19 AI/ML methods (i.e., AI/ML Positioning Case 1), the UE performs inference locally and does not report measurements, making such prioritization unnecessary. |
|  |  |  |

**Open issue LPP-2:****Applicability of IE *NR-DL-PRS-ProcessingCapability***

**Issue description:**

In the case of capabilities for multiple NR positioning methods are provided, the IE *NR-DL-PRS-ProcessingCapability* applies across the NR positioning methods and the target device shall indicate the same values for the capabilities in IEs *NR-DL-TDOA-ProvideCapabilities*, *NR-DL-AoD-ProvideCapabilities*, and *NR-Multi-RTT-ProvideCapabilities*.

If the IE *NR-DL-PRS-ProcessingCapability* is applicable to NR AI/ML positioning, it needs to be clarified whether the above also applies to *NR-AI-ML-PositioningProvideCapabilities*.

**Status in running CR:**

Captured as "Editor's Note" (without changes to the current specification text).

**Relevant Agreements:**

R2-25xxxxx (R1-2502979): LS on updated Rel-19 RAN1 UE features lists for NR after RAN1#120bis.

The above RAN1 feature list includes some DL-PRS Resource capabilities (58-2-3/3a/3b), however, all in yellow highlight (indicating that they are not yet final).

Whether the *NR-DL-PRS-ProcessingCapability*are applicable to NR AI/ML positioning Case 1 or not is currently unclear (most capabilities in this IE are primarily for UE-assisted mode). In addition, if the capabilities should be applicable, it is unclear whether the same values as in IEs *NR-DL-TDOA-ProvideCapabilities*, *NR-DL-AoD-ProvideCapabilities*, and *NR-Multi-RTT-ProvideCapabilities* shall be indicated.

**Proposed resolution:**

Wait for further RAN1 input and keep the "Editor's Note" in the running CR.

**Proposal 2: Regarding the applicability of IE *NR-DL-PRS-ProcessingCapability* to NR AI/ML positioning Case 1, wait for further RAN1 input and keep the current "Editor's Note" in the running CR for now.**

Companies are invited to provide feedback regarding the above open issue and proposed resolution:

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree to proposal?** | **Other comments** |
| Huawei, HiSilicon | Yes |  |
| ZTE | Yes |  |
| Lenovo | Yes |  |
| Nokia | Yes | We should wait for a reasonably complete RAN1 UE features list that has sufficient details about UE capabilities for AI/ML positioning. |
| Xiaomi | Yes | This can be further discussed in the capability discussion after RAN1 concludes their FL. |
| LG | Yes | In UE-based AI/ML positioning, location inference is performed locally at the UE without measurement reporting, so the NR-DL-PRS-ProcessingCapability is not strictly required.However, we consider that this capability may still be useful to ensure consistency between training and inference PRS configurations.We agree with the proposed way forward to keep the current Editor’s Note and wait for further RAN1 input. |
|  |  |  |

**Open issue LPP-3:****Applicability of *NR-DL-PRS-QCL-ProcessingCapability***

**Issue description:**

In the case of capabilities for multiple NR positioning methods are provided, the IE *NR-DL-PRS-QCL-ProcessingCapability* applies across the NR positioning methods and the target device shall indicate the same values for the capabilities in IEs *NR-DL-TDOA-ProvideCapabilities*, *NR-DL-AoD-ProvideCapabilities*, and *NR-Multi-RTT-ProvideCapabilities*.

If the IE *NR-DL-PRS-QCL-ProcessingCapability* is applicable to NR AI/ML positioning, it needs to be clarified whether the above also applies to *NR-AI-ML-PositioningProvideCapabilities*.

**Status in running CR:**

Captured as "Editor's Note" (without changes to the current specification text).

**Relevant Agreements:**

R2-25xxxxx (R1-2502979): LS on updated Rel-19 RAN1 UE features lists for NR after RAN1#120bis.

The above RAN1 feature list includes some DL-PRS Resource capabilities (58-2-3/3a/3b), however, all in yellow highlight (indicating that they are not yet final).

Whether the *NR-DL-PRS-QCL-ProcessingCapability* are applicable to NR AI/ML positioning Case 1 or not is currently unclear (most capabilities are primarily for UE-assisted mode). In addition, if the capabilities should be applicable, it is unclear whether the same values as in IEs *NR-DL-TDOA-ProvideCapabilities*, *NR-DL-AoD-ProvideCapabilities*, and *NR-Multi-RTT-ProvideCapabilities* shall be indicated.

**Proposed resolution:**

Wait for further RAN1 input and keep the "Editor's Note" in the running CR.

**Proposal 3: Regarding the applicability of IE *NR-DL-PRS-QCL-ProcessingCapability* to NR AI/ML positioning Case 1, wait for further RAN1 input and keep the current "Editor's Note" in the running CR for now.**

Companies are invited to provide feedback regarding the above open issue and proposed resolution:

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree to proposal?** | **Other comments** |
| Huawei, HiSilicon | Yes |  |
| ZTE | Yes |  |
| Lenovo | Yes |  |
| Nokia | Yes | We should wait for a reasonably complete RAN1 UE features list that has sufficient details about UE capabilities for AI/ML positioning. |
| Xiaomi | Yes | This can be further discussed in the capability discussion after RAN1 concludes their FL. |
| LG | Yes | We have a similar view as for LPP-2. In UE-based AI/ML positioning, the NR-DL-PRS-QCL-ProcessingCapability is not strictly required, but it may still be useful to ensure configuration consistency between training and inference.We support keeping the current Editor’s Note and waiting for further RAN1 input. |
|  |  |  |

**Open issue LPP-4:****Applicability *of NR-DL-PRS-ResourcesCapability***

**Issue description:**

The IE *NR-DL-PRS-ResourcesCapability* defines the DL-PRS Resources capability for each positioning method.

However, most capabilities are primarily for UE-assisted mode. Whether and which DL-PRS Resources capabilities are needed for UE-based direct NR AI/ML positioning depends on RAN1.

**Status in running CR:**

Captured as "Editor's Note" (without changes to the current specification text).

**Relevant Agreements:**

R2-25xxxxx (R1-2502979): LS on updated Rel-19 RAN1 UE features lists for NR after RAN1#120bis.

The above RAN1 feature list includes some DL-PRS Resource capabilities (58-2-3/3a/3b), however, all in yellow highlight (indicating that they are not yet final).

However, this indicates that DL-PRS Resource capabilities specifically for NR AI/ML Positioning Case 1 are going to be defined.

**Proposed resolution:**

Wait for further RAN1 input and keep the "Editor's Note" in the running CR.

**Proposal 4: Regarding the applicability of IE *NR-DL-PRS-ResourcesCapability* to NR AI/ML positioning Case 1, wait for further RAN1 input and keep the current "Editor's Note" in the running CR for now.**

Companies are invited to provide feedback regarding the above open issue and proposed resolution:

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree to proposal?** | **Other comments** |
| Huawei, HiSilicon | Yes |  |
| ZTE | Yes |  |
| Lenovo | Yes |  |
| Nokia | Yes |  |
| Xiaomi | Yes |  |
| LG | Yes |  |
|  |  |  |

**Open issue LPP-5:****Applicability of *NR-On-Demand-DL-PRS-Configurations-Selected-IndexList***

**Issue description:**

In the case of available on-demand DL-PRS configurations for multiple NR positioning methods are provided, the IE *NR-On-Demand-DL-PRS-Configurations* shall be present in only one of *NR-Multi-RTT-ProvideAssistanceData*, *NR-DL-AoD-ProvideAssistanceData*, or *NR-DL-TDOA-ProvideAssistanceData.*

If on-demand DL-PRS is applicable to NR AI/ML positioning, it needs to be clarified whether the above also applies to *NR-AI-ML-PositioningProvideAssistanceData*.

**Status in running CR:**

Captured as "Editor's Note" in IEs *NR-On-Demand-DL-PRS-Configurations-Selected-IndexList*, *NR-DL-TDOA-ProvideAssistanceData, NR-DL-AoD-ProvideAssistanceData.*

**Relevant Agreements:**

From RAN1#119 (see Annex in LPP running CR [1] for the full list of RAN1 and RAN2 agreements):

|  |
| --- |
| **Agreement**For AI/ML based positioning Case 1, all assistance information from legacy UE-based DL-TDOA, other than info #7, can be provided from LMF to UE. For info #7, RAN1 study, if necessary, choose one alternative from the following:[…] |

**Proposed resolution:**

Given that all assistance information for UE-based DL-TDOA (other than info #7) are applicable to NR AI/ML positioning Case1, the on-demand DL-PRS feature, and associated assistance data and signalling is also applicable to NR AI/ML positioning Case 1. Since the on-demand DL-PRS configurations can then be included in the assistance data for each NR positioning method (incl. NR AI/ML positioning), they need to be provided only once in the case of multiple NR positioning methods are requested and an index indicates the applicable configuration(s) for each method. There seems no reason why NR AI/ML positioning Case 1 should not follow the same logic.

**Proposal 5: The IE *NR-On-Demand-DL-PRS-Configurations-Selected-IndexList* is also applicable to NR AI/ML positioning Case 1. The corresponding Editor's Notes in clause 6.4.3, 6.5.10.1, and 6.5.11.1 can be removed.**

Companies are invited to provide feedback regarding the above open issue and proposed resolution:

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree to proposal?** | **Other comments** |
| Huawei, HiSilicon | Yes |  |
| ZTE | Yes |  |
| Lenovo | Yes |  |
| Nokia | Yes |  |
| Xiaomi | Yes |  |
| LG | No | Sharing of NR-On-Demand-DL-PRS-Configurations among multiple NR positioning methods, including AI/ML positioning Case 1, is generally feasible. However, in the case of AI/ML positioning, the PRS configurations used during model training may not be aligned with those used by other positioning methods. Therefore, shared configurations should only be applied when compatibility with the AI/ML inference model can be ensured. |
|  |  |  |

**Open issue LPP-6:****Applicability of *NR-PRU-DL-Info***

**Issue description:**

Currently, the IE *NR-PRU-DL-Info* is primarily used for NR carrier phase positioning.

If the IE *NR-PRU-DL-Info* is also applicable to NR AI/ML positioning, the IE description needs to be generalized.

**Status in running CR:**

Captured as "Editor's Note" in IE *NR-PRU-DL-Info.*

**Relevant Agreements:**

From RAN1#119 (see Annex in LPP running CR [1] for the full list of RAN1 and RAN2 agreements):

|  |
| --- |
| **Agreement**For AI/ML based positioning Case 1, all assistance information from legacy UE-based DL-TDOA, other than info #7, can be provided from LMF to UE. For info #7, RAN1 study, if necessary, choose one alternative from the following:[…] |

**Proposed resolution:**

Given that all assistance information for UE-based DL-TDOA (other than info #7) are applicable to NR AI/ML positioning Case1, the IE *NR-PRU-DL-Info* is also applicable:

|  |  |
| --- | --- |
| 14 | PRU measurements together with the location information of the PRU |

Therefore, the IE description should be generalized (i.e., not specific to carrier phase measurements).

**Proposal 6: The IE *NR-PRU-DL-Info*****is also applicable to NR AI/ML positioning Case 1. The corresponding Editor's Notes in clause 6.4.3 can be removed.**

Companies are invited to provide feedback regarding the above open issue and proposed resolution:

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree to proposal?** | **Other comments** |
| Huawei, HiSilicon | Yes |  |
| ZTE | Yes, but | The current single *NR-PRU-DL-Info* IE can only contain one PRU’s label. However for training, UE needs to gather a training data set contain multiple PRU’s label. So I suggest to add a PRU list inside the current *NR-PRU-DL-Info* IE, and this list is applicable for AI pos method. |
| Lenovo | Yes |  |
| Nokia | See comments | Agree that NR-PRU-DL-Info is also applicable to AI/ML positioning Case 1, but it may be more than just the use of carrier phase measurement for UE-based AI/ML positioning. RAN2 needs to discuss and decide if PRU is used for ground truth label information for AI/ML positioning. If so, this particular aspect needs to be explained in the IE description. In addition, the PRU reporting of “CP measurements with associated measurements” is still valid even when CP measurements are used for AI/ML positioning and hence this information must be retained in the IE description.We can strive to provide a general description in the first part of the IE description but still the specifics of ground truth forwarding and forwarding of carrier phase measurements with associated measurements can be explained as part of the IE description. See also our comments on the running LPP CR provided in “R2-250xxxx\_([POST129bis][015][AI PHY] Discussion)\_v02\_Nokia”. |
| Xiaomi | Yes |  |
| LG | Yes, but | We agree that NR-PRU-DL-Info is applicable to NR AI/ML positioning Case 1, as the PRU label and associated location information can be used as part of the training and inference model input (e.g., as ground truth data). However, the current description should be generalized beyond carrier phase positioning. In addition, supporting multiple PRUs within this IE (e.g., by introducing a list structure) may be beneficial and could be considered in future revisions. |
|  |  |  |

**Open issue LPP-7:****Applicability of *NR-SelectedDL-PRS-IndexList***

**Issue description:**

In the case of assistance data for multiple NR positioning methods are provided, the IE *NR-DL-PRS-AssistanceData* shall be present in only one of *NR-Multi-RTT-ProvideAssistanceData*, *NR-DL-AoD-ProvideAssistanceData*, or *NR-DL-TDOA-ProvideAssistanceData*.

If the IE *NR-DL-PRS-AssistanceData* is applicable to NR AI/ML positioning, it needs to be clarified whether the above also applies to *NR-AI-ML-PositioningProvideAssistanceData*.

**Status in running CR:**

Captured as "Editor's Note" in IEs *NR-SelectedDL-PRS-IndexList*, *NR-DL-TDOA-ProvideAssistanceData, NR-DL-AoD-ProvideAssistanceData.*

**Relevant Agreements:**

From RAN1#119 (see Annex in LPP running CR [1] for the full list of RAN1 and RAN2 agreements):

|  |
| --- |
| **Agreement**For AI/ML based positioning Case 1, all assistance information from legacy UE-based DL-TDOA, other than info #7, can be provided from LMF to UE. For info #7, RAN1 study, if necessary, choose one alternative from the following:[…] |

**Proposed resolution:**

Given that all assistance information for UE-based DL-TDOA (other than info #7) are applicable to NR AI/ML positioning Case1, the *NR-DL-PRS-AssistanceData* and associated signalling is also applicable to NR AI/ML positioning Case 1. Since the *NR-DL-PRS-AssistanceData* can then be included in the assistance data for each NR positioning method (incl. NR AI/ML positioning), they need to be provided only once in the case of multiple NR positioning methods are requested and an index indicates the applicable configuration(s) for each method. There seems no reason why NR AI/ML positioning Case 1 should not follow the same logic.

**Proposal 7: The IE *NR-SelectedDL-PRS-IndexList* is also applicable to NR AI/ML positioning Case 1. The corresponding Editor's Notes in clause 6.4.3, 6.5.10.1, and 6.5.11.1 can be removed.**

Companies are invited to provide feedback regarding the above open issue and proposed resolution:

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree to proposal?** | **Other comments** |
| Huawei, HiSilicon | Yes |  |
| ZTE | Yes |  |
| Lenovo | Yes |  |
| Nokia | Maybe | Given that we need to wait for RAN1 to understand the applicability of DL-PRS, PRS processing capabilities, on-demand PRS and other PRS related IEs etc, it is easier to keep the FFS also on this NR-SelectedDL-PRS-IndexList and resolve it all together as the PRS assistance details becomes clear from RAN1 features list. |
| Xiaomi | Yes |  |
| LG | No | The applicability of NR-SelectedDL-PRS-IndexList depends on whether a shared NR-DL-PRS-AssistanceData is used across multiple positioning methods. While this IE allows each method, including AI/ML positioning Case 1, to refer to a subset of the common PRS resources via index, it can only be used when the assistance data itself is shared. If AI/ML requires a distinct PRS assistance configuration, a separate instance may be needed and the index-based referencing may not apply. |
|  |  |  |

### NR AI/ML Positioning Information Elements (Clause 6.5.13)

**Open issue LPP-8:****Details of IE *NR-AI-ML-PositioningProvideAssistanceData***

**Issue description:**

This IE defines the assistance data for NR AI/ML positioning Case 1. According to RAN1#119 agreements, the assistance data should be analogous to DL-TDOA assistance data:

|  |  |  |
| --- | --- | --- |
| **Agreement**For AI/ML based positioning Case 1, all assistance information from legacy UE-based DL-TDOA, other than info #7, can be provided from LMF to UE. For info #7, RAN1 study, if necessary, choose one alternative from the following:* Alternative 1. Info #7 is provided implicitly via associated ID.
	+ Associated ID is signaled by LMF to indicate whether info #7 is consistent between training and inference.
* Alternative 2. Info #7 can be provided either implicitly or explicitly by LMF. Note: no UE capability is introduced on whether info #7 is provided implicitly or explicitly, and the UE can request info #7 to be provided explicitly or implicitly.
	+ If provided implicitly, associated ID is signaled by LMF to indicate whether info #7 is consistent between training and inference.
* Alternative 3. Info #7 is **not** be provided from LMF to UE.
	+ If info #7 is not provided, UE may assume info #7 is consistent between training and inference.
* Alternative 4. Info #7 is provided explicitly from LMF to UE.

|  |  |
| --- | --- |
| 7 | Geographical coordinates of the TRPs served by the gNB (include a transmission reference location for each DL-PRS Resource ID, reference location for the transmitting antenna of the reference TRP, relative locations for transmitting antennas of other TRPs) |

 |

**Status in running CR:**

The running CR currently includes all assistance data from UE-based DL-TDOA, except the *NR-PeriodicAssistData* (which is only for carrier phase positioning and not included in the RAN1 agreement), together with an Editor's Note. The RAN1 agreement refers to the information in Stage 2 (38.305):

|  |  |
| --- | --- |
|   | **Information** |
| 1 | Physical cell IDs (PCIs), global cell IDs (GCIs), ARFCN, and PRS IDs of candidate NR TRPs for measurement |
| 2 | Timing relative to the serving (reference) TRP of candidate NR TRPs |
| 3 | DL-PRS configuration of candidate NR TRPs |
| 4 | Indication of which DL-PRS Resource Sets across DL-PRS positioning frequency layers are linked for DL-PRS bandwidth aggregation |
| 5 | SSB information of the TRPs (the time/frequency occupancy of SSBs) |
| 6 | Spatial direction information (e.g. azimuth, elevation etc.) of the DL-PRS Resources of the TRPs served by the gNB |
| 7 | Geographical coordinates of the TRPs served by the gNB (include a transmission reference location for each DL-PRS Resource ID, reference location for the transmitting antenna of the reference TRP, relative locations for transmitting antennas of other TRPs) |
| 8 | Fine Timing relative to the serving (reference) TRP of candidate NR TRPs |
| 9 | PRS-only TP indication |
| 10 | The association information of DL-PRS resources with TRP Tx TEG ID |
| 11 | LOS/NLOS indicators |
| 12 | On-Demand DL-PRS-Configurations, possibly together with information on which configurations are available for DL-PRS bandwidth aggregation |
| 13 | Validity Area of the Assistance Data |
| 14 | PRU measurements together with the location information of the PRU |
| 15 | Data facilitating the integrity results determination of the calculated location |
| 16 | TRP beam/antenna information (including azimuth angle, zenith angle and relative power between PRS resources per angle per TRP) |
| 17 | Expected Angle Assistance information |
| 18 | PRS priority list |

[1] Table 8.12.2.1.0-1 in 38.305, Use equipment (UE) positioning in NG-RAN (Release 18), v18.3.0

[2] Table 8.11.2.1.0-1 in 38.305, Use equipment (UE) positioning in NG-RAN (Release 18), v18.3.0

NOTE: Items #7, 16-18 (assistance data for DL-AoD) are still under discussion in RAN1.

**Proposed resolution:**

Given that all assistance information for UE-based DL-TDOA (other than info #7) are applicable to NR AI/ML positioning Case1, the *NR-AI-ML-PositioningProvideAssistanceData* should include (at least) all the assistance data IEs currently defined for UE-based DL-TDOA. This needs to be revised once additional RAN1 agreements are available.

**Proposal 8: The IE *NR-AI-ML-PositioningProvideAssistanceData* contains (at least) all assistance data elements from UE-based DL-TDOA as starting point. This will be revised when additional RAN1 input is available. The current Editor's Note is kept for now.**

Companies are invited to provide feedback regarding the above open issue and proposed resolution:

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree to proposal?** | **Other comments** |
| Huawei, HiSilicon | Yes |  |
| ZTE | Yes |  |
| Lenovo | Yes |  |
| Nokia | Maybe | While the assumption here based on the RAN1 agreement is correct, we prefer to wait for RAN1 parameters list to specify the contents of the NR-AI-ML-PositioningProvideAssistanceData IE. Since the information from 38.305 was used by RAN1 as a basis for discussion in RAN1, a more normative way to specify is to base it on the parameters list from RAN1. Otherwise, we will have to spend time trying to align between RAN1 and RAN2 agreements as discrepancies are found later. If this proposed approach is to be agreed, the Editor’s Note currently in the running CR shall be kept until the parameters list from RAN1 is final. Also, the proposal text must include “(other than info #7)” as that is still an issue for RAN1 to resolve. |
| Xiaomi | Yes |  |
| LG | Yes |  |
|  |  |  |

**Open issue LPP-9:****Details of IE *NR-AI-ML-PositioningRequestAssistanceData***

**Issue description:**

The IE *NR-AI-ML-PositioningRequestAssistanceData* is used by the target device to request assistance data from a location server for NR AI/ML direct positioning (e.g., during an ongoing LPP session or via MO-LR).

This IE should be analogous to the *NR-AI-ML-PositioningProvideAssistanceData.* I.e., the "Request" must match the "Provide".

For the *NR-AI-ML-PositioningProvideAssistanceData*, see issue #LPP-8.

**Status in running CR:**

The running CR currently includes all assistance data from UE-based DL-TDOA, except the *NR-PeriodicAssistData* (which is only for carrier phase positioning), together with an Editor's Note (see issue #LPP-8).

**Proposed resolution:**

Given that all assistance information for UE-based DL-TDOA (other than info #7) are applicable to NR AI/ML positioning Case1, the *NR-AI-ML-PositioningRequestAssistanceData* should include (at least) all the assistance data IEs currently defined for UE-based DL-TDOA. This needs to be revised once additional RAN1 agreements are available.

**Proposal 9: The IE *NR-AI-ML-PositioningRequestAssistanceData* contains (at least) all assistance data elements from UE-based DL-TDOA as starting point. This will be revised when additional RAN1 input is available. The current Editor's Note is kept for now.**

Companies are invited to provide feedback regarding the above open issue and proposed resolution:

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree to proposal?** | **Other comments** |
| Huawei, HiSilicon | Yes |  |
| ZTE | Yes, but | Suggest RAN2 to discuss detailed/specified request assistance data for AI, to facilitate consistency or facilitate training. So this proposal can also be wait for RAN1 or RAN2. |
| Lenovo | Yes |  |
| Nokia | Maybe | While the assumption here based on the RAN1 agreement is correct, we prefer to wait for RAN1 parameters list to specify the contents of the NR-AI-ML-PositioningRequestAssistanceData IE. If this proposed approach is to be agreed, the Editor’s Note currently in the running CR shall be kept until the parameters list from RAN1 is final. Also, the proposal text must include “(other than info #7)” as that is still an issue for RAN1 to resolve. |
| Xiaomi | Yes | We are also fine to wait for RAN1 parameter list for detailed information. |
| LG | Yes |  |
|  |  |  |

**Open issue LPP-10:****Details of IE** ***NR-AI-ML-PositioningProvideLocationInformation***

**Issue description:**

The IE *NR-AI-ML-PositioningProvideLocationInformation* provides the results of the inference operation. This should comprise the location coordinates (which are reported in *CommonIEsProvideLocationInformation*) together with the time stamp (as for any UE-based method). However, for the NR positioning methods, batch reporting was introduced in Rel-17 (i.e., up to 32 instances (location results) can be reported at once). One issue here is whether batch reporting should also be applicable to NR AI/ML positioning.

**Status in running CR:**

Captured as "Editor's Note" in IE *NR-AI-ML-PositioningProvideLocationInformation.*

**Proposed resolution:**

The IE *NR-AI-ML-PositioningProvideLocationInformation* includes at least the location coordinates together with time stamp (as for any UE-based method). Any additional elements depend on further RAN1 progress.

Since NR AI/ML positioning also falls into the category of "NR positioning methods" (e.g., measurements are based on NR DL-PRS), it seems consequent that batch reporting is also applicable to NR AI/ML positioning (in the same way as UE-based DL-TDOA and DL-AoD).

**Proposal 10: The IE *NR-AI-ML-PositioningProvideLocationInformation* contains (at least) the time stamp for the location coordinates (which are reported in *CommonIEsProvideLocationInformation*). This will be revised when additional RAN1 input is available. The current Editor's Note is kept for now.**

Companies are invited to provide feedback regarding the above open issue and proposed resolution:

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree to proposal?** | **Other comments** |
| Huawei, HiSilicon | Yes |  |
| ZTE | Yes |  |
| Lenovo | Yes |  |
| Nokia | Yes |  |
| Xiaomi | Yes |  |
| LG | Yes |  |
|  |  |  |

Companies are requested to provide their view on whether batch reporting (i.e., up to 32 instances (location results) can be reported at once) should also be applicable to NR AI/ML positioning Case 1.

|  |  |  |
| --- | --- | --- |
| **Company** | **Applicable/Not Applicable** | **Comment/Reason** |
| Huawei, HiSilicon | Yes | This may need new UE capability indication, but we could discuss it later. |
| ZTE | No | This batch reporting is a R17 enhancement rather than a fundamental function of a positioning method. So this should be explicited confirmed before adding to the running CR. Also this is not an essential function to be supported in AI/ML positioning. |
| Nokia | See comment | We think it is up to RAN1 to decide if there are any benefits in using batch reporting for AI/ML positioning also. |
| Xiaomi | See comment | Agree with Nokia that this is up to RAN1 whether batch reporting needs to be supported or not. |
| LG | Yes, but | We support applying batch reporting to NR AI/ML positioning Case 1, for consistency with other NR positioning methods defined in Rel-17. Batch reporting may also be beneficial in scenarios where the AI/ML model performs inference across multiple time instances. However, it may require a corresponding UE capability indication, which can be further discussed in RAN1 or RAN2. |
|  |  |  |

**Open issue LPP-11:****Details of IE *NR-AI-ML-PositioningRequestLocationInformation***

**Issue description:**

The IE *NR-AI-ML-PositioningRequestLocationInformation* includes information on the location request. Per agreement from RAN2#129:

|  |
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| * Existing LPP procedures related to Location Information Transfer (RequestLocationInformation/ ProvideLocationInformation messages) are used for providing and requesting the results of the UE sided model inference operation. The detail stage 3 message extension can be discussed while drafting the stage 3 CR.
 |

**Status in running CR:**

The running CR currently includes only the common *AssistanceAvailability* flag (which is included in all LPP positioning methods for which assistance data are defined), together with an "Editor's Note" in IE *NR-AI-ML-PositioningRequestLocationInformation.*

**Proposed resolution:**

Companies to provide contributions to the following meeting on additional positioning instructions for IE *NR-AI-ML-PositioningRequestLocationInformation* (if any).

**Proposal 11: The IE *NR-AI-ML-PositioningRequestLocationInformation* contains (at least) the *AssistanceAvailability* flag. Additional details/information can be discussed via company contributions.**

Companies are invited to provide feedback regarding the above open issue and proposed resolution:

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree to proposal?** | **Other comments** |
| Huawei, HiSilicon | Yes |  |
| ZTE | Yes |  |
| Lenovo | Yes |  |
| Nokia | Yes |  |
| Xiaomi | Yes |  |
| LG | Yes |  |
|  |  |  |

**Open issue LPP-12:****Details of IE *NR-AI-ML-PositioningProvideCapabilities***

**Issue description:**

The IE *NR-AI-ML-PositioningProvideCapabilities* indicates support for NR AI/ML direct positioning (i.e., Case 1) and provides the NR AI/ML positioning capabilities ("applicable functionality") to the location server.

|  |
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| RAN2#126:* The LPP Capability Transfer procedures (RequestCapabilities/ProvideCapabilities messages) are used to indicate supported AI/ML positioning capabilities. FFS how to handle dynamic capabilities, depending on further RAN1 progress and understanding of the functionality.

RAN2#128:* For POS Case 1, RAN2 confirm that the existing unsolicited UE capability report mechanism in LPP can support UE to report the applicable functionality in both “proactive” and “reactive” as a baseline.
	+ Proactive case: When the applicability change, UE can send an unsolicited LPP ProvideCapabilities message to LMF.
	+ Reactive case: If the applicability changes based on the configuration in LPP ProvideAssistanceData message in step 3, UE can send an unsolicited LPP ProvideCapabilities message to LMF. Configuration details are FFS.

RAN2#129bis:* UE reports the applicable functionality to the LMF by the LPP provide capabilities message without any additional LMF control.
 |

**Status in running CR:**

The IE *NR-AI-ML-PositioningProvideCapabilities* currently includes the common LPP capabilities and assistance data supported (per *NR-AI-ML-PositioningProvideAssistanceData* (which are the same as in *NR-DL-TDOA-ProvideAssistanceData*)).

DL-PRS capabilities depend on further RAN1 agreements and are not included yet (see #LPP-2/3/4).

Captured as "Editor's Note" in IE *NR-AI-ML-PositioningProvideCapabilities.*

**Proposed resolution:**

Given that all assistance information for UE-based DL-TDOA (other than info #7) are applicable to NR AI/ML positioning Case1, the *NR-AI-ML-PositioningProvideCapabilities* should include (at least) all the capabilities currently defined for UE-based DL-TDOA.

**Proposal 12: The IE *NR-AI-ML-PositioningProvideCapabilities*** **contains (at least) all capabilities from UE-based DL-TDOA as starting point, except the capability related to DL-PRS processing (see #LPP-2/3/4). This will be revised when additional RAN1 input is available. The current Editor's Note is kept for now.**

Companies are invited to provide feedback regarding the above open issue and proposed resolution:

|  |  |  |
| --- | --- | --- |
| **Company** | **Agree to proposal?** | **Other comments** |
| Huawei, HiSilicon | Yes |  |
| ZTE | Yes |  |
| Lenovo | Yes |  |
| Nokia | Maybe | While the assumption here based on the RAN1 agreement is correct, we prefer to wait for RAN1 parameters list to specify the contents of the NR-AI-ML-PositioningRequestAssistanceData IE. If this proposed approach is to be agreed, the Editor’s Note currently in the running CR shall be kept until the parameters list from RAN1 is final. Also, the proposal text must include “(other than info #7)” as that is still an issue for RAN1 to resolve. |
| Xiaomi |  | We prefer to wait for RAN1 conclusion before capturing it. |
| LG | Yes |  |
|  |  |  |

**Open issue LPP-13:****Location server error causes**

**Issue description:**

The IE *NR-AI-ML-Positioning-Error* is used by the location server or target device to provide NR AI/ML positioning error reasons to the target device or location server, respectively.

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| RAN2#128:* As a baseline, if the AIML based positioning method becomes non-applicable when LMF requests UE location estimation, UE cannot perform the AIML based positioning, and reply with LPP Providelocationinformation message with error cause. FFS if other fallback options are considered.

RAN2#129* The content of error cause is discussed while drafting stage3 CRs.
 |

**Status in running CR:**

The IE *NR-DL-AI-ML-LocationServerErrorCauses* currently includes the error causes from DL-TDOA.

Captured as "Editor's Note" in IE *NR-DL-AI-ML-LocationServerErrorCauses.*

**Proposed resolution:**

Companies to provide contributions to the following meeting on error causes for IE *NR-DL-AI-ML-LocationServerErrorCauses* (the proposed error causes should be accompanied by some justification (e.g., why needed? Expected receiver behaviour? etc.)

**Open issue LPP-14:****Target device error causes**

**Issue description:**

The IE *NR-AI-ML-Positioning-Error* is used by the location server or target device to provide NR AI/ML positioning error reasons to the target device or location server, respectively.

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| RAN2#128:* As a baseline, if the AIML based positioning method becomes non-applicable when LMF requests UE location estimation, UE cannot perform the AIML based positioning, and reply with LPP Providelocationinformation message with error cause. FFS if other fallback options are considered.

RAN2#129* The content of error cause is discussed while drafting stage3 CRs.
 |

**Status in running CR:**

The IE *NR-DL-AI-ML-TargetDeviceErrorCauses* currently includes the error causes from DL-TDOA.

Captured as "Editor's Note" in IE *NR-DL-AI-ML-TargetDeviceErrorCauses.*

**Proposed resolution:**

Companies to provide contributions to the following meeting on error causes for IE *NR-DL-AI-ML-TargetDeviceErrorCauses* (the proposed error causes should be accompanied by some justification (e.g., why needed? Expected receiver behaviour? etc.)

# Other identified open issues

Companies are invited to describe any other identified open issues not currently included within this document.

|  |  |
| --- | --- |
| **Company** | **Other identified open issues? (please describe)** |
| CATT | Suggested open issue: whether positioning Integrity is supported for AI/ML positioning method (i.e., Case 1)?Per RAN1 agreement: "For AI/ML based positioning Case 1, all assistance information from legacy UE-based DL-TDOA, other than info #7, can be provided from LMF to UE. “The RAN1 agreement already includes info #15 for positioning integrity: *Data facilitating the integrity results determination of the calculated location*So it seems that RAN1 already agreed positioning Integrity is supported for AI/ML positioning method, but there is still no RAN2 discussion on this topic. And according to the comments received in [POST129bis][014][AI PHY] 38.305 Running CR, companies have different views on this understanding. |
| Lenovo | In terms of monitoring for AI/ML positioning, RAN1 agrees to support :* Option A: The target UE side performs monitoring metric calculation. The target UE may signal the monitoring outcome to the LMF.
* the content of monitoring outcome includes at least an indication that the target UE cannot perform the Case 1 positioning method.

This includes all the sub-options A-1, A-2 and A-3. The details are upon Ran1 still, but there are expected RAN2 impact. Could be captured in the open issue list. Following up on sub-option A-1, RAN1 agreed that: Option A-1. At least information on ground truth label of the target UE is generated by LMF and provided to the target UE.The details on whether a new message or existing message is used to provide the ground truth label to the target UE is also expected to have RAN2 impact. Currently, there is no mechanism for LMF to provide the target UE with ground truth label, e.g., target UE location to the target UE. |
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# Conclusions

*<To be filled after companies have provided feedback to the proposed resolutions for simple issues only. Please include the number of supporting companies (e.g., 18/20]) in brackets within the proposal>*

The following proposals have been provided based on feedback to the above document:

[Proposals for easy agreement]

*<List all proposals with consensus and/or may be easily agreed based on Rapporteur’s opinion>*

[Proposals for discussion]

*<List all proposals which will likely require further online/offline discussion to resolve>*

# References

1. R2-250xxxx\_(Running CR 37355-i40)\_v01.docx: "Running CR for AI/ML Positioning Accuracy Enhancements";
provided in the '[docs](https://www.3gpp.org/ftp/Email_Discussions/RAN2/%5BRAN2%23129bis%5D/%5BPOST129bis%5D%5B015%5D%5BAI%20PHY%5D%2037.355%20Running%20CR%20%28Qualcomm%29/docs)' sub-folder for this email discussion.