**3GPP TSG RAN WG1#107 R1-2112508**

**e-meeting, November 11th – 19th, 2021**

**Title: FL Summary for Rel-17 RRC parameters for positioning enhancement**

**Source: Moderator (CATT)**

**Agenda item: 8.5**

**Document for:** **Discussion and Decision**

1. Introduction

This document provides a summary of the following email discussion for AI 8.5:

[107-e-R17-RRC-NR-ePos] Email discussion on Rel-17 RRC parameters for positioning enhancement – Ren Da (CATT)

* Email discussion to start on November 15

The RRC parameters from the last meeting are included in R1-2110573[1].

The recommendations for RAN1 RRC parameter preparation are provided in [2]. The suggested guidelines are copied in the following for convenience:

* *Column* ***E*** (RAN2 Parent IE): *Should be left empty*. Provide information on Parent IE in *Column* ***M***, if needed.
* *Column F* (RAN2 ASN.1 name): *Should be left empty*.
* *Column J* (description): Should be suitable as “field description” for the RRC specification. i.e. it should clarify what the UE does when the NW sets the field. Should e.g., contain the unit of the numerical values. Short and concrete descriptions are preferred.
* *Column M* (per UE, cell, ...): May also *contain the name of a parent IE* that RAN1 considers appropriate.
* *Column P* (Comments): Should contain *background information* from RAN1 to RAN2 that helps RAN2 to understand the context and the feature.
* *Column Q (Status [Post 106b-e]): No change is allowed*
  + use different color (e.g. blue) for any change applied to a row that is marked as “stable” for “Status [Post 106b-e]”
* *Column R (Status [Post 1067-e]): Please provide the status, i.e. “stable/unstable” for all row under column “Status Post [107-e]”.*
* “Stable”: For previously unstable rows that are stable now->Mean the row is stable.
* “Unstable” For rows that were stable before but have become unstable Or they are still unstable -> Mean the row is unstable. Please keep the changes that people see.
* “New-Stable”: New rows which are stable
* “New-unstable”: New rows which are not stable
* Only rows marked as {Stable, New-stable} will be included for LS to RAN2.
* Only rows marked as {Unstable, New-unstable} will be kept in backlog for future meetings to be revisited.

Additional Notes:

1. Although the subject title says the email discussion is about Rel-17 RRC parameters, for Rel-17 ePOS, we will also need to include the parameters related to other protocols, namely, LPP/NRPPa, in this email discussion. We will basically follow the recommendation of the RRC parameter for the preparation of LPP/NRPPa parameters.
2. The parameters related to the maximum numbers (e.g., the maximum number of UE RX/Tx/RxTx TEGs) discussed in this document are the maximum numbers allowed in the specifications (e.g., TS 37.355, TS 38.455, TS 38.331). This is separate from the corresponding parameters related to UE capability, which will be discussed in UE feature session. Obviously, the maximum numbers supported by a UE capability do not exceed the maximum numbers allowed in the specifications.
3. For new RRC parameters added in Rel-107-e, we may use the word document for email discussion, which makes it easier to track the comments and changes. The final tables of the parameters after this email discussion will be copied into the companion spreadsheet, which will be submitted together with this word document.

2. Accuracy improvements by mitigating UE Rx/Tx and/or gNB Rx/Tx timing delays

(1st Round) Parameter Table

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **WI code** | **Sub-feature group** | **Parameter name in the spec** | **New or existing?** | **Description** | **Value range** | **Per (UE, cell, TRP, …)** | **Specification** | **Comment** | **Status [Post 106b-e]** | **Status [Post 107-e]** |
| NR\_pos\_enh | Mitigation of UE Rx/Tx timing delays | ueRxTEG-ID | New | The ID of a UE Rx timing error group, which is sent with RSTD measurements by UE to LMF. The UE includes one ueRxTEG-ID for the RSTD reference time and one ueRxTEG-ID for each DL RSTD measurement (including each additional DL RSTD measurement). | FFS |  | FFS for RAN2 | Agreement: • Subject to UE capability, support a UE to include one UE Rx TEG ID for the RSTD reference time and one UE Rx TEG ID for each DL RSTD measurement (including each additional DL RSTD measurement), in a DL TDOA measurement report. These UE Rx TEG IDs can be the same or different. | stable |  |
| NR\_pos\_enh | Mitigation of UE Rx/Tx timing delays | ueTxTEG | New | A UE Tx TEG is associated with the transmissions of one or more UL positioning SRS resources. ueTxTEG may be sent from UE to LMF for supporting UL-TDOA or multi-RTT. | N/A |  | FFS for RAN2/RAN3 | **Agreement**  Confirm and modify the working assumption with the following modifications:   * For mitigating UE Tx timing errors for UL TDOA, subject to UE’s capability, support the serving gNB to request a UE to provide the association information of UL SRS resources for positioning with Tx TEGs to the serving gNB if the UE supports multiple UE Tx TEGs for UL TDOA.   + The serving gNB should forward the association information provided by the UE to the LMF.   + UE should report its capability of supporting multiple UE Tx TEGs for UL TDOA to serving gNB. * For mitigating UE Tx timing errors for Multi-RTT, subject to UE’s capability, support the LMF to request a UE to provide the association information of UL SRS resources for positioning with Tx TEGs directly to the LMF if the UE supports multiple Tx TEGs for Multi-RTT.   + UE should report its capability of supporting multiple UE Tx TEGs for Multi-RTT directly to the LMF. * Note: For mitigating UE Tx timing errors when both UL-TDOA and Multi-RTT, or UL-TDOA and DL-TDOA are used, the UE should provide the association information of UL SRS resources for positioning with Tx TEGs, subject to UE capability (in the bullets above):   + to the serving gNB if a request to provide the association information is received from the gNB   to the LMF if a request to provide the association information is received from the LMF | stable |  |
| NR\_pos\_enh | Mitigation of UE Rx/Tx timing delays | ueTxTEG-ID | New | The ID of a UE Tx timing error group. One UE Tx TEG ID can be associated with one or more UL positioning SRS resource IDs. | FFS | “in ueTxTEG” | FFS for RAN2/RAN3 |  | stable |  |
| NR\_pos\_enh | Mitigation of UE Rx/Tx timing delays | [srs-PosResourceSetId] | Existing | FFS: whether there is a need to include the positioning SRS resource set ID in ueTxTEG |  | “in ueTxTEG” | FFS for RAN2/RAN3 |  | stable |  |
| NR\_pos\_enh | Mitigation of UE Rx/Tx timing delays | [srs-PosResourceId] | Existing | Positioning SRS resource ID |  | “in ueTxTEG” | FFS for RAN2/RAN3 | FFS: the maximum number of positioning SRS Resources | stable |  |
| NR\_pos\_enh | Mitigation of UE Rx/Tx timing delays | ueRxTxTEG-ID-group | New | Up to UE capability, a UE may report an ueRxTxTEG-ID-group with a UE Rx-Tx measurement to LMF. The ueRxTxTEG-ID-group can include one of the following combinations of TEG IDs:  • An UE RxTx TEG ID • A pair of UE {RxTx TEG ID, Tx TEG ID} • A pair of UE {Rx TEG ID, Tx TEG ID} • FFS: A triplet of UE {RxTx TEG ID, Rx TEG ID, Tx TEG ID} | FFS |  | FFS for RAN2 | Agreements For mitigating UE Tx/Rx timing errors for DL+UL positioning, a UE may should support, up to UE capability, either one or both of the following options: • Option 1: Reporting of UE RxTx TEG ID • Option 2: Reporting of UE Rx TEG ID and UE Tx TEG ID.  Agreements If a RxTx TEG ID is reported with a UE Rx-Tx time difference measurement, the UE may optionally also report a Tx TEG ID. | stable |  |
| NR\_pos\_enh | Mitigation of UE Rx/Tx timing delays | ueRxTxTEG-ID | New | The ID of a UE RxTx timing error group. | FFS | “in ueRxTxTEG-ID-group” | FFS for RAN2 |  | stable |  |
| NR\_pos\_enh | Mitigation of UE Rx/Tx timing delays | ueTxTEG-ID | New | The ID of a UE Tx timing error group. | FFS | “in ueRxTxTEG-ID-group” | FFS for RAN2 |  | stable |  |
| NR\_pos\_enh | Mitigation of UE Rx/Tx timing delays | ueRxTEG-ID | New | The ID of a UE Rx timing error group. | FFS | “in ueRxTxTEG-ID-group” | FFS for RAN2 |  | stable |  |
| NR\_pos\_enh | Mitigation of UE Rx/Tx timing delays | [maxNumOfUE-RxTEG] | New | FFS | [Per UE] | FFS for RAN2 |  | stable |  |
| NR\_pos\_enh | Mitigation of UE Rx/Tx timing delays | [maxNumOfUE-TxTEG] | New | The maximum number of UE-RxTEG | FFS | [Per UE] | FFS for RAN2 |  | stable |  |
| NR\_pos\_enh | Mitigation of UE Rx/Tx timing delays | [maxNumOfPosSRSResourcesPerTxTEG] | New | FFS: The maximum number of positioning SRS resources associated with one UE TxTEG | FFS |  | FFS for RAN2 |  | ~~stable~~ unstable |  |
| NR\_pos\_enh | Mitigation of UE Rx/Tx timing delays | [maxNumOfUE-RxTxTEG] | New | The Max number of UE-RxTxTEG per UE | FFS | [Per UE] | FFS for RAN2 |  | stable |  |
| NR\_pos\_enh | Mitigation of UE Rx/Tx timing delays | numOfUERxTEG-PerPRSResource | New | **The** number of  **different** UE Rx TEGs that the LMF request a UE to measure the **same** DL PRS resource of a TRP for RSTD. | FFS |  | FFS for RAN2 | Agreement: support the LMF to request a UE to optionally measure the same DL PRS resource of a TRP with N different UE Rx TEGs and report the corresponding multiple RSTD measurements. • N=[2, 3, 4, 6, 8] (FFS: other values), where the maximum value of N depends on UE capability • The TRP can be either a “RSTD” reference TRP or a neighbour TRP • FFS: details of the signalling, procedures, and UE capability • The timestamps of the multiple RSTD measurements in the same measurement report can be the same or different. • Note: All RSTD measurements are relative to a single reference timing | stable |  |
| NR\_pos\_enh | Mitigation of UE Rx/Tx timing delays | UETxTEG\_Request\_UL-TDOA | New | The parameter is used for the serving gNB to request a UE to provide UE Tx TEG association for UL-TDOA | FFS | FFS | FFS for RAN2 | **Agreement**   * For mitigating UE Tx timing errors for UL TDOA, subject to UE’s capability, support the serving gNB to request a UE to provide the association information of UL SRS resources for positioning with Tx TEGs to the serving gNB if the UE supports multiple UE Tx TEGs for UL TDOA.   + The serving gNB should forward the association information provided by the UE to the LMF   + UE should report its capability of supporting multiple UE Tx TEGs for UL TDOA to serving gNB | ~~stable~~ unstable |  |
| NR\_pos\_enh | Mitigation of UE Rx/Tx timing delays | UETxTEG-Request\_Multi-RTT | New | The parameter is used by a LMF to request a UE to provide UE Tx TEG association for Multi-RTT | FFS | FFS | FFS for RAN2 | **Agreement**   * For mitigating UE Tx timing errors for Multi-RTT, subject to UE’s capability, support the LMF to request a UE to provide the association information of UL SRS resources for positioning with Tx TEGs directly to the LMF if the UE supports multiple Tx TEGs for Multi-RTT.   + UE should report its capability of supporting multiple UE Tx TEGs for Multi-RTT directly to the LMF. | new stable |  |
| NR\_pos\_enh | Mitigation of UE Rx/Tx timing delays | UERxTEG-ID-Request\_DL-TDOA | New | The parameter is used by a LMF to request a UE to provide the information related to UE Rx TEG IDs for DL TDOA | FFS | FFS | FFS for RAN2 | Agreement: Support the following for mitigating TRP Tx timing errors and/or UE Rx timing errors for DL TDOA • Support a UE to provide the association information of RSTD measurements with UE Rx TEG(s) to the LMF when the UE reports the RSTD measurements to the LMF if the UE has multiple TEGs | new stable |  |
| NR\_pos\_enh | Mitigation of UE Rx/Tx timing delays | UERxTxTEG-ID-Request | New | The parameter is used by a LMF to request a UE to provide ueRxTxTEG-ID-group information for DL+UL positioning. | FFS | FFS | FFS for RAN2 | For mitigating UE Tx/Rx timing errors for DL+UL positioning, a UE may should support, up to UE capability, either one or both of the following options: • Option 1: Reporting of UE RxTx TEG ID • Option 2: Reporting of UE Rx TEG ID and UE Tx TEG ID.  Agreements If a RxTx TEG ID is reported with a UE Rx-Tx time difference measurement, the UE may optionally also report a Tx TEG ID. | new stable |  |
| NR\_pos\_enh | Mitigation of UE Rx/Tx timing delays | MeasPRSwithDiffRxTEGs\_Request\_RSTD | New | The parameter is used by a LMF to request a UE to measure the same DL PRS with different UE Rx TEGs for RSTD measurements | [2, 3, 4, 6, 8] | FFS | FFS for RAN2 | Agreement: support the LMF to request a UE to optionally measure the same DL PRS resource of a TRP with N different UE Rx TEGs and report the corresponding multiple RSTD measurements.  • N=[2, 3, 4, 6, 8] (FFS: other values), where the maximum value of N depends on UE capability • The TRP can be either a “RSTD” reference TRP or a neighbour TRP • FFS: details of the signalling, procedures, and UE capability • The timestamps of the multiple RSTD measurements in the same measurement report can be the same or different. • Note: All RSTD measurements are relative to a single reference timing  Agreement  Make the following modification on the previous agreement made in RAN#106bis-e:  • Subject to UE capability, support the LMF to request a UE to optionally measure the same DL PRS resource of a TRP with N different UE Rx TEGs and report the corresponding multiple RSTD measurements.   N=[2, 3, 4, 6, 8], where the maximum value of N depends on UE capability, and applies to all DL PRS positioning frequency layers   Note: If N is not explicitly included in the request, it is up to UE to determine the number of different UE Rx TEGs to measure the same DL PRS resource within its capability  o The TRP can be either a “RSTD” reference TRP or a neighbour TRP  o FFS: details of the signalling, procedures, and UE capability  o The timestamps of the multiple RSTD measurements in the same measurement report can be the same or different.  o Note: All RSTD measurements are relative to a single reference timing | new stable |  |
| NR\_pos\_enh | Mitigation of UE Rx/Tx timing delays | MeasPRSwithDiffRxTEGs\_Request\_UERxTx | New | The parameter is used by a LMF to request a UE to measure the same DL PRS with different UE Rx TEGs for UE Rx-Tx time difference measurements | [2, 3, 4, 6, 8] | FFS | FFS for RAN2 | Agreement  • Subject to UE capability, support the LMF to request a UE to optionally measure the same DL PRS resource of a TRP with N different UE Rx TEGs and report the corresponding multiple UE Rx-Tx time difference measurements.   N=[2, 3, 4, 6, 8], where the maximum value of N depends on UE capability, and applies to all DL PRS positioning frequency layers   Note: If N is not explicitly included in the request, it is up to UE to determine the number of different UE Rx TEGs to measure the same DL PRS resource within its capability  o FFS: details of the signalling, procedures, and UE capability  o The timestamps of the multiple UE Rx-Tx time difference measurements in the same measurement report can be the same or different. |  | new stable |
| NR\_pos\_enh | Mitigation of UE Rx/Tx timing delays | Timestamp of a UE measurement instance | New | The timestamp of a UE measurement instance. One measurement report may contain multiple measurement instances of the same or different types of the measurements. | FFS | FFS | FFS for RAN2 | Agreement: Support enabling • A UE to report one or more measurement instances (of RSTD, DL RSRP, and/or UE Rx-Tx time difference measurements) in a single measurement report to LMF for UE-assisted positioning, and  • A TRP to report one or more measurement instances (of RTOA, UL RSRP, and/or gNB Rx-Tx time difference measurements) in a single measurement report to LMF, and • Each measurement instance is reported with its own timestamp o FFS: The measurement instances are within a [configured] measurement time window • FFS: Each UE measurement instance can be configured with N instances of the DL-PRS Resource Set o FFS: N (including N=1) • FFS: Each TRP measurement instance can be configured with M SRS measurement time occasions o FFS: M (including M=1) • FFS: details of signalling, procedures, and UE capability if any • FFS: whether and how to consider the additional enhancement related to measurement reporting of multi-paths and quality metric • Note 1: A measurement instance refers to one or more measurements, which can either be the same or different types, which are obtained from the same DL PRS resource(s), or the same UL SRS resource(s). • Note 2: This enhancement has no intention to change the mapping of measurement types to Rel-16 positioning techniques and no intention to introduce new positioning techniques either. | New-Unstable |  |
|  |  |  |  |  |  |  |  |  | stable |  |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays | trpRxTEG-ID | New | The ID of a TRP Rx timing error group, which is sent with RTOA measurements from gNB to LMF. | FFS |  | FFS for RAN3 |  | stable |  |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays | trpTxTEG | New | A TRP Tx TEG is associated with the transmissions of one or more DL PRS resources.  trpTxTEG may be sent from gNB to LMF for supporting DL-TDOA or multi-RTT. |  |  | FFS for RAN3 |  | stable |  |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays | trpTxTEG-ID | New | The ID of a TRP Tx timing error group. One TRP Tx TEG ID can be associated with one or more DL PRS resources | FFS | “in trpTxTEG” | FFS for RAN3 |  | stable |  |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays | NR-DL-PRS-ResourceSetID | Existing | NR DL PRS ResourceSetID |  | “in trpTxTEG” | FFS for RAN3 |  | stable |  |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays | NR-DL-PRS-ResourceID | Existing | •NR DL PRS ResourceID |  | “in trpTxTEG” | FFS for RAN3 |  | stable |  |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays | trpRxTxTEG-ID-group | New | A gNB may report a trpRxTxTEG-ID-group with a TRP Rx-Tx measurement to LMF. The trpRxTxTEG-ID-group can be one of the following combinations of the TEG IDs: • An TRP RxTx TEG ID • A pair of TRP {RxTx TEG ID, Tx TEG ID} • A pair of TRP {Rx TEG ID, Tx TEG ID} • FFS: A triplet of TRP {RxTx TEG ID, Rx TEG ID, Tx TEG ID} | FFS |  | FS for RAN3 | Assuming the similar agreement as UE side will be made in the next meetAgreement: • For mitigating TRP Tx/Rx timing errors for DL+UL positioning, when a gNB reports a gNB Rx-Tx time difference measurement, the gNB can support either or both of the following options: • Option 1: Reporting of a TRP RxTx TEG ID, and optionally a TRP Tx TEG ID • Option 2: Reporting of a TRP Rx TEG ID and a TRP Tx TEG ID • Note: The TRP Rx TEG ID is associated with one UL positioning SRS resource (or more UL positioning SRS resources) corresponding to the Rx time of the gNB Rx-Tx time difference measurement. • If a TRP Tx TEG ID is reported with a gNB Rx-Tx time difference measurement, the gNB also reports the association of the TRP Tx TEG ID to the DL PRS resource(s) to the LMF under the condition that the TRP has more than one DL PRS resource. • FFS: how the association of the Tx TEG ID to the DL PRS resource(s) is determined by the TRP and how the association is reported to the LMF. • FFS: details of the signallinging | stable |  |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays | trpRxTxTEG-ID | New | The ID of the TRP RxTx timing error group. | FFS | “in trpRxTxTEG-ID-group” | FFS for RAN3 |  | stable |  |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays | trpTxTEG-ID | New | The ID of a TRP Tx timing error group. | FFS | “in trpRxTxTEG-ID-group” | FFS for RAN3 |  | stable |  |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays | trpRxTEG-ID | New | The ID of a TRP Rx timing error group. | FFS | “in trpRxTxTEG-ID-group” | FFS for RAN3 |  | stable |  |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays | [srs-PosResourceSetId] | New | The ID of a positioning SRS resource set.  FFS: whether there is a need to include positioning SRS resource set ID. | FFS |  | FFS for RAN3 | Agreement: • Support gNB to report the associated SRS resource ID/resource set ID of the RTOA measurement to LMF | stable |  |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays | srs-PosResourceId | New | The ID of a positioning SRS resource reported with RTOA measurement | FFS |  | FFS for RAN3 | Agreement: • Support gNB to report the associated SRS resource ID/resource set ID of the RTOA measurement to LMF | stable |  |
|  |  |  |  |  |  |  |  |  |  |  |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays | [maxNumOfTRPRxTEG] | New | The maximum number of TRP-RxTEG per TRP | FFS | [per TRP] | FFS for RAN3 |  | stable |  |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays | [maxNumOfTRPTxTEG ] | New | The maximum number of TRP-TxTEG per TRP | FFS | [per TRP] | FFS for RAN3 |  | stable |  |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays | [maxNumOfPRSResourcesPerTxTEG] | New | The maximum number of PRS resources associated with one TRP TxTEG | FFS | [per TRP] | FFS for RAN3 |  | ~~stable~~ unstable |  |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays | [maxNumOfTRPRxTxTEG] | New | The Max number of TRP RxTxTEG per TRP | FFS | [per TRP] | FFS for RAN3 |  | stable |  |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays | numOfTRPRxTEG-PerPRSResource\_RTOA | New | The number of different TRP Rx TEGs that the LMF requests a TRP to measure the same UL positioning SRS resource of a UE for RTOA measurements | [2, 3, 4, 6, 8] | [per TRP] | FFS for RAN3 | Agreement: ~~Support the LMF to request a TRP to optionally measure the same SRS resource of a UE with M different TRP Rx TEGs and report the corresponding multiple RTOA measurements • M = [2, 3, 4, 6, 8] (FFS: other values) • FFS: details of the signalling, procedures • The timestamps of the multiple RTOA measurements in the same measurement report can be the same or different.~~  • Support the LMF to request a TRP to optionally measure the same SRS resource of a UE with M different TRP Rx TEGs and report the corresponding multiple RTOA measurements.  o M = [2, 3, 4, 6, 8] (FFS: other values) applies to all configured SRS resources for positioning  o Note: If M is not explicitly included in the request, it is up to TRP to determine the number of different TRP Rx TEGs to measure the same SRS resources for positioning  o FFS: details of the signalling, procedures  o The timestamps of the multiple RTOA measurements in the same measurement report can be the same or different. | stable |  |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays | numOfTRPRxTEG-PerPRSResource\_TRPRxTx | New | The number of different TRP Rx TEGs that the LMF requests a TRP to measure the same UL positioning SRS resource of a UE for gNB Rx-Tx time difference measurements | [2, 3, 4, 6, 8] | [per TRP] | FFS for RAN3 | • Support the LMF to request a TRP to optionally measure the same SRS resource of a UE with M different TRP Rx TEGs and report the corresponding multiple gNB Rx-Tx time difference measurements.  o M = [2, 3, 4, 6, 8] applies to all configured SRS resources.  o Note: If M is not explicitly included in the request, it is up to TRP to determine the number of different TRP Rx TEGs to measure the same SRS resources  o FFS: details of the signalling, procedures  o The timestamps of the multiple gNB Rx-Tx time difference measurements in the same measurement report can be the same or different. |  | New stable |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays | TRPTxTEG\_Request\_DL-TDOA | New | The parameter is used by a LMF to request a TRP to provide TRP Tx TEG association for DL-TDOA | FFS |  | FFS for RAN3 | Agreement: Support the following for mitigating TRP Tx timing errors and/or UE Rx timing errors for DL TDOA • Support a TRP providing the association information of DL PRS resources with Tx TEGs to the LMF if the TRP has multiple TEGs • Support the LMF to provide the association information of DL PRS resources with Tx TEGs to a UE for UE-based positioning if the TRP has multiple TEGs | New-stable |  |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays | TRPRxTEG\_Request\_UL-TDOA | New | The parameter is used by a LMF to request a TRP to provide TRP Rx TEG association for UL-TDOA | FFS |  | FFS for RAN3 | Agreement: Support the following for mitigating UE Tx timing errors and/or TRP Rx timing errors for UL TDOA • Support a TRP to provide the association information of RTOA measurements with TRP Rx TEG(s) to the LMF when the TRP reports the RTOA measurements to the LMF if the TRP has multiple Rx TEGs | New-stable |  |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays | TRPRxTxTEG-ID-Request | New | The parameter is used by a LMF to request a gNB to provide TRP RxTxTEG-ID-group information for DL+UL positioning. | FFS |  | FFS for RAN3 |  | New-stable |  |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays | MeasPosSRSwithDiffRxTEGs\_Request | New | The parameter is used by a LMF to request a TRP to measure the same UL positioning SRS resource with different UE Rx TEGs | FFS |  | FFS for RAN3 | Agreement: Support the LMF to request a TRP to optionally measure the same SRS resource of a UE with M different TRP Rx TEGs and report the corresponding multiple RTOA measurements • M = [2, 3, 4, 6, 8] (FFS: other values) • FFS: details of the signalling, procedures | New-stable |  |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays | Timestamp of a TRP measurement instance | New | The timestamp of a measurement instance. One TRP measurement report may contain multiple measurement instances of the same or different types of the measurements. | FFS |  | FFS for RAN3 | Agreement: Support enabling • A UE to report one or more measurement instances (of RSTD, DL RSRP, and/or UE Rx-Tx time difference measurements) in a single measurement report to LMF for UE-assisted positioning, and  • A TRP to report one or more measurement instances (of RTOA, UL RSRP, and/or gNB Rx-Tx time difference measurements) in a single measurement report to LMF, and • Each measurement instance is reported with its own timestamp o FFS: The measurement instances are within a [configured] measurement time window • FFS: Each UE measurement instance can be configured with N instances of the DL-PRS Resource Set o FFS: N (including N=1) • FFS: Each TRP measurement instance can be configured with M SRS measurement time occasions o FFS: M (including M=1) • FFS: details of signalling, procedures, and UE capability if any • FFS: whether and how to consider the additional enhancement related to measurement reporting of multi-paths and quality metric • Note 1: A measurement instance refers to one or more measurements, which can either be the same or different types, which are obtained from the same DL PRS resource(s), or the same UL SRS resource(s). • Note 2: This enhancement has no intention to change the mapping of measurement types to Rel-16 positioning techniques and no intention to introduce new positioning techniques either. | New-unstable |  |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays | numOfSRSMeasTimeOccasions-perMeasurementInstance | New | Each measurement instance in a TRP measurement report can be configured by LMF with either N=1 or 4 SRS measurement time occasions. | [1, 4] |  | FFS for RAN3 | Agreement  Each measurement instance in a TRP measurement report can be configured by LMF with either N=1 or 4 SRS measurement time occasions. |  | New-stable |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays |  | New |  |  |  | FFS for RAN3 |  |  |  |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays |  | New |  | FFS |  | FFS for RAN3 |  |  |  |
| NR\_pos\_enh | Mitigation of TRP Rx/Tx timing delays |  | New |  | FFS |  | FFS for RAN3 |  |  |  |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Latency improvements | numOfSamples-perMeasurement | new | LMF can explicitly request UE to report the measurement with M-samples from LM to UE. | [1, 4] |  | FFS: RAN2 | Agreement: Subject to UE capability, support LMF to explicitly request UE to report the measurement with either M-sample or 4-sample, if RAN4 has supported M-sample measurement. • FFS signalling details. | stable |  |

## Comments

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Huawei, HiSilicon | Not sure why it is needed here. |
| ZTE | For the row [maxNumOfPosSRSResourcesPerTxTEG], we don’t have any agreement related to this parameter. Suggest to remove it. We think maxNumOfPosSRSResourcesPerTxTEG may anyway be limited by the maximum number of Tx TEG supported by UE per band or per FS, which is subject to UE capability discussion.  The same suggestion for the row [maxNumOfPRSResourcesPerTxTEG]. |
| vivo | 1. In following row, description column, ‘Rx’ should be changed to ‘Tx’.    2. The following 2 rows may be duplicated, regarding multiple RxTEGs for the same PRS resource. The same problem occurs on TRP side about ‘numOfTRPRxTEG-PerPRSResource\_RTOA’ and ‘MeasPosSRSwithDiffRxTEGs\_Request’. |

3. Accuracy improvements for UL-AoA positioning solutions

(1st Round) Parameter Table

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sub-feature group** | **Parameter name in the spec** | **New or existing?** | **Description** | **Value range** | **Per (UE, cell, TRP, …)** | **Specification** | **Comment** | **Status [Post 106b-e]** | **Status [Post 107-e]** |
|  |  |  |  |  |  |  |  |  |  |
| UL-AOA Enhancement | Expected UL Angle of Arrival | New | Indication of expected AoA/ZoA value and uncertainty (of the expected AoA/ZoA value) range(s) IE names are already used by RAN3 in R3-214516 | [1, …, 8] | FFS RAN3 | FFS RAN3 | Agreement: Granularity of 0.1 degrees is applied for the expected AoA (φAOA), expected ZoA (θZOA ) and the corresponding uncertainty values. | stable |  |
| UL-AOA Enhancement | Expected Azimuth AoA | New |  | FFS | “In Expected UL Angle of Arrival” | FFS RAN3 |  | ~~stable~~ unstable |  |
| UL-AOA Enhancement | Expected Zenith AoA | New |  | FFS | “In Expected UL Angle of Arrival” | FFS RAN3 |  | ~~stable~~ unstable |  |
| UL-AOA Enhancement | Expected Azimuth AoA Value | New |  | FFS | “in Expected Azimuth AoA” | FFS RAN3 |  | ~~stable~~ unstable |  |
| UL-AOA Enhancement | Expected Azimuth AoA Uncertainty Range | New |  | FFS | “in Expected Azimuth AoA” | FFS RAN3 |  | ~~stable~~ unstable |  |
| UL-AOA Enhancement | Expected Zenith AoA Value | New | Uncertainty range for expected azimuth angle of arrival | FFS | “in Expected Zenith AoA” | FFS RAN3 |  | ~~stable~~ unstable |  |
| UL-AOA Enhancement | Expected Zenith AoA Uncertainty Range | New | uncertainty range for expected zenith angle of arrival | FFS | “in Expected Zenith AoA” | FFS RAN3 |  | stable |  |
| UL-AOA Enhancement | Zenith Angle of Arrival | New | This information element contains the Zenith Angle of Arrival, which can correspond to linear array measurement | FFS | “in TRP Measurement Result” | FFS RAN3 | Agreement: ● The following option is supported to enhance signaling of UL-AOA measurement report in case of a linear array ○ Option 2: The z-axis of LCS is defined along the linear array axis. gNB reports only the ZoA relative to z-axis in the LCS, and the LCS-to-GCS translation function is used to set up the specific z-axis direction | stable |  |
| UL-AOA Enhancement | ULAoAOfFirstPathPerSRSResource | New | The multiple UL-AOAs values (pair of AOA & ZOA values) can be reported per SRS resource for the first arrival path corresponding to the same timestamp. | FFS | FFS RAN3 | FFS RAN3 | Agreement: Reporting of one UL-RTOA and multiple UL-AOAs measurements for the first arrival path per SRS resource for positioning and per SRS resource for MIMO in a single gNB report to LMF is supported • The above measurements are associated with SRS resource ID which is also reported to LMF • FFS: Reporting of RSRP for the first arrival path • Note: The use of SRS for MIMO resource is transparent to the UE • FFS: Reporting of gNB Rx-Tx  Agreement: Reporting of one gNB Rx-Tx time difference and multiple UL-AOAs measurements for the first arrival path per SRS resource for positioning in a single gNB report to LMF is supported  • The above measurements are associated with SRS resource ID which is also reported to LMF • FFS: Reporting of RSRP for the first arrival path | stable |  |
| UL-AOA Enhancement | UL Angle of Arrival | Existing | A pair of AOA & ZOA values to be reported per SRS resource | FFS | “in ULAoAOfFirstPathPerSRSResource” | FFS RAN3 |  | stable |  |
| UL-AOA Enhancement | It seems the existing IE “UL Angle of Arrival ” should be used represent all AoA values. | New | A pair of AOA & ZOA values to be reported per SRS resource | FFS | “in ULAoAOfFirstPathPerSRSResource” | FFS RAN3 |  | Removed |  |
| UL-AOA Enhancement | maxNumOfULAoAOfFirstPathPerSRSResource | New | The maximum number of UL-AOAs values (pair of AOA & ZOA values) to be reported per SRS resource for the first arrival path corresponding to the same timestamp. | 8 | FFS RAN3 | FFS RAN3 | Agreement: The maximum number of UL-AOAs values (pair of AOA & ZOA values) to be reported per SRS resource for the first arrival path corresponding to the same timestamp is 8. | stable |  |
| UL-AOA Enhancement | srs-PosResourceId | New | The ID of a positioning SRS resource reported with RTOA and multiple UL-AOAs measurements | FFS | FFS for RAN3 | FFS RAN3 | Agreement: • Reporting of one UL-RTOA and multiple UL-AOAs measurements for the first arrival path per SRS resource for positioning and per SRS resource for MIMO in a single gNB report to LMF is supported • The above measurements are associated with SRS resource ID which is also reported to LMF | stable |  |
| UL-AOA Enhancement | TRP Position Relative Geodetic | Existing | Relative position of the ARP to TRP for UL-AoA measurement | Defined in 9.2.48, TS 38.455 | FFS for RAN3 | FFS for RAN3 | Agreement: Association of UL-AOA positioning measurements with gNB ARP is supported in Rel.17. | stable |  |
| UL-AOA Enhancement | TRP Position Relative Cartesian | Existing | Relative position of the ARP to TRP for UL-AoA measurement | Defined in 9.2.50, TS 38.456 | FFS for RAN3 | FFS for RAN3 | Agreement: Association of UL-AOA positioning measurements with gNB ARP is supported in Rel.17. | stable |  |
| UL-AOA Enhancement | firstPath-SRS-RSRP | New | For the first arrival path RSRP measurements on SRS for positioning resource, | FFS | FFS for RAN3 | FFS for RAN3 | • For the first arrival path measurements on SRS for positioning resource,  o gNB can report to LMF the following set of measurements {one SRS-RSRP, multiple UL-AOAs (AoA/ZoA pairs), one UL-RTOA} o gNB can report to LMF the following set of measurements {one SRS-RSRP, multiple UL-AOAs (AoA/ZoA pairs), one-gNB Rx-Tx time difference} o FFS additional option: gNB can report to LMF the following set of measurements {multiple SRS-RSRP, multiple UL-AOAs (AoA/ZoA pairs), one UL-RTOA, one-gNB Rx-Tx time difference} o All gNB measurements above are associated with SRS resource ID and timestamp, which are also reported to LMF • For the first arrival path measurements on SRS for MIMO resource, o gNB can report to LMF the following set of measurements {one SRS-RSRP, multiple UL-AOAs (AoA/ZoA pairs), one UL-RTOA}  o FFS: gNB can report to LMF the following set of measurements {multiple SRS-RSRP, multiple UL-AOAs (AoA/ZoA pairs), one UL-RTOA}  o All gNB measurements above are associated with SRS resource ID and timestamp, which are also reported to LMF o Note: The operation of SRS for MIMO is transparent to the UE | new-stable |  |

## Comments

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| --- | --- |
| **Company** | **Comments** |
| Huawei, HiSilicon | Suggest to remove “for positioning” in column 4.   |  |  |  |  | | --- | --- | --- | --- | | UL-AOA Enhancement | firstPath-SRS-RSRP | New | For the first arrival path RSRP measurements on SRS resource, | |
| ZTE | Suggest to update the following rows according to the agreement below,   |  | | --- | | TRP Position Relative Geodetic | | TRP Position Relative Cartesian |   **Agreement**   * ARP location is associated with UL measurements for NR Positioning (UL AOA, UL-RTOA, UL SRS-RSRP, UL SRS-RSRPP and gNB Rx-Tx time difference measurements) * Use of ARP ID for potential overhead reduction in NRPPa signaling is up to RAN3 * Send LS to RAN3 to enable relevant signaling in RAN3 specification |
| vivo | 1. Suggest to change the value [1,…,8] to FFS since there is no agreement for the value    2. Why only srs-PosResourceId in here since the agreement is for SRS for positioning and SRS for MIMO    3. whether“firstPath-SRS-RSRP” should be changed to SRS-RSRPP, and similar question in other IE for path RSRP |

4. Accuracy improvements for DL-AoD positioning solutions

(1st Round) Parameter Table

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sub-feature group** | **Parameter name in the spec** | **New or existing?** | **Description** | **Value range** | **Per (UE, cell, TRP, …)** | **Specification** | **Comment** | **Status [Post 106b-e]** | **Status [Post 107-e]** |
|  |  |  |  |  |  |  |  |  |  |
| UL-AOA Enhancement | antennaInfoRequest\_DL-AOD | New | Request from LMF to a gNB, asking for TRP beam/antenna information for DL-AOD | FFS |  | FFS RAN3 | Agreement: Regarding support of angle calculation enhancement for DL-AoD: • Support gNB providing the beam/antenna information to the LMF. o The gNB beam/antenna information can be provided to the UE for UE-based DL-AoD | New-stable |  |
| DL-AoD Enhancement | trpAntennaInformation | New | TRP beam/antenna information reported from gNB to LMF for DL-AoD.  FFS: The deails of TRP beam/antenna information | FFS |  | FFS RAN3 | Agreement: Regarding support of angle calculation enhancement for DL-AoD: • Support gNB providing the beam/antenna information to the LMF. o The gNB beam/antenna information can be provided to the UE for UE-based DL-AoD | New-stable |  |
| UL-AOA Enhancement | antennaInfoRequest\_DL-AOD | New | Request from UE to LMF, asking for TRP beam/antenna information for DL-AOD | FFS |  | FFS RAN2 | Agreement: Regarding support of angle calculation enhancement for DL-AoD: • Support gNB providing the beam/antenna information to the LMF. o The gNB beam/antenna information can be provided to the UE for UE-based DL-AoD | unstable |  |
| DL-AoD Enhancement | trpAntennaInformation | New | TRP beam/antenna information provided to the UE for UE-based DL-AoD. FFS: The deails of TRP beam/antenna information | FFS |  | FFS RAN3 | Agreement: Regarding support of angle calculation enhancement for DL-AoD: • Support gNB providing the beam/antenna information to the LMF. o The gNB beam/antenna information can be provided to the UE for UE-based DL-AoD  Agreement  From the RAN1 perspective, for the TRP beam/antenna information to be optionally provided by the LMF to the UE for UE-based DL-AoD:  • The LMF provides the quantized version of the relative Power between PRS resources per angle per TRP.  o The relative power is defined with respect to the peak power in each angle  o For each angle, at least two PRS resources are reported.  o Note: the peak power per angle is not provided  • Note: up to RAN3 to decide how the TRP beam information is provided to the LMF for both UE-assisted and UE-based  • Send an LS to RAN2/RAN3 to decide on the signaling details | New-stable |  |
| DL-AoD Enhancement | requestFirstPathRSRP | New | The parameter is used for LMF to request a UE to report the RSRP of first arrival path. | FFS |  | FFS RAN2 | Agreement: For both UE-based and UE-assisted DL-AOD, the UE can be requested subject to UE capability to measure and report (for UE-assisted) the PRS RSRP of the first path | stable |  |
| DL-AoD Enhancement | firstPathRSRP | New | The reported PRS RSRP of the first path from UE to LMF. | FFS |  | FFS RAN2 | Agreement: For both UE-based and UE-assisted DL-AOD, the UE can be requested subject to UE capability to measure and report (for UE-assisted) the PRS RSRP of the first path | stable |  |
| DL-AoD Enhancement | TBD | New or existing | PRS assistance information for DL-AoD from LMF to UE | FFS |  | FFS RAN2 | Agreement: For UE-assisted DL-AOD positioning method, select one or more of the following to enhance the signaling to the UE for the purpose of PRS resource(s) measurement and reporting: | unstable |  |
| DL-AoD Enhancement | maxNumRSRPperTRP | New | Maximum number of DL PRS RSRP measurements per TRP | FFS |  | FFS RAN2 | Agreement: • For UE-A DL-AOD, support reporting more than 8 DL PRS RSRP measurements per TRP. • Note: Multiple RSRPs corresponding to same or different Rx Beam index should be able to be reported for a given PRS resource for different timestamps.  • FFS: Limit the maximum number of DL PRS RSRP associated with the same Rx beam index   Agreement: The agreement from RAN1#106e on the number of DL PRS RSRP measurements per TRP is extended as follows: • For UE-A DL-AOD, support reporting ~~more than~~ 8 up to ~~16~~ N DL PRS RSRP measurements per TRP, where N is UE capability and candidate values include {16,24}. • For UE-A DL-AOD, support reporting ~~more than 8~~ up to ~~16~~ M first path PRS RSRP measurements per TRP, where M is a UE capability  o FFS: Values of M. Candidate values include {2,4,8,16,24}. o FFS: Whether M is always equal to N • Note: Multiple RSRPs corresponding to same or different Rx Beam index should be able to be reported for a given PRS resource for same or different timestamps.  • Note: the maximum number of DL PRS RSRP associated with the same Rx beam index is up to the UE implementation | stable |  |
| DL-AoD Enhancement | [maxNumPathRSRPperTRP] | New | [Maximum number of DL Path PRS RSRP measurements per TRP] | FFS |  | FFS RAN3 | Under discussion Agreement: • For UE-A DL-AOD, support reporting more than 8 DL PRS RSRP measurements per TRP. • Note: Multiple RSRPs corresponding to same or different Rx Beam index should be able to be reported for a given PRS resource for different timestamps.  • FFS: Limit the maximum number of DL PRS RSRP associated with the same Rx beam index   Agreement: The agreement from RAN1#106e on the number of DL PRS RSRP measurements per TRP is extended as follows: • For UE-A DL-AOD, support reporting more than 8 up to 16 N DL PRS RSRP measurements per TRP, where N is UE capability and candidate values include {16,24}. • For UE-A DL-AOD, support reporting more than 8 up to 16 M first path PRS RSRP measurements per TRP, where M is a UE capability  o FFS: Values of M. Candidate values include {2,4,8,16,24}. o FFS: Whether M is always equal to N • Note: Multiple RSRPs corresponding to same or different Rx Beam index should be able to be reported for a given PRS resource for same or different timestamps.  • Note: the maximum number of DL PRS RSRP associated with the same Rx beam index is up to the UE implementation | ~~stable~~ unstable |  |

## Comments

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| --- | --- |
| **Company** | **Comments** |
| Huawei, HiSilicon | We do not think the following parameter should be captured in the table.   |  |  |  |  | | --- | --- | --- | --- | | UL-AOA Enhancement | antennaInfoRequest\_DL-AOD | New | Request from UE to LMF, asking for TRP beam/antenna information for DL-AOD |   The reason is that there would be dedicated signaling on UE capability if the feature is supported, so that LMF understands that providing this to the UE is OK.  If there is special request by the UE for the beam pattern, it should be included in the on-demand PRS parameter.  FL: The row was marked as “unstable” in previous meeting. We can removed whole row if the parameter is no needed. |
| Qualcomm | 1. With regards to the issue that HW pointed above, first it hasn’t yet been agreed that there will be a UE capability for this. Also, the “on-demand PRS framework” is not for asking “on-demand” of additional assistance data of PRS already configured; otherwise we would call the feature “Enhancements of the Assistance Data Request” and not “On-demand PRS”. The On-demand PRS is about asking for new/different PRS or PRS with specific properties. We don’t see how the “on-demand” framework will be used for the UE to request that new Assistance data are needed.   We prefer to keep it, and not remove it. From our side, we believe that both the UE capability and the request is needed.  FL: Okay. Reversed the changes. But, keep in mind the row marked as “unstable” was NOT sent to RAN2/3. We will need an agreement to make it stable.   1. It may be useful in the trpAntennaInformation rows, to add the new agreement that points to the details of this Assistance data   FL: added  **Agreement**  From the RAN1 perspective, for the TRP beam/antenna information to be optionally provided by the LMF to the UE for UE-based DL-AoD:   * The LMF provides the quantized version of the relative Power between PRS resources per angle per TRP.   + The relative power is defined with respect to the peak power in each angle   + For each angle, at least two PRS resources are reported.   + Note: the peak power per angle is not provided * Note: up to RAN3 to decide how the TRP beam information is provided to the LMF for both UE-assisted and UE-based * Send an LS to RAN2/RAN3 to decide on the signaling details |
| Huawei, HiSilicon | Reply to QC:  What is view on the number of positioning frequency layer as the on-demand PRS feature, and even the number of TRP. Why requesting a specific parameter is not part of the on-demand PRS framework? Or is there any specific clarification on the difference between on-demand PRS and “assistance data request enhancement”?  My understanding is that on-demand PRS is also using RequestAssistanceData, and this can even be done via MO-LR without receiving assistance data in the first place.  To FL:  We have the following suggestions on the parameter of trpAntennaInformation  1. The name could be changed to trpBeamInformation. I believe the antenna info was used when we decide Option 1 (number of elements, dv/dh etc.).  2. The column 7 should be FFS RAN2/RAN3. We do not mind to have separate rows for RAN2 and RAN3, but primarily this agreement only has RAN2 impact, and RAN3 check whether to adopt it or via OAM. |
| ZTE | Comments for antenna/beam information:   1. Agree with Huawei to remove the row antennaInfoRequest\_DL-AOD(row#3) 2. Agree with Huawei to use trpBeamInformation 3. We only agree the beam information from LMF to UE for UE-based positioning, so we suggest to remove all rows related to NRPPa message (i.e. row#1 and row#2) 4. For row#4, column#7，which can be revised by “FFS RAN2/RAN3” since we agree it’s up to RAN3 to decide how the TRP beam information is provided to the LMF for both UE-assisted and UE-based. |
| vivo | 1. Whether thefollowing line are needed based on our latest agreement “up to RAN3 to decide how the TRP beam information is provided to the LMF for both UE-assisted and UE-based”.    2. The following line can be updated based on the listed agreement     |  | | --- | | **Agreement**  For the purpose of both UE-B and UE-A DL-AoD, and with regards to the support of AOD measurements with an expected uncertainty window, the following is supported   * Indication of expected angle value and uncertainty (of the expected azimuth and zenith angle value) range(s) is signaled by the LMF to the UE * The type of expected angle and uncertainty can be requested by the UE, between the following options   + - Option 1: Indication of expected DL-AoD/ZoD value and uncertainty (of the expected DL-AoD/ZoD value) range(s) is signaled by the LMF to the UE     - Option 2: Indication of expected DL-AoA/ZoA value and uncertainty (of the expected DL-AoA/ZoA value) range(s) is signaled by the LMF to the UE     **Agreement**  For UE-assisted DL-AOD positioning method, to enhance the signaling to the UE for the purpose of PRS resource(s) reporting, the LMF may indicate in the assistance data (AD), one or both the following:   * option 1: subject to UE capability, for each PRS resource, a subset of PRS resources for the purpose of prioritization of DL-AOD reporting:   + a UE may include the requested PRS measurement for the subset of the PRS in the DL-AoD additional measurements if the requested PRS measurement of the associated PRS is reported     - The requested PRS measurement can be DL PRS RSRP and/or path PRS RSRP.   + UE may report PRS measurements only for the subset of PRS resources.   + Note: The subset associated with a PRS resource can be in a same or different PRS resource set than the PRS resource * option 2: subject to UE capability, for each PRS resource, the boresight direction information. * Note: Either case does not imply any restriction on UE measurement * FFS: prioritization of the PRS resources and resource subsets to be measured |   3. Suggest to change FFS to 24 based agreement    4. Can remove the bracket for the parameter name and change the FFS to 24    5. In column 1, some names of this feature is ‘UL-AOA Enhancement’, which should be changed to ‘DL-AoD Enhancement’ |

5. Latency improvements for both DL and DL+UL positioning

(1st Round) Parameter Table

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sub-feature group** | **Parameter name in the spec** | **New or existing?** | **Description** | **Value range** | **Per (UE, cell, TRP, …)** | **Specification** | **Comment** | **Status [Post 106b-e]** | **Status [Post 107-e]** |
|  |  |  |  |  |  |  |  | stable |  |
| Latency improvements | numOfSamples-perMeasurement | new | LMF can explicitly request UE to report the measurement with M-samples from LM to UE. | [1, 4] |  | FFS: RAN2 | Agreement: Subject to UE capability, support LMF to explicitly request UE to report the measurement with either M-sample or 4-sample, if RAN4 has supported M-sample measurement. • FFS signalling details.  The following is not in the agreement:  FFS (to be further dicussed in RAN1): whether a single numOfSamples-perMeasurement applies for all PFLs, or there is a separate numOfSamples-perMeasurement for a separate PFL.” | stable |  |
| Latency improvements | responseTime | Existing | the maximum response time as measured between receipt of the RequestLocationInformation and transmission of a ProvideLocationInformation. | FFS: others |  | TS 37.355 | R1-2108696(R2-2108959)  RAN2#115-e has discussed the issue of finer granularity for response time in LPP and reached the conclusion that RAN2 can signal the finer granularity | stable |  |
| Latency improvements | MG\_ activationRequest | New | LMF can send a MG activation request to serving gNB for the activation of a measurement gap via an NRPPa message | FFS |  | FFS: RAN3 | Agreement: Support the following options (in the agreement made in RAN1#106-e) for a new mechanism of MG activation request for the purpose of positioning. • Option 2: by UE (via UCI or UL MAC CE) o Select only one of UCI and UL MAC CE in RAN1#106bis-e • Option 1: by LMF (via an NRPPa message) o Note: This is transparent to the UE | ~~stable~~ unstable |  |
|  |  |  |  |  |  |  |  |  |  |
| ~~Latency improvements~~ | ~~MG\_ activationRequest~~ | ~~New~~ | ~~UL MAC CE for MG activation request by UE for the purpose of positioning.~~ | ~~FFS~~ |  | ~~FFS: RAN2~~ | ~~Agreement: Support using UL MAC CE for MG activation request by UE (Option 2) for the purpose of positioning.~~ | ~~New-stable~~ | Removed |
| ~~Latency improvements~~ | ~~MG\_ activation~~ | ~~New~~ | ~~DL MAC CE for MG activation by gNB for the purpose of positioning.~~ | ~~FFS~~ |  | ~~FFS: RAN2~~ | ~~Agreement: Support the following option (from the agreement made in RAN1#106-e) for a new MG activation procedure to be performed by the gNB for the purpose of positioning. Option 2: DL MAC CE FFS: Deactivation process~~ | ~~New-stable~~ | Removed |
| Latency improvements | PRS-ProcessingWindowIndication | New | PRS processing window indication from gNB for PRS measurement outside MG. FFS RRC/MAC CE. FFS per CC/PFL/UE | FFS |  | FFS: RAN2 | Agreement: • With regards to UE determining the PRS priority with other DL signal/channels within the PRS processing window for PRS measurement outside MG, support the priority indicated by gNB. o FFS: What are the other DL signals/channels • With regards to the PRS processing window for PRS measurement outside MG, at least support the window indicated by gNB. | ~~stable~~ unstable |  |
| Latency improvements | PRS-PriorityIndicator | New | PRS priority indicator within the PRS processing window for PRS measurement outside MG FFS RRC/MAC CE. FFS per CC/PFL/UE | FFS |  | FFS: RAN2 | Agreement: • With regards to UE determining the PRS priority with other DL signal/channels within the PRS processing window for PRS measurement outside MG, support the priority indicated by gNB. o FFS: What are the other DL signals/channels • With regards to the PRS processing window for PRS measurement outside MG, at least support the window indicated by gNB. | ~~stable~~ unstable |  |
| ~~Latency improvements~~ | ~~preconfigMG\_ID~~ | ~~New~~ | ~~Each MG in the preconfiguration is associated with an ID~~ | ~~FFS~~ |  | ~~FFS: RAN2~~ | **~~Agreement~~**  ~~Preconfiguration of MG(s) in RRC is supported from RAN1 perspective.~~   * + ~~Each MG in the preconfiguration is associated with an ID~~   + ~~The information in the UL MAC CE for MG activation request by the UE can be one ID associated with the preconfiguration of the MG~~   + ~~Send an LS to RAN2 and RAN3~~ |  |  |
| Latency improvements |  |  |  |  |  |  |  |  |  |
| Latency improvements |  |  |  |  |  |  |  |  |  |

## Comments

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| --- | --- |
| **Company** | **Comments** |
| Huawei, HiSilicon | OK with reverting some “stable” parameters to “unstable”.  I heard that there would be a separate spreadsheet to collect the MAC CE impact, can FL confirm?  FL: Yes, [107-e-R17-MAC-CE]. We do not need to cover MAC parameters in this email thread.  We suggest to add another parameter to control whether network acceptable UL MAC CE based on MG activation request.  FL: Maybe HW can make the proposal directly in the [107-e-R17-MAC-CE].   |  |  |  |  | | --- | --- | --- | --- | | Latency improvements | enable-MAC-CE-MG-ActvRequest | New | Enables using UL MAC CE for MG activation request by the UE. | |
| vivo | Regarding ‘MG\_ activationRequest’ by UE in row 6, we think the following new agreement should be added to ‘comments’ column. In addition, we think MG-ID should also be added, since MG ID is not only associated with RRC configured pre-MG, but also associated with UL MAC CE UE activation request.  **Agreement**  Preconfiguration of MG(s) in RRC is supported from RAN1 perspective.   * + Each MG in the preconfiguration is associated with an ID   + The information in the UL MAC CE for MG activation request by the UE can be one ID associated with the preconfiguration of the MG   + Send an LS to RAN2 and RAN3   FL: I have included the suggestion to in the email thread [107-e-R17-MAC-CE]. |
| Qualcomm | To FL, and with regards to the HW’s request on adding “enable-MAC-CE-MG-ActvRequest”. Wouldn’t that be an RRC parameter that is configured to the UE, and therefore would need to be discussed here and not in the MAC-CE impact?  FL: The parameter is related to which of the agreements? |
| Qualcomm2 | To FL/all: With regards to the numOfSamples-perMeasurement, is the understanding that it applies across all the PFLs, or will there be an association to a PFL? E.g., UE performing fast measurements for one PFL, but “slow measurements” in another PFL?  Since PRS measurement period is defined in RAN4 at a per-PFL level, ( the “number of samples” applies to the measurement period of each PFL), we may need to discuss this to finalize the RRC aspect. Suggest to add an FFS:  **FFS (for RAN1): Whether a single numOfSamples-perMeasurement applies for all PFLs, or there is a separate numOfSamples-perMeasurement for a separate PFL.**  FL: Okay. add “FFS (to be further dicussed in RAN1): whether a single numOfSamples-perMeasurement applies for all PFLs, or there is a separate numOfSamples-perMeasurement for a separate PFL.” |
| Huawei, HiSilicon | Reply to FL:  1. This parameter is in RRC to indicate that gNB accepts the UL MAC CE sent by the UE. We do not have explicit agreement for this, but we think this is common understanding that the use of UL MAC CE should have a RRC parameter to switch it ON/OFF; otherwise we may have interoperability issue   |  |  |  |  | | --- | --- | --- | --- | | Latency improvements | enable-MAC-CE-MG-ActvRequest | New | Enables using UL MAC CE for MG activation request by the UE. |   2. not sure why this row is deleted.  We have explicit agreement that the preconfiguration is in RRC.  **Agreement**  Preconfiguration of MG(s) in RRC is supported from RAN1 perspective.   * + Each MG in the preconfiguration is associated with an ID   + The information in the UL MAC CE for MG activation request by the UE can be one ID associated with the preconfiguration of the MG   + Send an LS to RAN2 and RAN3   Of course, we may have again the preconfiguration ID in the MAC CE to match the RRC configuration, but we do not think preconfiguration ID for MG does not belong to RRC. |
| ZTE | Comment#1：  For the parameter( enable-MAC-CE-MG-ActvRequest) suggested by Huawei, we cannot agree at this moment. We think whether UE support UL MAC CE MG request should be reported by UE capability. If UE claims that it supports the feature, why gNB needs to disable/enable this feature?  Comment#2:  Preconfiguration ID should be kept on the table since it has RRC impact. |
|  |  |

6. Potential enhancements of information reporting from UE and gNB for multipath/NLOS mitigation

(1st Round) Parameter Table

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sub-feature group** | **Parameter name in the spec** | **New or existing?** | **Description** | **Value range** | **Per (UE, cell, TRP, …)** | **Specification** | **Comment** | **Status [Post 106b-e]** | **Status [Post 107-e]** |
|  |  |  |  |  |  |  |  | stable |  |
| Multipath/NLOS mitigation | losNlosIndicator | New | This parameter is used for UE to report LoS/NLoS information for UE measurements (including RSTD, RSRP and UE Rx-Tx time difference) from UE to LMF. | ~~[0, 0.1, …0.9,1]~~  FFS |  | FFS: RAN2 | Agreement: • Support LoS/NLoS indicators which are reported to the LMF for DL and DL+UL positioning measurements taken at UE for UE-assisted positioning or UL and DL+UL measurements at the TRP for NG-RAN assisted positioning.  o Reporting from UE is subject to UE capability.  ~~Working assumption: Supported LoS/NLoS indicator values are [0, 0.1, …, 0.9, 1] (in steps of 0.1) with the values corresponding to the likelihood of LoS~~ | stable |  |
| Multipath/NLOS mitigation | losNlosIndicator | New | This parameter is used for gNB to report LoS/NLoS information for gNB measurements, including RTOA, UL RSRP, UL AOA, and gNB Rx-Tx time difference measurements for TRP from gNB to LMF. | ~~[0, 0.1, …0.9,1]~~ FFS |  | FFS: RAN3 | Agreement: • Support LoS/NLoS indicators which are reported to the LMF for DL and DL+UL positioning measurements taken at UE for UE-assisted positioning or UL and DL+UL measurements at the TRP for NG-RAN assisted positioning.  o Reporting from UE is subject to UE capability. | stable |  |
| Multipath/NLOS mitigation | losNlosIndicator | New | This parameter is used for LMF to include LoS/NLoS information for UE-based positioning. Indicators can be associated with either: Option 1: Each DL PRS resource for each TRP (working assumption) Option 2: Each TRP | ~~[0, 0.1, …, 0.9, 1]~~ FFS |  | FFS: RAN2 | Agreement: • Positioning assistance data from LMF is enhanced for UE-based positioning by including LoS/NLoS indicators.   Agreeement: For UE-based positioning, support the following options for LoS/NLoS indicators within positioning assistance data: Option 1 (Working assumption): LMF associates UE-based LoS/NloS indicators with each DL PRS resource for each TRP Option 2: LMF associates UE-based LoS/NloS indicators with each TRP Note: For option 1, one LoS/NloS indicator is associated with one DL-PRS resource | stable |  |
| Multipath/NLOS mitigation | maxNumOfAdditionalPath | New | The maximum number of reporting relative timing of additional path relative to the timing of the first detected path for UE timing measurement from UE to LMF. Note: In Rel-16, N is set to hard-coded to 2 in  NR-AdditionalPathList-r16 in TS 37.355. | 8 |  | FFS: RAN2 | Agreement: • For up to N>2 additional paths, support reporting relative timing (to the first detected path) in the measurement reports from UE to LMF for at least DL-TDOA and multi-RTT  **Agreement**   * For enhanced multipath reporting support N=8 for the value of maximum number of additional paths.   + Define a UE capability for the UE to report its supported value of maximum number of additional paths (no larger than 8) | stable |  |
| Multipath/NLOS mitigation | maxnopath | existing | The maximum number of reporting relative timing of additional path relative to the timing of the first detected path for TRP timing measurement to be reported from gNB to LMF. Note: In Rel-16, maxnopath is 2 in TS 38.455. | 8 |  | FFS: RAN3 | Agreement: • For multipath reporting enhancements, support reporting from TRP to LMF, angle, timing, for up to additional N>2 paths for at least UL-TDOA and multi-RTT.  **Agreement**   * For enhanced multipath reporting support N=8 for the value of maximum number of additional paths.   + Define a UE capability for the UE to report its supported value of maximum number of additional paths (no larger than 8) | stable |  |
| Multipath/NLOS mitigation | ULAoAOfAdditionalPathPerSRSResource | New | UL-AoA values per SRS resource for the additional path to be reported from gNB to LMF. Up to M=8 UL-AoA values can be reported per additional path. | FFS |  | FFS: RAN3 | Agreement: Reporting multiple UL-AoA values per SRS resource for the additional path is supported for at least UL TDOA and multi-RTT. • FFS: maximum number of UL-AoA values per additional path.   Agreement: For hybrid positioning methods where UL TDOA and multi-RTT are used in addition to UL AoA, support reporting of up to M=8 UL-AoA values per additional path | stable |  |
| Multipath/NLOS mitigation | maxNumOfULAoAOfAdditionalPathPerSRSResource | New | The maximum number of UL-AOAs values (pair of AOA & ZOA values) per SRS resource for the additional arrival path to be reported from gNB to LMF. | 8 |  | FFS: RAN3 | Agreement: Reporting multiple UL-AoA values per additional path is supported for at least UL TDOA and multi-RTT. • FFS: maximum number of UL-AoA values per additional path. Agreement: For hybrid positioning methods where UL TDOA and multi-RTT are used in addition to UL AoA, support reporting of up to M=8 UL-AoA values per additional path | stable |  |
| Multipath/NLOS mitigation | losNlosIndicator\_Request | New | This parameter is used for LMF to request a UE to report LoS/NLoS information with UE measurements (including RSTD, PRS RSRP and UE Rx-Tx time difference). | FFS |  | FFS REN2 | Agreement: • Support LoS/NLoS indicators which are reported to the LMF for DL and DL+UL positioning measurements taken at UE for UE-assisted positioning or UL and DL+UL measurements at the TRP for NG-RAN assisted positioning.  o Reporting from UE is subject to UE capability. | New-stable |  |
| Multipath/NLOS mitigation | losNlosIndicator\_Request | New | This parameter is used for LMF to request a gNB to report LoS/NLoS information with gNB measurements, including RTOA, UL RSRP, UL AOA, and gNB Rx-Tx time difference measurements. | FFS |  | FFS REN2 | Agreement: • Support LoS/NLoS indicators which are reported to the LMF for DL and DL+UL positioning measurements taken at UE for UE-assisted positioning or UL and DL+UL measurements at the TRP for NG-RAN assisted positioning.  o Reporting from UE is subject to UE capability. | New-stable |  |
| Multipath/NLOS mitigation | AdditionalPath\_relativeTiming\_Request | New | This parameter is used for LMF to request a UE to report (N>2) relative timing (to the first detected path) in the measurement reports for RSTD and UE Rx-Tx time difference. | FFS |  | FFS RAN2 | Agreement: • For up to N>2 additional paths, support reporting relative timing (to the first detected path) in the measurement reports from UE to LMF for at least DL-TDOA and multi-RTT | New-stable |  |
| Multipath/NLOS mitigation | AdditionalPath\_relativeTiming\_Request | New | This parameter is used for LMF to request a gNB to report (N>2) relative timing (to the first detected path) in the measurement reports for RTOA and gNB Rx-Tx time difference. | FFS |  | FFS RAN3 | Agreement: • For multipath reporting enhancements, support reporting from TRP to LMF, angle, timing, for up to additional N>2 paths for at least UL-TDOA and multi-RTT. | New-stable |  |
| Multipath/NLOS mitigation | AdditionalPath\_UL-AoA\_Request | New | This parameter is used for LMF to request a gNB to report multiple UL-AoA values per SRS resource for the additional path is supported for UL TDOA and multi-RTT. | FFS |  | FFS RAN3 | Agreement: Reporting multiple UL-AoA values per SRS resource for the additional path is supported for at least UL TDOA and multi-RTT. • FFS: maximum number of UL-AoA values per additional path. | New-stable |  |
| Multipath/NLOS mitigation | DL PRS-RSRPP\_Request | New | This parameter is used for LMF to request a UE to report DL PRS-RSRPP together with timing measurement as part of DL-TDOA and multi-RTT reporting enhancements | FFS |  | FFS RAN2 | **Agreement**   * Support the LMF to request DL PRS-RSRPP together with timing measurement as part of DL-TDOA and multi-RTT reporting enhancements   + Note: This applies to the first path and also to additional paths. |  | New-stable |
| Multipath/NLOS mitigation | UL SRS-RSRPP\_Request | New | This parameter is used for LMF to request a gNB to report UL SRS-RSRPP together with timing measurement as part of UL-TDOA and multi-RTT reporting enhancements | FFS |  | FFS RAN3 | **Agreement**   * Support the LMF to request UL SRS-RSRPP together with timing measurement as part of UL-TDOA and multi-RTT reporting enhancements   + Note: This applies to the first path and also to additional paths. |  | New-stable |
| Multipath/NLOS mitigation |  |  |  |  |  |  |  |  |  |

## Comments

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Huawei, HiSilicon | For DL PRS-RSRPP\_Request and UL SRS-RSRPP\_Request, we prefer to add “first path and also additional path” in column “Description”, so that the field description in RAN2 and RAN3 can capture that a single request can be applied to additional path also.  FL: Okay. |
| vivo | Regarding row 1 ‘losNlosIndicator’, the ‘working assumption’ has not been achieved so far. Therefore, we propose to remove the description of ‘working assumption’ in the column, and change the ‘value range’ in row1, row2 and row 3 to ‘FFS’.  FL: Okay. I may change it back if we make the agreement in this meeting. |
| Nokia/NSB | The working assumption was confirmed so we can have it in without qualification. |
| vivo2 | 1. Based on the discussion and agreement, DL AoD doesn’t support an additional path, and the parameter only adopt to DL TDOA and Multi-RTT, but it doesn't reflect on parameter description |
| CATT | We support the parameters listed in this section in principle.  Just a reminder, for the value ranges of the first three parameters “losNlosIndicator” as shown in the table below, we prefer to change the “FFS” into the following “soft values and hard values” if proposal 1.1-C was agreed in the email discussion of AI 8.5.5 (this proposal is still waiting for endorsement).  o   Soft values: [0, 0.1, …, 0.9, 1] (in steps of 0.1)  o   Hard values: [0, 1]  In addition, we are not sure whether we need one additional parameter to indicate whether the values of “losNlosIndicator” is soft values or hard values, if proposal 1.1-C was agreed in the email discussion of AI 8.5.5.   |  | | --- | | **Proposal 1.1-C**         Support the following two options of values for LoS/NLoS indicator reporting from UE/TRP:  o   Soft values: [0, 0.1, …, 0.9, 1] (in steps of 0.1)  o   Hard values: [0, 1]         The values correspond to the likelihood of LoS, with a value of 1 corresponding to LoS and a value of 0 corresponding to NLoS | |

7. On-demand transmission and reception of DL PR

(1st Round) Parameter Table

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sub-feature group** | **Parameter name in the spec** | **New or existing?** | **Description** | **Value range** | **Per (UE, cell, TRP, …)** | **Specification** | **Comment** | **Status [Post 106b-e]** | **Status [Post 107-e]** |
|  |  |  |  |  |  |  |  |  |  |
| On-demand PRS | On-demand PRS information for LMF-initiated on-demand DL PRS requests | New | The IE name “On-demand PRS information” is already used by RAN3 in (R3-214516) |  |  | FFS: RAN2/RAN3 | Agreement: At least the following list of on-demand DL PRS parameters is supported for UE-initiated and LMF-initiated on-demand DL PRS requests 1. DL PRS Periodicity 2. DL PRS resource bandwidth 3. DL PRS QCL information Agreement: • The following list of parameters is supported for UE-initiated and LMF initiated on-demand DL PRS request 1. Start/end time of DL PRS transmission 2. DL PRS resource repetition factor 3. Number of DL PRS resource symbols per DL PRS resource  4. DL-PRS CombSizeN 5. Number of DL PRS frequency layers 6. ON/OFF indicator (for LMF initiated request only) • FFS values for requested on-demand DL PRS parameters and whether parameters are resource-specific, TRP-specific, or PFL-specific | stable |  |
| On-demand PRS | NR-DL-PRS-Periodicity | New | NR DL PRS Periodicity | FFS | On-demand PRS information for LMF-initiated on-demand DL PRS requests |  |  | stable |  |
| On-demand PRS | dl-PRS-ResourceBandwidth | Existing | DL PRS ResourceBandwidth | FFS | On-demand PRS information for LMF-initiated on-demand DL PRS requests |  |  | stable |  |
| On-demand PRS | DL-PRS-QCL-Info | Existing | DL PRS QCL Information | FFS | On-demand PRS information for LMF-initiated on-demand DL PRS requests |  |  | stable |  |
| On-demand PRS | startTimeOfDLPRS | New | Start time of on-demand DL PRS transmission | FFS | On-demand PRS information for LMF-initiated on-demand DL PRS requests |  |  | New-stable |  |
| On-demand PRS | endTimeOfDLPRS | New | End time of on-demand DL PRS transmission | FFS | On-demand PRS information for LMF-initiated on-demand DL PRS requests |  |  | New-stable |  |
| On-demand PRS | dl-PRS-ResourceRepetitionFactor | Existing | DL PRS resource repetition factor | FFS | On-demand PRS information for LMF-initiated on-demand DL PRS requests |  |  | New-stable |  |
| On-demand PRS | dl-PRS-NumSymbols | Existing | Number of DL PRS resource symbols per DL PRS resource | FFS | On-demand PRS information for LMF-initiated on-demand DL PRS requests |  |  | New-stable |  |
| On-demand PRS | dl-PRS-CombSizeN | Existing | DL-PRS CombSizeN | FFS | On-demand PRS information for LMF-initiated on-demand DL PRS requests |  |  | New-stable |  |
| On-demand PRS | dl-PRS-NumPosFreqLayers | New | Number of DL PRS positioning frequency layers | FFS | On-demand PRS information for LMF-initiated on-demand DL PRS requests |  |  | New-stable |  |
| On-demand PRS | onOffIndicator | New | ON/OFF indicator (for LMF initiated request only) | FFS | On-demand PRS information for LMF-initiated on-demand DL PRS requests |  |  | New-stable |  |

## Comments

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| --- | --- |
| **Company** | **Comments** |
| Huawei, HiSilicon | So all UE initiated on-demand PRS is not included in this table? |
| Nokia/NSB | For DL-PRS-QCL-Info we are not sure if this is captured correctly based on the discussion ongoing. |

8. Support of positioning for UEs in RRC\_ INACTIVE state

(1st Round) Parameter Table

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sub-feature group** | **Parameter name in the spec** | **New or existing?** | **Description** | **Value range** | **Per (UE, cell, TRP, …)** | **Specification** | **Comment** | **Status [Post 106b-e]** | **Status [Post 107-e]** |
| RRC\_ INACTIVE positioning |  |  |  |  |  |  |  |  |  |

## Comments

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| **Company** | **Comments** |
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|  |  |
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9. Summary

TBD

10. References

1. R1-2110573 Consolidated higher layers parameter list for Rel-17 NR Moderator (Ericsson)
2. R1-2111193 Recommendations for RAN1 RRC Parameter Preparation Moderator(Ericsson)
3. RAN1 Chair’s Notes#104e.
4. RAN1 Chair’s Notes#104bis-e.
5. RAN1 Chair’s Notes#105e.
6. RAN1 Chair’s Notes#106e.
7. RAN1 Chair’s Notes#106bis-e.