**3GPP TSG RAN WG1#106bis R1-2110389**

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

**Title: FL Summary #2 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:

 [106bis-e-R17-RRC-NR-ePos] Email discussion on Rel-17 RRC parameters for positioning enhancement – Ren Da (CATT)

* 1st check point: October 14
* Final check point: October 19

The RRC parameters proposed for the 1st Round email discussion are based on the summary of the email discussion from the last meeting [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.

Since Column E and F *should be left empty*, they will not be included in the tables of this document. In addition,

* For Column C (RAN1 specification) and Column D(Section): The understanding is that they can be left empty for now.
* Column I (Parameter name in the text): It is assumed it can be the same as Column G (Parameter name in the spec). So, we may leave Column I empty during email discussion, but will copy Column G to Column I when submitting the discussion summary.

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). There will be a separate discussion related to the corresponding parameters related to UE capability. Obviously, the maximum numbers supported by a UE capability do not exceed the maximum numbers allowed in the specifications.
3. The word document is used 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.
4. In the draft spreadsheet, one column “Status” is added. According to the instruction from the moderator for the RRC parameter list, on Second check point Oct 19th:
* “Status” column uses the following indications:
* “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.
* Note: Based on the suggested guidelines for preparation of RRC parameter list, “RAN1 is encouraged to include RRC parameter lists in LS to RAN2 that are stable (not necessarily complete) and achieve the primary goal”, the “Stable” parameters are not necessarily be completed.

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

(1st Round) Parameter Table

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **B****Sub-feature group** | **C****RAN1 specification** | **D****Section** | **G****Parameter name in the spec** | **H****New or existing?** | **I****Parameter name in the text** | **J****Description** | **K****Value range** | **L****Default value aspect** | **M****Per (UE, cell, TRP, …)** | **N****UE-specific or Cell-specific** | **O****Specification** | **P****Comment** |
| 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.  |
| 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. |  |   |  |  | FFS for RAN2/RAN3 | FFS: Whether the association information is sent directly from UE to LMF, or is first provided to gNB and then forwarded to LMF. |
| 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 |  |
| 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 |  |
| Mitigation of UE Rx/Tx timing delays |   |   | srs-PosResourceId |  Existing |  | Positioning SRS resource ID |    |   | “in ueTxTEG” |  | FFS for RAN2 | FFS: the maximum number of positioning SRS Resources |
| 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}
* A triplet of UE {RxTx TEG ID, Rx TEG ID, Tx TEG ID}
 |  FFS |   |  |  | FFS for RAN2 | AgreementsFor 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.AgreementsIf a RxTx TEG ID is reported with a UE Rx-Tx time difference measurement, the UE may optionally also report a Tx TEG ID. |
| 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 |  |
| 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 |  |
| 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 |  |
| Mitigation of UE Rx/Tx timing delays |   |   | [maxNumOfUE-RxTEG] |  New |  | The maximum number of UE-RxTEG per UE |  FFS |   |  [Per UE] |  | FFS for RAN2 |  |
| Mitigation of UE Rx/Tx timing delays |   |   | [maxNumOfUE-TxTEG] |  New |  | The maximum number of UE-TxTEG per UE |  FFS |   |  [Per UE] |  | FFS for RAN2 |  |
| 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 |  |
| Mitigation of UE Rx/Tx timing delays |   |   | [maxNumOfUE-RxTxTEG] |  New |  | The Max number of UE-RxTxTEG per UE |  FFS |   |  [Per UE] |  | FFS for RAN2 |  |
| 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. |
|  |   |   |   |   |  |   |   |   |   |  |   |   |
| 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 |   |
| 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 |   |
| 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 |   |
| Mitigation of TRP Rx/Tx timing delays |   |   | NR-DL-PRS-ResourceSetID |  Existing |  |  |   |   |  “in trpTxTEG” |  | FFS for RAN3 |   |
| Mitigation of TRP Rx/Tx timing delays |   |   | NR-DL-PRS-ResourceID |  Existing |  | 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, TxTEG ID}
* A pair of TRP {Rx TEG ID, TxTEG ID}

A triplet of TRP {RxTx TEG ID, Rx TEG ID, TxTEG ID} |   |   |  “in trpTxTEG” |  | FFS for RAN3 |   |
| 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}

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 meeting |
| 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 |   |
| 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 |   |
| 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 |   |
| 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 |
| 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 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| Mitigation of TRP Rx/Tx timing delays |   |   | [maxNumOfTRPRxTEG] |   New |  | The maximum number of TRP-RxTEG per TRP |  FFS |   |  [per TRP] |  | FFS for RAN3 | maximum number allowed by spec, instead of UE capability |
| Mitigation of TRP Rx/Tx timing delays |   |   | [maxNumOfTRPTxTEG ] |   New |  | The maximum number of TRP-TxTEG per TRP |  FFS |   |   [per TRP] |  | FFS for RAN3 |   |
| 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 |   |
| Mitigation of TRP Rx/Tx timing delays |   |   | [maxNumOfTRPRxTxTEG] |   New |  | The Max number of TRP RxTxTEG per TRP |  FFS |   |   [per TRP] |  | FFS for RAN3 |   |
| Mitigation of TRP Rx/Tx timing delays |   |   | numOfTRPRxTEG-PerPRSResource |   New |  | **The** number of  **different** TRP Rx TEGs that the LMF requests a TRP to measure the **same U**L positioning SRS resource of a UE |  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 |
|  |  |  |  |  |  |   |   |   |   |   |   |   |

|  |  |
| --- | --- |
| **Company** | **Comments**  |
| Huawei, HiSilicon | Comment #1:We prefer to group the hierarchical structure of field/IEs in a single row, e.g. it would be nice if the following fields are in a single row, with ueTxTEG-ID, srs-PosResourceID included either in description column or the comments column.

|  |
| --- |
| ueTxTEG |
| ueTxTEG-ID |
| [srs-PosResourceSetId] |
| srs-PosResourceId |

FL: I assume the comment is to make RAN2 to better understand the relationship between the parameters. The issue is that if we use a single row for multiple parameters, we may not be able to add the fields (e.g., “new”, “value range”, for each of them. Maybe we can use color in the spreadsheet to group them if needed. Comment #2:For ueRxTxTEG-ID-group, it would be nice to also adopt what is proposed in comment #1. In addition, we suggest to make the following change (by adding ID to RxTx TEG. Also it is preferred to have a space between “Tx” and “TEG” if not for the field name.

|  |
| --- |
| 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, TxTEG ID}
* A pair of TRP {Rx TEG ID, TxTEG ID}
* A triplet of TRP {RxTx TEG ID, Rx TEG ID, TxTEG ID}
 |

FL: CorrectedComment #3:Apart from the reporting, we believe there should be the parameter to request the associated TEG ID reporting. Is the FL intention to let RAN2 work out?FL: I was thinking that RAN2 will have a copy of RAN1’s agreement on which information the LMF/gNB can request. If the group considers it is good for us to provide the parameters to RAN2, we can add them later. |
| Qualcomm | We also Agree with Commetn #3 by HW: There should be request IEs from LMF to the UE and the TRP for each type of TEGs (TxTEG, RxTEG, RxTxTEG) in the location request messages of each corresponding method. FL: I was thinking that RAN2 will have a copy of RAN1’s agreement on which information the LMF/gNB can request. If the group considers it is good for us to provide the parameters to RAN2, we can add them later. |
| CATT | Currently measurement time window is under the discussion, if the configurable MTW was agreed, it may be necessary to add some parameters related to the configuration of MTW.FL: They can be added once we have the agreement. |
| OPPO | For “ueRxTxTEG-ID-group”, “A triplet of UE {RxTx TEG, Rx TEG ID, TxTEG ID}” seems not needed. According to the following agreement, only a Tx TEG ID may be reported along with RxTx TEG IDAgreementsIf a RxTx TEG ID is reported with a UE Rx-Tx time difference measurement, the UE may optionally also report a Tx TEG IDFL: “A triplet of UE {RxTx TEG, Rx TEG ID, TxTEG ID}” is for the case when the UE supports both Option 1 and Option 2. For Option 1, the UE reports RxTx TEG ID. For Option 2, UE reports {Rx TEG ID, TxTEG ID}. The above agreement is for Option 1, which says UE may report Tx TEG ID with RxTx TEG ID. |

(2nd Round) Parameter Table

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **B****Sub-feature group** | **C****RAN1 specification** | **D****Section** | **G****Parameter name in the spec** | **H****New or existing?** | **I****Parameter name in the text** | **J****Description** | **K****Value range** | **L****Default value aspect** | **M****Per (UE, cell, TRP, …)** | **UE-specific or Cell-specific** | **O****Specification** | **P****Comment** |
| Mitigation of UE Rx/Tx timing delays |   |   | ueRxTEG-ID |  New |  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.  |
| Mitigation of UE Rx/Tx timing delays |   |   | ueTxTEG | New | 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. |  |   |  |  | FFS for RAN2/RAN3 | FFS: Whether the association information is sent directly from UE to LMF, or is first provided to gNB and then forwarded to LMF. |
| Mitigation of UE Rx/Tx timing delays |   |   | ueTxTEG-ID | New | 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 |  |
| Mitigation of UE Rx/Tx timing delays |   |   | [srs-PosResourceSetId] |  Existing |  Existing | FFS: whether there is a need to include the positioning SRS resource set ID in ueTxTEG  |    |   | “in ueTxTEG” |  | FFS for RAN2 |  |
| Mitigation of UE Rx/Tx timing delays |   |   | [srs-PosResourceId] |  Existing |  Existing | Positioning SRS resource ID |    |   | “in ueTxTEG” |  | FFS for RAN2 | FFS: the maximum number of positioning SRS Resources |
| Mitigation of UE Rx/Tx timing delays |   |   | ueRxTxTEG-ID-group |  New |  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 | AgreementsFor 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.AgreementsIf a RxTx TEG ID is reported with a UE Rx-Tx time difference measurement, the UE may optionally also report a Tx TEG ID. |
| Mitigation of UE Rx/Tx timing delays |   |   | ueRxTxTEG-ID |  New |  New | The ID of a UE RxTx timing error group. |  FFS |   |  “in ueRxTxTEG-ID-group” |  | FFS for RAN2 |  |
| Mitigation of UE Rx/Tx timing delays |   |   | ueTxTEG-ID |  New |  New | The ID of a UE Tx timing error group. |  FFS |   |   “in ueRxTxTEG-ID-group” |  | FFS for RAN2 |  |
| Mitigation of UE Rx/Tx timing delays |   |   | ueRxTEG-ID |  New |  New | The ID of a UE Rx timing error group. |  FFS |   |   “in ueRxTxTEG-ID-group” |  | FFS for RAN2 |  |
| Mitigation of UE Rx/Tx timing delays |   |   | [maxNumOfUE-RxTEG] |  New |  New | The maximum number of UE-RxTEG  |  FFS |   |  [Per UE] |  | FFS for RAN2 |  |
| Mitigation of UE Rx/Tx timing delays |   |   | [maxNumOfUE-TxTEG] |  New |  New | The maximum number of UE-TxTEG |  FFS |   |  [Per UE] |  | FFS for RAN2 |  |
| Mitigation of UE Rx/Tx timing delays |   |   | [maxNumOfPosSRSResourcesPerTxTEG] | New | New | FFS: The maximum number of positioning SRS resources associated with one UE TxTEG | FFS |  |  |  | FFS for RAN2 |  |
| Mitigation of UE Rx/Tx timing delays |   |   | [maxNumOfUE-RxTxTEG] |  New |  New | The Max number of UE-RxTxTEG per UE |  FFS |   |  [Per UE] |  | FFS for RAN2 |  |
| Mitigation of UE Rx/Tx timing delays |   |   | numOfUERxTEG-PerPRSResource | New | 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. |
|  |   |   |   |   |   |   |   |   |   |   |   |   |
| Mitigation of TRP Rx/Tx timing delays |   |   | trpRxTEG-ID |   New |   New | The ID of a TRP Rx timing error group, which is sent with RTOA measurements from gNB to LMF.  |  FFS |   |   |   | FFS for RAN3 |   |
| Mitigation of TRP Rx/Tx timing delays |   |   | trpTxTEG |   New |   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 |   |
| Mitigation of TRP Rx/Tx timing delays |   |   | trpTxTEG-ID |   New |   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 |   |
| Mitigation of TRP Rx/Tx timing delays |   |   | NR-DL-PRS-ResourceSetID |  Existing |  Existing | NR DL PRS ResourceSetID |   |   |  “in trpTxTEG” |  | FFS for RAN3 |   |
| Mitigation of TRP Rx/Tx timing delays |   |   | NR-DL-PRS-ResourceID |  Existing |  Existing | 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, TxTEG ID}
* A pair of TRP {Rx TEG ID, TxTEG ID}
* FFS: A triplet of TRP {RxTx TEG ID, Rx TEG ID, TxTEG ID}
 |   |   |  “in trpTxTEG” |  | FFS for RAN3 |   |
| Mitigation of TRP Rx/Tx timing delays |  |  | trpRxTxTEG-ID-group |  New |  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 meeting |
| Mitigation of TRP Rx/Tx timing delays |   |   | trpRxTxTEG-ID |   New |   New | The ID of the TRP RxTx timing error group.  |  FFS |   | “in trpRxTxTEG-ID-group” |  | FFS for RAN3 |   |
| Mitigation of TRP Rx/Tx timing delays |   |   | trpTxTEG-ID |  New |  New | The ID of a TRP Tx timing error group. |  FFS |   | “in trpRxTxTEG-ID-group” |  | FFS for RAN3 |   |
| Mitigation of TRP Rx/Tx timing delays |   |   | trpRxTEG-ID |  New |  New | The ID of a TRP Rx timing error group. |  FFS |   | “in trpRxTxTEG-ID-group” |  | FFS for RAN3 |   |
| Mitigation of TRP Rx/Tx timing delays |  |  | [srs-PosResourceSetId] | New | 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 |
| Mitigation of TRP Rx/Tx timing delays |  |  | srs-PosResourceId | New | 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 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| Mitigation of TRP Rx/Tx timing delays |   |   | [maxNumOfTRPRxTEG] |   New |   New | The maximum number of TRP-RxTEG per TRP |  FFS |   |  [per TRP] |  [per TRP] | FFS for RAN3 |  |
| Mitigation of TRP Rx/Tx timing delays |   |   | [maxNumOfTRPTxTEG ] |   New |   New | The maximum number of TRP-TxTEG per TRP |  FFS |   |   [per TRP] |   [per TRP] | FFS for RAN3 |   |
| Mitigation of TRP Rx/Tx timing delays |   |   | [maxNumOfPRSResourcesPerTxTEG] |   New |   New | The maximum number of PRS resources associated with one TRP TxTEG |  FFS |   |   [per TRP] |   [per TRP] | FFS for RAN3 |   |
| Mitigation of TRP Rx/Tx timing delays |   |   | [maxNumOfTRPRxTxTEG] |   New |   New | The Max number of TRP RxTxTEG per TRP |  FFS |   |   [per TRP] |   [per TRP] | FFS for RAN3 |   |
| Mitigation of TRP Rx/Tx timing delays |   |   | numOfTRPRxTEG-PerPRSResource |   New |   New | **The** number of  **different** TRP Rx TEGs that the LMF requests a TRP to measure the **same U**L positioning SRS resource of a UE |  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 |
|  |  |  |  |  |  |   |   |   |   |   |   |   |

Comments

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| **Company** | **Comments**  |
| ZTE | We suggest to put srs-PosResourceId (fifth row) in bracket. Although we have agreed that UE should report the association of the Tx TEG ID to the UL SRS resource(s), which doesn’t mean SRS resource ID and SRS resource set ID should be in the report. It’s still up to RAN2/RAN3 on how to design the signaling structure. For example, if 4 SRS resources are configured, UE may only provide a list of TEGs with 4 entries to network. Each entry in the list is one-to-one mapped to the corresponding TEG ID. By this way, there is no need to explicitly indicate SRS resource ID and SRS resource set ID in the report.Therefore, we also prefer to add brackets for NR-DL-PRS-ResourceSetID and NR-DL-PRS-ResourceID.FL: Okay. The list is used for reference for RAN2/RAN3. It is up to them to design the signaling. |
| OPPO | Reply to FL: We have different views* For the 1st agreement, it is only to say that UE can support Option 1, or support Option 2, or both Option 2 and Option 1 via UE capability reporting. But it does not say both Option 1 and Option 2 will be reported for the same measurement
* The 2nd agreement l clearly said that if RxTx TEG ID is reported, only a Tx TEG ID. The original version of this proposal included the Rx TEG ID, which was removed by companies’ comment. If ““A triplet of UE {RxTx TEG, Rx TEG ID, TxTEG ID}”” is included, it means we support the original proposal rather than the agreement.

AgreementsFor 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.AgreementsIf a RxTx TEG ID is reported with a UE Rx-Tx time difference measurement, the UE may optionally also report a Tx TEG ID.FL: We indeed has different understanding. At least when I prepare the proposal for the 2nd agreement, I was thinking to address the following FFS issue related to Option 1. The agreement says if UE reports RxTx TEG ID, is can also send Tx TEG ID for Option 1. It does not say if the UE also support Option 1, it cannot support Option 2, which is to report {UE RxTx TEG ID, UX Tx TEG ID}Agreement: (RAN1#105e)For mitigating UE Tx/Rx timing errors for DL+UL positioning, a UE may support, up to UE capability, one or both of the following options:• Option 1: Reporting of UE RxTx TEG ID is supported by the UEo FFS: Further details on how the RxTx TEG IDs are related/associated to Tx TEG IDs and/or Rx TEG IDs and to the Rx-Tx measurements. • Option 2: Reporting of UE RxTx TEG ID is not supported by the UE; reporting of Rx TEG ID and Tx TEG ID is supported.Since Option 1: Reporting of UE RxTx TEG ID and Option 2: Reporting of UE Rx TEG ID and UE Tx TEG ID, then Option 1 + Option 2 will support reporting the sum of each option can support. I don’t see other interpretation. If Option 1 + Option 2 cannot support the combination of these IDs, then we shall say the UE can only support one option at a time. By the way, do you see any issue for a UE to support both option at the same time? Due to the comment, I will add “FFS” the triplet of {RxTx TEG ID, Rx TEG ID, Tx TEG ID} for now. |

(3rd Round) Parameter Table

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **B****Sub-feature group** | **Status** | **D****Section** | **G****Parameter name in the spec** | **H****New or existing?** | **I****Parameter name in the text** | **J****Description** | **K****Value range** | **L****Default value aspect** | **M****Per (UE, cell, TRP, …)** | **UE-specific or Cell-specific** | **O****Specification** | **P****Comment** |
| Mitigation of UE Rx/Tx timing delays |  stable |   | 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.  |
| Mitigation of UE Rx/Tx timing delays |  stable |   | 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. |  |   |  |  | FFS for RAN2/RAN3 | Working assumption:* + - 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.
				+ FFS: whether to support the serving gNB to forward the association information to the neighboring gNBs
			* 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.
			* FFS: whether to support the LMF to forward the association information to the serving and neighboring gNBs
			* UE should report its capability of supporting multiple UE Tx TEGs for Multi-RTT *directly* to the LMF.
		- FFS: Mitigation of UE Tx timing errors when Multi-RTT, UL-TDOA and/or DL-TDOA are used.
 |
| Mitigation of UE Rx/Tx timing delays |  stable |   | 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 |  |
| Mitigation of UE Rx/Tx timing delays |  stable |   | [srs-PosResourceSetId] |  Existing |  | FFS: whether there is a need to include the positioning SRS resource set ID in ueTxTEG  |    |   | “in ueTxTEG” |  | FFS for RAN2 |  |
| Mitigation of UE Rx/Tx timing delays |  stable |   | [srs-PosResourceId] |  Existing |  | Positioning SRS resource ID |    |   | “in ueTxTEG” |  | FFS for RAN2 | FFS: the maximum number of positioning SRS Resources |
| Mitigation of UE Rx/Tx timing delays |  stable |   | 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 | AgreementsFor 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.AgreementsIf a RxTx TEG ID is reported with a UE Rx-Tx time difference measurement, the UE may optionally also report a Tx TEG ID. |
| Mitigation of UE Rx/Tx timing delays |  stable |   | ueRxTxTEG-ID |  New |  | The ID of a UE RxTx timing error group. |  FFS |   |  “in ueRxTxTEG-ID-group” |  | FFS for RAN2 |  |
| Mitigation of UE Rx/Tx timing delays |  stable |   | ueTxTEG-ID |  New |  | The ID of a UE Tx timing error group. |  FFS |   |   “in ueRxTxTEG-ID-group” |  | FFS for RAN2 |  |
| Mitigation of UE Rx/Tx timing delays |  stable |   | ueRxTEG-ID |  New |  | The ID of a UE Rx timing error group. |  FFS |   |   “in ueRxTxTEG-ID-group” |  | FFS for RAN2 |  |
| Mitigation of UE Rx/Tx timing delays |  stable |   | [maxNumOfUE-RxTEG] |  New |  | The maximum number of UE-RxTEG  |  FFS |   |  [Per UE] |  | FFS for RAN2 |  |
| Mitigation of UE Rx/Tx timing delays |  stable |   | [maxNumOfUE-TxTEG] |  New |  | The maximum number of UE-TxTEG |  FFS |   |  [Per UE] |  | FFS for RAN2 |  |
| Mitigation of UE Rx/Tx timing delays |  stable |   | [maxNumOfPosSRSResourcesPerTxTEG] | New |  | FFS: The maximum number of positioning SRS resources associated with one UE TxTEG | FFS |  |  |  | FFS for RAN2 |  |
| Mitigation of UE Rx/Tx timing delays |  stable |   | [maxNumOfUE-RxTxTEG] |  New |  | The Max number of UE-RxTxTEG per UE |  FFS |   |  [Per UE] |  | FFS for RAN2 |  |
| Mitigation of UE Rx/Tx timing delays |  stable |   | 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
 |
| Mitigation of UE Rx/Tx timing delays | New-stable |   | 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 |  Working assumption:* + - 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.
				+ FFS: whether to support the serving gNB to forward the association information to the neighboring gNBs
			* UE should report its capability of supporting multiple UE Tx TEGs for UL TDOA to serving gNB.
 |
| Mitigation of UE Rx/Tx timing delays | New-stable |   | 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 |  Working assumption:* + - 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.
			* FFS: whether to support the LMF to forward the association information to the serving and neighboring gNBs
			* UE should report its capability of supporting multiple UE Tx TEGs for Multi-RTT *directly* to the LMF.
		- FFS: Mitigation of UE Tx timing errors when Multi-RTT, UL-TDOA and/or DL-TDOA are used.
 |
| Mitigation of UE Rx/Tx timing delays | New-stable |   | 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
 |
| Mitigation of UE Rx/Tx timing delays | New-stable |   | 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 | AgreementsFor 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.AgreementsIf a RxTx TEG ID is reported with a UE Rx-Tx time difference measurement, the UE may optionally also report a Tx TEG ID. |
| Mitigation of UE Rx/Tx timing delays | New-stable |   |  MeasPRSwithDiffRxTEGs\_Request |  New |  | The parameter is used by a LMF to request a UE to measure the same DL PRS with different UE Rx TEGs |  FFS |   |  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
 |
| Mitigation of UE Rx/Tx timing delays | New-Unstable |  | 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 timestampo 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 Seto FFS: N (including N=1)• FFS: Each TRP measurement instance can be configured with M SRS measurement time occasionso 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. |
|  |  |   |   |   |  |   |   |   |   |   |   |   |
| Mitigation of TRP Rx/Tx timing delays |  stable |   | 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 |   |
| Mitigation of TRP Rx/Tx timing delays |  stable |   | 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 |   |
| Mitigation of TRP Rx/Tx timing delays |  stable |   | 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 |   |
| Mitigation of TRP Rx/Tx timing delays |  stable |   | NR-DL-PRS-ResourceSetID |  Existing |  | NR DL PRS ResourceSetID |   |   |  “in trpTxTEG” |  | FFS for RAN3 |   |
| Mitigation of TRP Rx/Tx timing delays |  stable |   | NR-DL-PRS-ResourceID |  Existing |  | * NR DL PRS ResourceID
 |   |   |  “in trpTxTEG” |  | FFS for RAN3 |   |
| Mitigation of TRP Rx/Tx timing delays |  stable |  | 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 | Agreement:* 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 signalling
 |
| Mitigation of TRP Rx/Tx timing delays |  stable |   | trpRxTxTEG-ID |   New |  | The ID of the TRP RxTx timing error group.  |  FFS |   | “in trpRxTxTEG-ID-group” |  | FFS for RAN3 |   |
| Mitigation of TRP Rx/Tx timing delays |  stable |   | trpTxTEG-ID |  New |  | The ID of a TRP Tx timing error group. |  FFS |   | “in trpRxTxTEG-ID-group” |  | FFS for RAN3 |   |
| Mitigation of TRP Rx/Tx timing delays |  stable |   | trpRxTEG-ID |  New |  | The ID of a TRP Rx timing error group. |  FFS |   | “in trpRxTxTEG-ID-group” |  | FFS for RAN3 |   |
| Mitigation of TRP Rx/Tx timing delays |  stable |  | [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 |
| Mitigation of TRP Rx/Tx timing delays |  stable |  | 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 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| Mitigation of TRP Rx/Tx timing delays |  stable |   | [maxNumOfTRPRxTEG] |   New |  | The maximum number of TRP-RxTEG per TRP |  FFS |   |  [per TRP] |  [per TRP] | FFS for RAN3 |  |
| Mitigation of TRP Rx/Tx timing delays |  stable |   | [maxNumOfTRPTxTEG ] |   New |  | The maximum number of TRP-TxTEG per TRP |  FFS |   |   [per TRP] |   [per TRP] | FFS for RAN3 |   |
| Mitigation of TRP Rx/Tx timing delays |  stable |   | [maxNumOfPRSResourcesPerTxTEG] |   New |  | The maximum number of PRS resources associated with one TRP TxTEG |  FFS |   |   [per TRP] |   [per TRP] | FFS for RAN3 |   |
| Mitigation of TRP Rx/Tx timing delays |  stable |   | [maxNumOfTRPRxTxTEG] |   New |  | The Max number of TRP RxTxTEG per TRP |  FFS |   |   [per TRP] |   [per TRP] | FFS for RAN3 |   |
| Mitigation of TRP Rx/Tx timing delays |  stable |   | numOfTRPRxTEG-PerPRSResource |   New |  | **The** number of  **different** TRP Rx TEGs that the LMF requests a TRP to measure the **same U**L positioning SRS resource of a UE |  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
* The timestamps of the multiple RTOA measurements in the same measurement report can be the same or different.
 |
| Mitigation of TRP Rx/Tx timing delays | New-stable |   | 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 |   | 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
 |
| Mitigation of TRP Rx/Tx timing delays | New-stable |  | TRPRxTEG\_Request\_UL-TDOA |  |  | The parameter is used by a LMF to request a TRP to provide TRP Rx TEG association for UL-TDOA |  |  |  |  |  | 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 |
| Mitigation of TRP Rx/Tx timing delays | New-stable |  | 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 |   | FFS for RAN3 |  |
| Mitigation of TRP Rx/Tx timing delays | New-stable |   |  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 |   | 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
 |
| Mitigation of TRP Rx/Tx timing delays | New-Unstable |  | 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 |   | 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 timestampo 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 Seto FFS: N (including N=1)• FFS: Each TRP measurement instance can be configured with M SRS measurement time occasionso 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. |
|  |  |  |  |  |  |   |   |   |   |   |   |   |

## Comments

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| **Company** | **Comments**  |
| Nokia/NSB | We have some comments and questions: Comment #1: Should the ueTxTEG parameter should be included in this list? We have not discussed/agreed if the TEGs will be signaled over capability signaling or more dynamically. Question for clarification: is it the correct process to include the parameter to RAN2 if it eventually is only sent in capability signaling and/or hard coded in the spec by RAN4? We have only agreed to have the association information reported so far. FL: My understanding is that parameters only sent in capability signaling do not need to be included in this RRC table since RAN1 will include all parameters in capability signaling in UE feature list table. For hard coded one, I assume we can include them. It is hen upto RAN2/3 on whether to hard code it. But, it is unclear to me why it is question on whether “ueTxTEG parameter should be included in this list”. It seems to me it is obvious that the ueTxTEG will be include based on the agreements.Comment #2: For the description of ueTxTEG-ID we suggest to included the WA (or in the comments) about reporting of this parameter so that RAN2 is aware that it can be sent over RRC or LPP depending on the technique. FL: We have WA in the comment for ueTxTEG, and we also have indicated ueTxTEG-ID is included “in ueTxTEG” in Column M. Comment #3: Same comment as comment #1 but for trpTxTEG but relevant for RAN3 not RAN2.FL: See response on comment #1.Comment #4: For “trpRxTxTEG-ID-group”, the similar agreement may be made but now in fact we have no clear agreement or WA, so it may be appropriate to add square bracket. One minor comment is that in the “O” column, a typo needs to be corrected as FFS for RAN3.FL: Added the new agreement for trpRxTxTEG-ID-group. The typo is corrected.We have a clarification question. Regarding batch reporting (different measurements reporting in a single report), don't we need request from LMF or is it up to implementation?FL: I think if RAN1 has time, it may be better to define it. Maybe discussed in the next meeting. |
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3. Accuracy improvements for UL-AoA positioning solutions

(1st Round) Parameter Table

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **B****Sub-feature group** | **C****RAN1 specification** | **D****Section** | **G****Parameter name in the spec** | **H****New or existing?** | **I****Parameter name in the text** | **J****Description** | **K****Value range** | **L****Default value aspect** | **M****Per (UE, cell, TRP, …)** | **N****UE-specific or Cell-specific** | **O****Specification** | **P****Comment** |
| 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 | FFS |  | 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 |
| UL-AOA Enhancement |  |  | Expected Azimuth AoA |  New |  |  | FFS |  | “In Expected UL Angle of Arrival” |  | FFS RAN3 |  |
| UL-AOA Enhancement |  |  | Expected Zenith AoA |  New |  |  | FFS |  | “In Expected UL Angle of Arrival” |  | FFS RAN3 |  |
| UL-AOA Enhancement |  |  | Expected Azimuth AoA Value |  New |  |  | FFS |  | “in Expected Azimuth AoA” |  | FFS RAN3 |  |
| UL-AOA Enhancement |  |  | Expected Azimuth AoA Uncertainty Range |  New |  |  | FFS |  | “in Expected Azimuth AoA” |  | FFS RAN3 |  |
| UL-AOA Enhancement |  |  | Expected Zenith AoA Value |  New |  | Uncertainty range for expected azimuth angle of arrival | FFS |  | “in Expected Zenith AoA” |  | FFS RAN3 |  |
| UL-AOA Enhancement |  |  | Expected Zenith AoA Uncertainty Range |  New |  | uncertainty range for expected zenith angle of arrival | FFS |  | “in Expected Zenith AoA” |  | FFS RAN3 |  |
| 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 |
| 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-TxAgreement: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 pathAgreement:• 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 LMFo Note: The operation of SRS for MIMO is transparent to the UE |
| UL-AOA Enhancement |  |  | firstPathAoA |  New |  | A pair of AOA & ZOA values to be reported per SRS resource |  FFS |   | “in ULAoAOfFirstPathPerSRSResource” |  |  FFS RAN3 |  |
| UL-AOA Enhancement |  |  | firstPathZoA |  New |  | A pair of AOA & ZOA values to be reported per SRS resource |  FFS |   | “in ULAoAOfFirstPathPerSRSResource” |  |  FFS RAN3 |  |
| 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. |
| 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 for 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 |
| UL-AOA Enhancement |  |  | TRP Position Relative Geodetic | Existing |  | Relative position of the ARP to TRP for UL-AoA measurement | Define in TS 38.455 |  | FFS for RAN3 |  | FFS for RAN3 | Agreement:Association of UL-AOA positioning measurements with gNB ARP is supported in Rel.17. |
| UL-AOA Enhancement |  |  | TRP Position Relative Cartesian | Existing |  | Relative position of the ARP to TRP for UL-AoA measurement | Define in TS 38.455 |  | FFS for RAN3 |  | FFS for RAN3 | Agreement:Association of UL-AOA positioning measurements with gNB ARP is supported in Rel.17. |

Comments

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| **Company** | **Comments**  |
| **FL** | RAN3 had already implemented some of the requirements according to the RAN1’s LS to RAN3, and added some new NRPPa parameters accordingly. Some of the parameters in above table are actually copied from RAN3 CR R3-214516. During previous discussion, there was a comment on whether there is no need to copy the NRPPa parameters that RAN3 already implemented into RAN1’s list of these parameters, and then sent back to RAN3. I assume whether to include these NRPPa parameters may really depend on whether RAN3 considers it is necessary to do so. I will check with the Rapporteur for RAN3 work to see his opinion.FL: After checking with the Rapporteur for RAN3 work, the feedback is suggesting RAN1 to provide a complete list for R17, including these parameters already defined iby RAN3. |
| Huawei, HiSilicon | As presented in our paper R1-2108731, we consider it worthwhile to clarify that the value 0 of expected AoA uncertainty would mean that the expected AoA is accurate, which is suggested by Alexey to be discussed in the parameters list.***Proposal 3: RAN1 confirms that the expected AoA/ZoA uncertainty can take the value 0, in which case the expected AoA/ZoA is accurate.******Note: This can be used for receiving SRS for a PRU.***FL: The values are all FFS currently. I assume we can add the value=0 for expected AoA/ZoA uncertainty to see if there is any different view. |
| ZTE | 1st comment:Regarding Huawei’s comment to take the value 0 for expected AoA/ZoA uncertainty might not be necessary. If expected AoA/ZoA and the expected AoA/ZoA uncertainty are optional, LMF may only indicate expected AoA/ZoA to TRP without the need to indicate expected AoA/ZoA uncertainty.FL: Okay for further discussion.2nd comment:The agreement may also need to be reflected in the table,Agreement:* For the first arrival path measurements on SRS for positioning resource,
	+ gNB can report to LMF the following set of measurements {one SRS-RSRP, multiple UL-AOAs (AoA/ZoA pairs), one UL-RTOA}
	+ 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}
	+ 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}
	+ 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,
	+ gNB can report to LMF the following set of measurements {one SRS-RSRP, multiple UL-AOAs (AoA/ZoA pairs), one UL-RTOA}
	+ FFS: gNB can report to LMF the following set of measurements {multiple SRS-RSRP, multiple UL-AOAs (AoA/ZoA pairs), one UL-RTOA}
	+ All gNB measurements above are associated with SRS resource ID and timestamp, which are also reported to LMF
	+ Note: The operation of SRS for MIMO is transparent to the UE

FL: Added.  |
| Huawei, HiSilicon 1015 | For the newly added **TRP Position Relative Geodetic**, we would suggest to also include **TRP Position Relative Cartesian**.RAN3 is enabling both coordinates in NRPPa specification, and there is no reason why Cartesian coordinates cannot be used for TRP ARP.FL: Added |
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(2nd Round) Parameter Table

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **B****Sub-feature group** | **Status** | **D****Section** | **G****Parameter name in the spec** | **H****New or existing?** | **I****Parameter name in the text** | **J****Description** | **K****Value range** | **L****Default value aspect** | **M****Per (UE, cell, TRP, …)** | **N****UE-specific or Cell-specific** | **O****Specification** | **P****Comment** |
| UL-AOA Enhancement | stable |  | 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 | FFS |  | 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 |
| UL-AOA Enhancement | stable |  | Expected Azimuth AoA |  New |  |  | FFS |  | “In Expected UL Angle of Arrival” |  | FFS RAN3 |  |
| UL-AOA Enhancement | stable |  | Expected Zenith AoA |  New |  |  | FFS |  | “In Expected UL Angle of Arrival” |  | FFS RAN3 |  |
| UL-AOA Enhancement | stable |  | Expected Azimuth AoA Value |  New |  |  | FFS |  | “in Expected Azimuth AoA” |  | FFS RAN3 |  |
| UL-AOA Enhancement | stable |  | Expected Azimuth AoA Uncertainty Range |  New |  |  | FFS |  | “in Expected Azimuth AoA” |  | FFS RAN3 |  |
| UL-AOA Enhancement | stable |  | Expected Zenith AoA Value |  New |  | Uncertainty range for expected azimuth angle of arrival | FFS |  | “in Expected Zenith AoA” |  | FFS RAN3 |  |
| UL-AOA Enhancement | stable |  | Expected Zenith AoA Uncertainty Range |  New |  | uncertainty range for expected zenith angle of arrival | FFS |  | “in Expected Zenith AoA” |  | FFS RAN3 |  |
| UL-AOA Enhancement | stable |  | 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 |
| UL-AOA Enhancement | stable |  | 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. | [1, …, 8] |   | 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-TxAgreement: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 pathAgreement:• 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 LMFo Note: The operation of SRS for MIMO is transparent to the UE |
| UL-AOA Enhancement | New-stable |  | UL Angle of Arrival |  Existing |  | A pair of AOA & ZOA values to be reported per SRS resource |  FFS |   | “in ULAoAOfFirstPathPerSRSResource” |  |  FFS RAN3 |  |
| ~~UL-AOA Enhancement~~ |  |  | ~~firstPathZoA~~ | ~~New~~ |  | ~~A pair of AOA & ZOA values to be reported per SRS resource~~ | ~~FFS~~ |  | ~~“in ULAoAOfFirstPathPerSRSResource”~~ |  | ~~FFS RAN3~~ |  |
| UL-AOA Enhancement | stable |  | 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. |
| UL-AOA Enhancement | stable |  | srs-PosResourceId | New |  | The ID of a positioning SRS resource reported with RTOA and multiple UL-AOAs measurements | FFS |  | FFS for RAN3 |  | FFS for 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 |
| UL-AOA Enhancement | stable |  | ARP 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. |
| UL-AOA Enhancement | stable |  | ARP Position Relative Cartesian | Existing |  | Relative position of the ARP to TRP for UL-AoA measurement | Defined in 9.2.50, TS 38.455 |  | FFS for RAN3 |  | FFS for RAN3 | Agreement:Association of UL-AOA positioning measurements with gNB ARP is supported in Rel.17. |
| UL-AOA Enhancement | stable |  | firstPath-SRS-RSRP | New |  | SRS-RSRP of the first arrival path measurements on SRS for positioning resource | FFS |  | FFS for RAN3 |  | FFS for RAN3 | Agreement:• 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 LMFo Note: The operation of SRS for MIMO is transparent to the UE |

## Comments

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| **Company** | **Comments**  |
| Nokia/NSB | Comment #1: In consideration of the previous agreement, we may need a parameter for the RSRP for the first path such as “firstPath-SRS-RSRP”.FL: AddedComment #2: For maxNumOfULAoAOfFirstPathPerSRSResource we are not sure that this parameter is needed. RAN3 can just hardcode the value into the spec. FL: Based on the inputs from RAN2/RAN3, RAN1’s LS provides the inputs for their work, and they have the right to change it.Comment #3: We would suggest renaming ‘TRP position relative’ to include ARP in the name: perhaps ‘ARP Position Relative’FL: Changed. |
| Huawei, HiSilicon | For comment #3 from Nokia, I think TRP Positioning Relative Geodetic/Cartesian are existing RAN3 names. How about the following change?

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| ARP Position Relative GeodeticFL: Added “Defined in 9.2.48, TS 38.455” | Existing9.2.48 Relative Geodetic Location |
| ARP Position Relative Cartesian | Existing9.2.50 Relative Cartesian Location |
| FL Added “Defined in 9.2.50, TS 38.455” |  |

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4. Accuracy improvements for DL-AoD positioning solutions

(1st Round) Parameter Table

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **B****Sub-feature group** | **C****RAN1 specification** | **D****Section** | **G****Parameter name in the spec** | **H****New or existing?** | **I****Parameter name in the text** | **J****Description** | **K****Value range** | **L****Default value aspect** | **M****Per (UE, cell, TRP, …)** | **N****UE-specific or Cell-specific** | **O****Specification** | **P****Comment** |
| DL-AoD Enhancement |   |   |  TBD |  New |   | gNB beam/antenna informationreported from gNB to LMF 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 |
| DL-AoD Enhancement |   |   |  TBD |  New |   | gNB beam/antenna informationprovided to the UE for UE-based 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 |
| 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 |
| 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 |
| 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: |
| 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 |
| DL-AoD Enhancement |  |  | [maxNumPathRSRPperTRP] | New |  | [Maximum number of DL Path PRS RSRP measurements per TRP] | FFS |  |  |  | FFS RAN2 | Under discussion |
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Comments

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| **Company** | **Comments**  |
| Qualcomm | We think that there can be 2 maximum values: One for RSRP and one for path-RSRP. (maxNumRSRPperTRP)FL: Okay. Path RSRP is still under discussion. I assume we will add it in bracket. |
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(2nd Round) Parameter Table

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **B****Sub-feature group** | **Status** | **D****Section** | **G****Parameter name in the spec** | **H****New or existing?** | **I****Parameter name in the text** | **J****Description** | **K****Value range** | **L****Default value aspect** | **M****Per (UE, cell, TRP, …)** | **N****UE-specific or Cell-specific** | **O****Specification** | **P****Comment** |
| DL-AoD Enhancement |  New-stable |   | 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 |
| DL-AoD Enhancement | New-stable |   | trpAntennaInformation |  New |   | TRP beam/antenna informationreported from gNB to LMF for DL-AoD.FFS: the details of the 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 |
| DL-AoD Enhancement |  New-unstable |   | antennaInfoRequest\_DL-AOD |  New |   | Request from UE to LMF, 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 |
| DL-AoD Enhancement | New-stable |   | trpAntennaInformation  |  New |   | TRP beam/antenna informationprovided to the UE for UE-based DL-AoD.FFS: the details of the 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 |
| DL-AoD Enhancement |  stable |   | 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 |
| DL-AoD Enhancement |  stable |   | 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 |
| DL-AoD Enhancement | unstable |   |  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: |
| DL-AoD Enhancement |  stable |   | 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 |
| DL-AoD Enhancement |  stable |  | [maxNumPathRSRPperTRP] | New |  | [Maximum number of DL Path PRS RSRP measurements per TRP] | FFS |  |  |  | FFS RAN2 | Under discussion |
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## Comments

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| **Company** | **Comments**  |
| Nokia/NSB | Comment #1: We suggest to remove the row with ‘TBD’ as the parameter name as the discussion is still very complex. We don’t think sending this incomplete information to RAN2 is helpful at this time. FL: Anything marked as “unstable” are place holder to RAN1 only. They will not be sent to RAN2. |
| Huawei, HiSilicon | For antennaInfoRequest\_DL-AOD associated with UE, why it is needed? Is it on-demand PRS for beam information?FL: I changed the status to “unstable”. If UE does not request, will the LMF provide the information? I am not thinking about on-demand PRS. But, from the requirement, Note that either request or beam information associated with UE should be RAN2 to decide.FL: Is this the common understanding? If so, we can let RAN2 to decide. |
| Qualcomm | Is the following unstable or stable? If it is unstable, why is that?

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| DL-AoD Enhancement | unstable |   | trpAntennaInformation  |  New |   | TRP beam/antenna informationprovided to the UE for UE-based 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 |

FL: The details of the TRP antenna information is still under discussion. We don’t know what are included in the parameter yet. |
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5. Latency improvements for both DL and DL+UL positioning

(1st Round) Parameter Table

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| **B****Sub-feature group** | **C****RAN1 specification** | **D****Section** | **G****Parameter name in the spec** | **H****New or existing?** | **I****Parameter name in the text** | **J****Description** | **K****Value range** | **L****Default value aspect** | **M****Per (UE, cell, TRP, …)** | **N****UE-specific or Cell-specific** | **O****Specification** | **P****Comment** |
| Latency improvements |   |   | numOfSamples-perMeasurement |  new |  | LMF can explicitly request UE to report the measurement with M-samples from LM to UE. | [1, 4]FFS: others |   |   |   |  FFS: RAN2 | May need to change *perMeasurement* to *perMeasInstance* due to the agreement for supporting multiple measurement instances in one measurement report |
| PRS-MeasurementIndication |  |  | MG\_ activationRequest | New |  | UE can send a MG activation request to serving gNB for the activation of a measurement gapFFS: UCI and UL MAC CE | FFS |  |  |  | FFS: RAN2 | 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)
	+ Select only one of UCI and UL MAC CE in RAN1#106bis-e
* Option 1: by LMF (via an NRPPa message)
	+ Note: This is transparent to the UE
 |
| PRS-MeasurementIndication |  |  | MG\_ activationRequest | New |  | LMF can send a MG activation request via NRPPa to serving gNB for the activation of a measurement gap for a UE | 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)
	+ Select only one of UCI and UL MAC CE in RAN1#106bis-e
* Option 1: by LMF (via an NRPPa message)

Note: This is transparent to the UE |
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| MeasurementGapActivation |  |  | TBD |  |  | FFS DL MAC CE |  |  |  |  |  |  |
| PRS-ProcessingWindow |  |  | TBD |  |  | FFS: RRC/MAC CE or LPP. FFS per CC/PFL/UE |  |  |  |  |  |  |
| PRS-PriorityIndictor |  |  | TBD |  |  | FFS RRC/MAC CE or LPP. FFS per CC/PFL/UE |  |  |  |  |  |  |
| Latency improvements |  |  | responseTime | Existing |  | the maximum response time as measured between receipt of the RequestLocationInformation and transmission of a ProvideLocationInformation. | FFS |  |  |  | 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 |

Comments

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| **Company** | **Comments**  |
| Huawei, HiSilicon | We think it should be useful to add the following parameters at least* [PRS-MeasurementIndication]: FFS NRPPa or UL MAC CE

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| Agreement:For the purpose of positioning latency reduction, with potential support of a new mechanism of MG request, consider the following options with a decision to be made in RAN1#106b.* Option. 1: by LMF (via a NRPPa message)
* Option. 2: by UE (via UCI or UL MAC CE)
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FL: Yes, since we have the following agreement to support them.

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| 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)
	+ Select only one of UCI and UL MAC CE in RAN1#106bis-e
* Option 1: by LMF (via an NRPPa message)
	+ Note: This is transparent to the UE
 |

* [MeasurementGapActivation]: FFS DL MAC CE

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| Agreement:For the purpose of positioning latency reduction, with potential support a new MG activation and deactivation procedure, consider the following options with a decision to be made in RAN1#106b (and RAN4 to be informed about any decision made)* Option. 1: DCI
* Option. 2: DL MAC CE
* Option. 3: UE autonomously applies the MG

FFS whether deactivation can be implicit via configurable number of the MG occasions |

FL: Added with TBDs. We can add more details we reach the agreement on the options in this meeting.* [PRS-ProcessingWindow]: FFS RRC/MAC CE or LPP. FFS per CC/PFL/UE

FL: Added with TBDs* [PRS-PriorityIndictor]: FFS RRC/MAC CE or LPP. FFS per CC/PFL/UE

FL: Added with TBDs |
| Qualcomm | Comment 1: We agree with HW’s comment that the above rows will be needed. Comment 2: A new granularity parameter for the response time would need to be added in LPP in the location request. FL: Added |
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(2nd Round) Parameter Table

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| **B****Sub-feature group** | **C****RAN1 specification** | **D****Section** | **G****Parameter name in the spec** | **H****New or existing?** | **I****Parameter name in the text** | **J****Description** | **K****Value range** | **L****Default value aspect** | **M****Per (UE, cell, TRP, …)** | **N****UE-specific or Cell-specific** | **O****Specification** | **P****Comment** |
| Latency improvements |   |   | numOfSamples-perMeasurement |  new |  | LMF can explicitly request UE to report the measurement with M-samples from LM to UE. | [1, 4]FFS: others |   |   |   |  FFS: RAN2 | May need to change *perMeasurement* to *perMeasInstance* due to the agreement for supporting multiple measurement instances in one measurement report |
| Latency improvements |  |  | responseTime | Existing |  | the maximum response time as measured between receipt of the RequestLocationInformation and transmission of a ProvideLocationInformation. | FFS |  |  |  | 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 |
| PRS-MeasurementIndication |  |  | MG\_ activationRequest | New |  | UE can send a MG activation request to serving gNB for the activation of a measurement gap FFS: UCI and UL MAC CE | FFS |  |  |  | FFS: RAN2 | 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)
	+ Select only one of UCI and UL MAC CE in RAN1#106bis-e
* Option 1: by LMF (via an NRPPa message)
	+ Note: This is transparent to the UE
 |
| PRS-MeasurementIndication |  |  | MG\_ activationRequest | New |  | LMF can send a MG activation request via NRPPa to serving gNB for the activation of a measurement gap for a UE | 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)
	+ Select only one of UCI and UL MAC CE in RAN1#106bis-e
* Option 1: by LMF (via an NRPPa message)

Note: This is transparent to the UE |
| MeasurementGapActivation |  |  | TBD |  |  | FFS DL MAC CE | FFS |  |  |  | FFS: RAN2/RAN3 |  |
| PRS-ProcessingWindow |  |  | TBD |  |  | FFS: RRC/MAC CE or LPP. FFS per CC/PFL/UE | FFS |  |  |  | FFS: RAN2/RAN3 |  |
| PRS-PriorityIndictor |  |  | TBD |  |  | FFS RRC/MAC CE or LPP. FFS per CC/PFL/UE | FFS |  |  |  | FFS: RAN2/RAN3 |  |

Comments

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| **Company** | **Comments**  |
| ZTE | Suggest to add corresponding agreements in RAN1 for MeasurementGapActivation, PRS-ProcessingWindow, PRS-PriorityIndictor so that RAN2/RAN3will better understand the motivations.FL: Yes. Will add them once we have more concrete parameter names for related parameters |
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(3rd Round) Parameter Table

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **B****Sub-feature group** | **Status** | **D****Section** | **G****Parameter name in the spec** | **H****New or existing?** | **I****Parameter name in the text** | **J****Description** | **K****Value range** | **L****Default value aspect** | **M****Per (UE, cell, TRP, …)** | **N****UE-specific or Cell-specific** | **O****Specification** | **P****Comment** |
| Latency improvements |  stable |   | numOfSamples-perMeasurement |  new |  | LMF can explicitly request UE to report the measurement with M-samples from LM to UE. | [1, 4]FFS: others |   |   |   |  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.

Agreement:For the PRS processing sample number M, at least M = 1 is supported. |
| Latency improvements |  stable |  | responseTime | Existing |  | the maximum response time as measured between receipt of the RequestLocationInformation and transmission of a ProvideLocationInformation. | FFS |  |  |  | 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 |
| PRS-MeasurementIndication |  stable |  | MG\_ activationRequest | New |  | UE can send a MG activation request to serving gNB for the activation of a measurement gap FFS: UCI and UL MAC CE | FFS |  |  |  | FFS: RAN2 | 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)
	+ Select only one of UCI and UL MAC CE in RAN1#106bis-e
* Option 1: by LMF (via an NRPPa message)
	+ Note: This is transparent to the UE
 |
| PRS-MeasurementIndication |  stable |  | MG\_ activationRequest | New |  | LMF can send a MG activation request via NRPPa to serving gNB for the activation of a measurement gap for a UE | 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)
	+ Select only one of UCI and UL MAC CE in RAN1#106bis-e
* Option 1: by LMF (via an NRPPa message)

Note: This is transparent to the UE |
| MeasurementGapActivation | New-stable |  | MG\_ activationRequest  |  |  | 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. |
| PRS-ProcessingWindow | New-stable |  | MG\_ activationRequest |  |  | DL MAC CE for MG activation request by gNB for the purpose of positioning. | 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.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 CEFFS: Deactivation process |
| PRS-PriorityIndictor | unstable |  | TBD |  |  | FFS RRC/MAC CE or LPP. FFS per CC/PFL/UE | FFS |  |  |  | FFS: RAN2/RAN3 |  |

## Comments

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| **Company** | **Comments**  |
| Nokia/NSB | Comment #1: For the parameter “numOfSamples-perMeasurement”, we suggest capturing the following agreement to clarify the feature of the LMF request.FL: AddedAgreement: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.

Comment #2: We do not think there is any value in including the TBD rows in the LS at this point. If/when further agreements are reached then we can add new rows. FL: Agreed no value to include TBD to RAN2. Based on the guideline, “unstable” parameters will not be included in the LS to RAN2. |
| Huawei, HiSilicon | We could capture the agreement for PRS-ProcessingWindow and PRS-PriorityIndictor.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.
	+ 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.

For MeasurementGapActivation, I think TBD can be kept as we are close to an agreement using DL MAC CE. I guess the higher layer parameter also include MAC layer, right?FL: That is also my understanding. At least ho hurt to do so, since we also include the corresponding agreements. |
| FL | Added the following agreements to the comment columnAgreement:For the PRS processing sample number M, at least M = 1 is supported.Agreement:Support using UL MAC CE for MG activation request by UE (Option 2) for the purpose of positioning.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

 Agreement:With regards to MG activation by DL MAC CE, further study* DL MAC CE payload
* The necessity of pre-configuration of MGs in higher layers.
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6. Potential enhancements of information reporting from UE and gNB for multipath/NLOS mitigation

(1st Round) Parameter Table

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **B****Sub-feature group** | **C****RAN1 specification** | **D****Section** | **G****Parameter name in the spec** | **H****New or existing?** | **I****Parameter name in the text** | **J****Description** | **K****Value range** | **L****Default value aspect** | **M****Per (UE, cell, TRP, …)** | **N****UE-specific or Cell-specific** | **O****Specification** | **P****Comment** |
| 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: 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 |
| 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, .1, …0.9,1] |   |   |   | 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. |
| Multipath/NLOS mitigation |   |   |  losNlosIndicator |  New |   | This parameter is used for LMF to include LoS/NLoS information for UE-based positioning.FFS: The LoS/NLoS information is associated with which measurements. | FFS |   |   |   | FFS: RAN2 | Agreement:• Positioning assistance data from LMF is enhanced for UE-based positioning by including LoS/NLoS indicators. |
| 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. |  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 |
| 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. |  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. |
| Multipath/NLOS mitigation |   |   | ULAoAOfAdditionalPathPerSRSResource |  New |   | UL-AoA values per SRS resource for the additional path to be reported from gNB to LMF. |  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. |
| 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 |

Comments

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| **Company** | **Comments**  |
| Qualcomm | Shouldn’t there be a request message from the LMF on the following:* The UE to report path-RSRP for the additional paths
* Number of additional paths to be reported
* Whether to report LOS/NLOS in the report

Similarly, shouldnt we have a request message from LMF to TRPs with regards to the above?* Requested number of additional paths
* Requested number of AoAs per path
* Whether path-RSRP is requested to be included

FL: Yes. I think it should be corresponding “Request”, unless the UE will provide the information w/o the request. I think we may need to go over all of the agreements to se which information neds to be requested by the LMF/gNB. |
| CATT | We prefer to use different names for the three losNlosIndicator parameters in the G column of the table, in order to distinguish the losNlosIndicators from UE, gNB or LMF, as shown in the table below.And according to current discussion in AI8.5.5, maybe the following proposal will be agreed, therefore, for RSTD measurement, maybe two parameters of losNlosIndicatorOfUE are needed to represent the los information related to target TRP and reference TRP.* Proposal: For DL-TDOA one LoS/NloS indicator is associated with the RSTD measurement performed with a target TRP and one LoS/NloS indicator is associated with the RSTD measurement performed with a reference TRP

FL: I check TS 38.331, 37.355 and 38.455, “UE”, “gNB”, “LMF” are not used with the parameters. I assume the reason is that these name are used in different protocols/messages, and thus, there will be no confusion even the same name is used.

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| **B****Sub-feature group** | **C****RAN1 specification** | **D****Section** | **G****Parameter name in the spec** | **H****New or existing?** | **I****Parameter name in the text** | **J****Description** |
| Multipath/NLOS mitigation |   |   | losNlosIndicatorOfUE |  New |   | For LoS/NLoS indicators, a single-indicator can be reported and the supported values are a discrete set in the interval [0, 1].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. |
| Multipath/NLOS mitigation |   |   |  losNlosIndicatorOfgNB |  New |   | For LoS/NLoS indicators, a single-indicator can be reported and the supported values are a discrete set in the interval [0, 1].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. |
| Multipath/NLOS mitigation |   |   |  losNlosIndicatorOfLMF |  New |   | For LoS/NLoS indicators, a single-indicator can be reported and the supported values are a discrete set in the interval [0, 1].This parameter is used for LMF to include LoS/NLoS information for for UE-based positioning.FFS: The LoS/NLoS information is associated with which measurements. |

 |
| ZTE | 1st comment:We haven’t decided the value that should be supported for  losNlosIndicator in assistance data. We prefer not to reuse the [0, .1, …0.9,1]. We think binary value would be enough for assistance data.FL: Okay. Change to FFS2nd comments:We think the following agreement should also be added to “maxnopath” since the additional path AOA is only supported for hybrid positioning.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 FL: Added. |
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(2nd Round) Parameter Table

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| **B****Sub-feature group** | **status** | **D****Section** | **G****Parameter name in the spec** | **H****New or existing?** | **I****Parameter name in the text** | **J****Description** | **K****Value range** | **L****Default value aspect** | **M****Per (UE, cell, TRP, …)** | **N****UE-specific or Cell-specific** | **O****Specification** | **P****Comment** |
| Multipath/NLOS mitigation |  stable |   | 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: 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 |
| Multipath/NLOS mitigation |  stable |   |  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, .1, …0.9,1] |   |   |   | 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. |
| Multipath/NLOS mitigation |  stable |   |  losNlosIndicator |  New |   | This parameter is used for LMF to include LoS/NLoS information for UE-based positioning.FFS: The LoS/NLoS information is associated with which measurements. | FFS |   |   |   | FFS: RAN2 | Agreement:• Positioning assistance data from LMF is enhanced for UE-based positioning by including LoS/NLoS indicators. |
| Multipath/NLOS mitigation |  stable |   | 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. |  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 |
| Multipath/NLOS mitigation |  stable |   | 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. |  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. |
| Multipath/NLOS mitigation |  stable |   | ULAoAOfAdditionalPathPerSRSResource |  New |   | UL-AoA values per SRS resource for the additional path to be reported from gNB to LMF. |  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. |
| Multipath/NLOS mitigation |  stable |   | 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 |
| Multipath/NLOS mitigation | New-stable |  | 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. |
| Multipath/NLOS mitigation | New-stable |  | 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. |
| Multipath/NLOS mitigation | New-stable |  | AdditionalPath\_relativeTiming\_Request |  |  | 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 |
| Multipath/NLOS mitigation | New-stable |  | AdditionalPath\_relativeTiming\_Request |  |  | 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. |
| Multipath/NLOS mitigation | New-stable |  | AdditionalPath\_UL-AoA\_Request |  |  | 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. |
| Multipath/NLOS mitigation |  |  |  |  |  |  |  |  |  |  |  |  |

## Comments

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| **Company** | **Comments**  |
| Nokia/NSB | Comment #1: It is not clear that we need maxNumOfAdditionalPath at this time as a parameter. It could just be hard coded by RAN2 as it was in Rel-16. Suggest to either remove it or at least put it in brackets.FL: RAN2 has a list of the “max” parameters. Anyway, all parameters in the list are recommendation. It is up to RAN2/3 to decide whether to hard coded. |
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7. On-demand transmission and reception of DL PRS

(1st Round) Parameter Table

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| **B****Sub-feature group** | **C****RAN1 specification** | **D****Section** | **G****Parameter name in the spec** | **H****New or existing?** | **I****Parameter name in the text** | **J****Description** | **K****Value range** | **L****Default value aspect** | **M****Per (UE, cell, TRP, …)** | **N****UE-specific or Cell-specific** | **O****Specification** | **P****Comment** |
| On-demand PRS |   |   | On-demand PRS information |  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 requests1. DL PRS Periodicity2. DL PRS resource bandwidth3. DL PRS QCL information |
| On-demand PRS |   |   | NR-DL-PRS-Periodicity-and-ResourceSetSlotOffset |  Existing |   |   |   |   | “in On-demand PRS information” |   |  FFS: RAN2/RAN3 |  |
| On-demand PRS |   |   | dl-PRS-ResourceBandwidth |  Existing |   |   |   |   | “in On-demand PRS information” |   |  FFS: RAN2/RAN3 |   |
| On-demand PRS |   |   | DL-PRS-QCL-Info |  Existing |   |   |   |   | “in On-demand PRS information” |   |  FFS: RAN2/RAN3 |   |
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Comments

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| **Company** | **Comments**  |
| Huawei, HiSilicon | Comment #1For NR-DL-PRS-Periodicity-and-ResourceSetSlotOffset, we only agreed periodicity, not offset. It should be clarified whether single value is included in On-demand PRS information, or multiple values each corresponding to a positioning frequency layer are included in On-demand PRS information. Since we do not have offset, this parameter should be a new parameter.Comment #2For DL-PRS-QCL-Info, we would like to discuss whether the value can be “requested” or be a specific SSB/PRS index. We have concern on the later one, since this could be PRS resource specific, which blows up the entire On-demand PRS information IE. So we suggest to change “existing” to “[Existing or New]”FL: Let us what for the decision in this week to update these parameters.. We are expected to add more on-demand PRS parameters in this week. |
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(2nd Round) Parameter Table

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| **B****Sub-feature group** | **Status** | **D****Section** | **G****Parameter name in the spec** | **H****New or existing?** | **I****Parameter name in the text** | **J****Description** | **K****Value range** | **L****Default value aspect** | **M****Per (UE, cell, TRP, …)** | **N****UE-specific or Cell-specific** | **O****Specification** | **P****Comment** |
| On-demand PRS |  stable |   | On-demand PRS information for UE-initiated on-demand DL PRS |  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 requests1. DL PRS Periodicity2. DL PRS resource bandwidth3. DL PRS QCL informationAgreement:• The following list of parameters is supported for UE-initiated and LMF initiated on-demand DL PRS request1. Start/end time of DL PRS transmission2. DL PRS resource repetition factor3. Number of DL PRS resource symbols per DL PRS resource 4. DL-PRS CombSizeN5. Number of DL PRS frequency layers6. 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 |
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| On-demand PRS |  stable |   | NR-DL-PRS-Periodicity-and-ResourceSetSlotOffset |  Existing |   |   |   |   | “in On-demand PRS information for UE-initiated on-demand DL PRS” |   |  FFS: RAN2/RAN3 |  |
| On-demand PRS |  stable |   | dl-PRS-ResourceBandwidth |  Existing |   |   |   |   | “in On-demand PRS information for UE-initiated on-demand DL PRS” |   |  FFS: RAN2/RAN3 |   |
| On-demand PRS |  stable |   | DL-PRS-QCL-Info |  Existing |   |   |   |   | “in On-demand PRS information for UE-initiated on-demand DL PRS” |   |  FFS: RAN2/RAN3 |   |
| On-demand PRS | New-stable |  | startTimeOfDLPRS | New |  | Start time of on-demand DL PRS transmission | FFS |  | “in On-demand PRS information for UE-initiated on-demand DL PRS” |  | FFS: RAN2/RAN3 |  |
| On-demand PRS | New-stable |  | endTimeOfDLPRS | New |  | End time of on-demand DL PRS transmission | FFS |  | “in On-demand PRS information for UE-initiated on-demand DL PRS” |  | FFS: RAN2/RAN3 |  |
| On-demand PRS | New-stable |  | dl-PRS-ResourceRepetitionFactor | Existing |  | DL PRS resource repetition factor | FFS |  | “in On-demand PRS information for UE-initiated on-demand DL PRS” |  | FFS: RAN2/RAN3 |  |
| On-demand PRS | New-stable |  | dl-PRS-NumSymbols | Existing |  | Number of DL PRS resource symbols per DL PRS resource | FFS |  | “in On-demand PRS information for UE-initiated on-demand DL PRS” |  | FFS: RAN2/RAN3 |  |
| On-demand PRS | New-stable |  | dl-PRS-CombSizeN | Existing |  | DL-PRS CombSizeN | FFS |  | “in On-demand PRS information for UE-initiated on-demand DL PRS” |  | FFS: RAN2/RAN3 |  |
| On-demand PRS | New-stable |  | dl-PRS-NumPosFreqLayers | New |  | Number of DL PRS positioning frequency layers | FFS |  | “in On-demand PRS information for UE-initiated on-demand DL PRS” |  | FFS: RAN2/RAN3 |  |
| On-demand PRS | New-stable |  | onOffIndicator | New |  | ON/OFF indicator (for LMF initiated request only) | FFS |  | “in On-demand PRS information for UE-initiated on-demand DL PRS” |  | FFS: RAN2/RAN3 |  |
| On-demand PRS |  stable |   | On-demand PRS information for LMF-initiated on-demand DL PRS |  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 requests1. DL PRS Periodicity2. DL PRS resource bandwidth3. DL PRS QCL informationAgreement:• The following list of parameters is supported for UE-initiated and LMF initiated on-demand DL PRS request1. Start/end time of DL PRS transmission2. DL PRS resource repetition factor3. Number of DL PRS resource symbols per DL PRS resource 4. DL-PRS CombSizeN5. Number of DL PRS frequency layers6. 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 |
| On-demand PRS |  stable |   | NR-DL-PRS-Periodicity-and-ResourceSetSlotOffset |  Existing |   |   |   |   | “in On-demand PRS information for LMF-initiated on-demand DL PRS” |   |  FFS: RAN2/RAN3 |  |
| On-demand PRS |  stable |   | dl-PRS-ResourceBandwidth |  Existing |   |   |   |   | “in On-demand PRS information for LMF-initiated on-demand DL PRS” |   |  FFS: RAN2/RAN3 |   |
| On-demand PRS |  stable |   | DL-PRS-QCL-Info |  Existing |   |   |   |   | “in On-demand PRS information for LMF-initiated on-demand DL PRS” |   |  FFS: RAN2/RAN3 |   |
| On-demand PRS | New-stable |  | startTimeOfDLPRS | New |  | Start time of on-demand DL PRS transmission | FFS |  | “in On-demand PRS information for LMF-initiated on-demand DL PRS” |  | FFS: RAN2/RAN3 |  |
| On-demand PRS | New-stable |  | endTimeOfDLPRS | New |  | End time of on-demand DL PRS transmission | FFS |  | “in On-demand PRS information for LMF-initiated on-demand DL PRS” |  | FFS: RAN2/RAN3 |  |
| On-demand PRS | New-stable |  | dl-PRS-ResourceRepetitionFactor | Existing |  | DL PRS resource repetition factor | FFS |  | “in On-demand PRS information for LMF-initiated on-demand DL PRS” |  | FFS: RAN2/RAN3 |  |
| On-demand PRS | New-stable |  | dl-PRS-NumSymbols | Existing |  | Number of DL PRS resource symbols per DL PRS resource | FFS |  | “in On-demand PRS information for LMF-initiated on-demand DL PRS” |  | FFS: RAN2/RAN3 |  |
| On-demand PRS | New-stable |  | dl-PRS-CombSizeN | Existing |  | DL-PRS CombSizeN | FFS |  | “in On-demand PRS information for LMF-initiated on-demand DL PRS” |  | FFS: RAN2/RAN3 |  |
| On-demand PRS | New-stable |  | dl-PRS-NumPosFreqLayers | New |  | Number of DL PRS positioning frequency layers | FFS |  | “in On-demand PRS information for LMF-initiated on-demand DL PRS” |  | FFS: RAN2/RAN3 |  |
| On-demand PRS | New-stable |  | onOffIndicator | New |  | ON/OFF indicator (for LMF initiated request only) | FFS |  | “in On-demand PRS information for LMF-initiated on-demand DL PRS” |  | FFS: RAN2/RAN3 |  |
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## Comments

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| **Company** | **Comments**  |
| Nokia/NSB | For “dl-PRS-CombSizeN”, we think is an existing parameter.FL: Changed. |
| Qualcomm | Wouldn’t there need to be different IEs for UE-initiated vs LMF-initiated? One is in a request from the UE to the LMF. In that case, even the:

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| NR-DL-PRS-Periodicity-and-ResourceSetSlotOffset |
| dl-PRS-ResourceBandwidth |
| DL-PRS-QCL-Info |

Will be new parameters inside the request from the UE to the LMF. FL: Added  |
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8. Support of positioning for UEs in RRC\_ INACTIVE state

(1st Round) Parameter Table

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| **B****Sub-feature group** | **Status** | **D****Section** | **G****Parameter name in the spec** | **H****New or existing?** | **I****Parameter name in the text** | **J****Description** | **K****Value range** | **L****Default value aspect** | **M****Per (UE, cell, TRP, …)** | **N****UE-specific or Cell-specific** | **O****Specification** | **P****Comment** |
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## Comments

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

TBD

10. References

1. R1-2108682 Summary of email discussion on RRC parameters for NR Positioning Enhancements, Moderator (CATT)
2. R1-2110415 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.