3GPP TSG-RAN WG2 Meeting #110-e***R2-200xxxx***

Online, June 01 – 12, 2020

**Agenda item:** 6.8.2.3

**Source:** Qualcomm Incorporated

**Title:** Email discussion report: [AT110-e][606][POS] Open issues in LPP ASN.1 review (Qualcomm)

**Document for:**  Discussion and Decision

# 1. Introduction

This document summarizes the following email discussion:

* [AT110-e][606][POS] Open issues in LPP ASN.1 review (Qualcomm)

Scope: Discuss and resolve remaining open issues identified in the LPP ASN.1 review process, and determine which issues need online discussion

Intended outcome: Update of open issues from R2-2005212, in R2-2005882

Deadline: Thursday 2020-06-04 1000 UTC

The open issues are summarized in R2-2006003 "Email discussion report: [Post109bis-e][948][POS] LPP ASN.1 review" [1], section 5, which is copied in section 2 below.

Section 3 collects any company views on the Proposed Conclusions in R2-2006003 [1] (the "green" elements in the Table in section 2), which are implemented in v3 of the "LPP Clean-Up" [2].

Section 4 collects company input on the open issues listed in section 2:

- The "yellow" elements are a continuation from the email discussion in [1], where no consensus on the issue was visible (if this should remain after this further email discussion, the item may need online resolution).

- The "white" elements are new/additional issues raised in [1], section 4.

## References

[1] R2-2006003, "Email discussion report: [Post109bis-e][948][POS] LPP ASN.1 review", Qualcomm.

[2] R2-2005213, "LPP Clean-Up" (v3), Qualcomm.

[3] R2-2003982, "Email discussion report: [AT109bis-e][601][POS] LPP ASN.1 issue gathering and easy agreements", Qualcomm.

# 2. Open Issues List

Color coding:

Green: The issue could be closed, if Proposed Conclusion #x in [1] is agreed.

Yellow: Needs further discussion at RAN2#110-e.

White: New issue from email discussion in [1].

NOTE: Some of the Yellow issues are related; and some of them go back to the same basic question/source (e.g., #3, 13, 14, 15).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Reference | Issue #  (digits before -x refer to LPP section) | Brief Description / Headline | Proposed Conclusion Number in [1] |
| 1 | Sec. 2.2 in [3] | 6.4.1-2 | The definition of NR-PhysCellId-r16 may fit better in the new collapsed 6.4.3  The new IE RelativeLocation-r16 may fit better in the common section 6.4.1 | 1  No change needed. |
| 2 | Sec. 3.1 in [3] | 6.4.3-1 | Consider renaming the IE NR-TimingMeasQuality. | 2  Change IE name |
| 3 | Sec. 3.2.1 in [3] | 6.4.3-2 | Reference TRP Information. The current LPP is unclear about the definition/signalling of "assistance data reference TRP" and "RSTD reference TRP". |  |
|  | Includes also potential issues on nr-DL-PRS-ReferenceInfo and nr-DL-PRS-SFN0-Offset fields, as described. | 3  Move SFN0-Offset to PRS AD |
| 4 | Sec. 3.2.2a in [3] | 6.4.3-4 | Currently, the field *dl-PRS-ResourceRepetitionFactor* is mandatory within *DL-PRS-ResourceSet*. While should be possible that the field is not configured and there is no repetition. The same rationale also goes for *dl-PRS-ResourceTimeGap.*  Also, check if nr-DL-PRS-expectedRSTD-r16 and nr-DL-PRS-expectedRSTD-uncerainty-r16 need to be mandatory. | 4  Agree in principle. |
| 5 | Sec. 3.2.2b in [3] | 6.4.3-5 | For the indication of SSB as PRS QCL, currently the field PCI is mandatory, however, it is unnecessary when the SSB and PRS locate on the same frequency layer. |  |
| 6 | Sec. 3.2.5 in [3] | 6.4.3-8 | Need codes are currently missing in IE TRP-ID and the existing condition is confusing/wrong.  Issue depends on the conclusion related to TRP-ID. |  |
| 7 | Sec. 3.2.6 in [3] | 6.4.3-9 | Conditional presence of trp-id field in IE NR-TimeStamp is confusing/wrong. |  |
| 8 | Sec. 3.3 in [3] | 6.4.3-10 | The IE NR-PositionCalculationAssistance may not be needed. It may be better moved to the IE definitions of NR-UEB-TRP-LocationData and NR-UEB-TRP-RTD-Info from 7.4.2 to 6.4.3. | 5  No change needed. |
| 9 | Sec. 3.3 in [3] | 6.4.3-11 | The description of ‘nr-DL-PRS-SFN0-Offset’ should be modified for UE-assisted positioning. | 6  Addopt solution analogous to LTE |
| 10 | Sec. 2.2 in [3] | 6.4.3-12 | Representation of beam directions: (a) 0.1 degrees resolution (current spec.) (b) 1 degree resolution with an optional refinement to 0.1 degrees. | 7  Adopt (b) |
| 11 | Sec. 4.1.2 in [3] | 6.5.9-2 | The TRP-ID in the IE NR-ECID-SignalMeasurementInformation is currently optional present. However, an identifier of the TRP/cell for which the measurements are applicable is always needed.  The systemFrameNumber can usually only be included if the NR-MeasuredResultsElement is provided for a serving cell. | 8  Agree in principle. |
| 12 | Sec. 5.1 in [3] | 6.5.10-1 | There is currently no complete description/explanation for the sharing of the assistance data provided in IE NR DL PRS AssistanceData and NR-SelectedDL-PRS-IndexList.  DL-PRS AssistanceData placement in the LPP message structure. |  |
| 13 | Sec. 5.3.1 in [3] | 6.5.10-3 | DL-PRS RSRP measurements can optionally be provided for DL-TDOA positioning. However, there is currently confusion, since RSTD is a measurement for a pair of TRPs, but the RSRP is a single TRP measurement only. |  |
| 14 | Sec. 5.3.2 in [3] | 6.5.10-4 | The IE NR-TimingMeasQuality is used to provide the quality of the RSTD measurement. However, the quality of the reference TRP TOA used for RSTD cannot be provided. Further, the quality of the additional RSTD measurements per TRP pair (up to 3) can also not be provided. |  |
| 15 | Sec. 5.3.5 in [3] | 6.5.10-7 | The IE NR-DL-TDOA-MeasElement provides the RSTD measurements for up to 256 TRPs. However, since the RSTD measurement is between a pair of TRPs, only up to 255 report elements for IE NR-DL-TDOA-MeasElement are possible. |  |
| 16 | Sec. 5.4.1 in [3] | 6.5.10-8 | The IE NR-DL-TDOA-RequestLocationInformation reserves a BIT STRING Size 1..8 for the requested RSRP measurement. However, a single bit would be sufficient. | 9  No change needed. |
| 17 | Sec. 5.5.1 in [3] | 6.5.10-10 | The capability for periodic reporting cannot be indicated separately for the positioning mode. | 10  Change to PositioningModes bit map |
| 18 | Sec. 5.5.2 in [3] | 6.5.10-11 | A BIT STRING Size 1..8 is used for indicating support for DL-PRS RSRP measurements for DL-TDOA positioning.  (related to Issue 6.5.10-8) | 11  No change needed. |
| 19 | Sec. 6.1 in [3] | 6.5.11-1 | Same as 6.5.10-1, but for DL-AoD |  |
| 20 | Sec. 6.4.1 in [3] | 6.5.11-6 | Same as 6.5.10-10, but for DL-AoD | 10  Change to PositioningModes bit map |
| 21 | Sec. 6.6 in [3] | 6.5.11-8 | nr-DL-PRS-RxBeamIndex-r16: a single bit of information, viz. Boolean may be enough. May be no need to report the ID of the RX beam used. |  |
| 22 | Sec. 7.1 in [3] | 6.5.12-1 | Same as 6.5.10-1, but for Multi-RTT |  |
| 23 | Sec. 7.3.1 in [3] | 6.5.12-4 | Same as 6.5.10-8, but for Multi-RTT | 9  No change needed. |
| 24 | Sec. 7.4.1 in [3] | 6.5.12-6 | Same as 6.5.10-11, but for Multi-RTT | 11  No change needed. |
| 25 | Sec. 4 in [1] | 6.5.10-12 | Add a request for posSIBs to LPP Request Assistance Data*.* |  |
| 26 | Sec. 4 in [1] | 6.4.3-13 | The *DL-PRS-NumSymbols-r16* should be moved under *NR-DL-PRS-Resource-r16.* |  |
| 27 | Sec. 4 in [1] | 6.5.12-7 | Add a *nr-DL-PRS-UE-Rx-Tx-MeasurementInfoRequest* to *NR-Multi-RTT-RequestLocationInformation*, analogous to *nr-DL-PRS-RstdMeasurementInfoRequest* for DL-TDOA. |  |
| 28 | Sec. 4 in [1] | 6.4.3-14 | *integerSubframeOffset-r16* in *nr-DL-PRS-SFN0-Offset-r16* is Need OP, but behaviour on absence is not defined |  |
| 29 | Sec. 4 in [1] | 6.4.3-15 | Muting is considered to be optional in RAN1. |  |
| 30 | Sec. 4 in [1] | 6.4.3-16 | Allow *nr-SSB-Config-r16* for up to 256 TRPs in IE NR-DL-PRS-AssistanceData-r16. |  |
| 31 | Sec. 4 in [1] | 6.5.10-13  6.5.11-9  6.5.12-8 | Define a priority of the assistance data for the UE (for DL-TDOA, DL-AoD, and Multi-RTT assistance data). |  |
| 32 | Sec. 4 in [1] | 6.5.12-9 | There is no quality indicator for the *nr-UE-RxTxTimeDiffAdditional-r16* in the IE *NR-Multi-RTT-AdditionalMeasurementElement-r16* |  |
| 33 | Sec. 4 in [1] | 6.5.10-14 | Missing value ranges for *nr-rstd* in IE *NR-DL-TDOA-MeasElement* can now be defined based on RAN4 LS R2-2004377/R2-2004383.  Missing value ranges for *timingReportingGranularityFactor* in IE *NR-DL-TDOA-ReportConfig* can now be defined based on RAN4 LS R2-2004377/R2-2004383. |  |
| 34 | Sec. 4 in [1] | 6.5.10-15 | Missing value ranges for *nr-RSTD-ResultDiff* in IE *NR-DL-TDOA-AdditionalMeasurementElement* can now be defined based on RAN4 LS R2-2004383. |  |
| 35 | Sec. 4 in [1] | 6.4.3-17 | Missing value ranges for *nr-relativeTimeDifference* in IE *NR-AdditionalPath* can now be defined based on RAN4 LS R2-2004383. |  |
| 36 | Sec. 4 in [1] | 6.5.12-10 | Missing value ranges for *nr-UE-RxTxTimeDiff* in IE *NR-Multi-RTT-MeasElement* can now be defined based on RAN4 LS R2-2004383.  Missing value ranges for *nr-UE-RxTxTimeDiffAdditional* in IE *NR-Multi-RTT-AdditionalMeasurementElement* can now be defined based on RAN4 LS R2-2004383. |  |
| 37 | Sec. 4 in [1] | 6.5.10-16  6.5.11-10  6.5.12-11 | Missing value ranges for *nr-PRS-RSRP-Result* in IE *NR-DL-AoD-MeasElement*, *NR-DL-TDOA-MeasElement* and *NR-Multi-RTT-MeasElement* can now be defined based on RAN4 LS R2-2004383. |  |
| 38 | Sec. 4 in [1] | 6.5.11-11 | Missing value ranges for *nr-PRS-RSRP-ResultDiff* in IE *NR-DL-AoD-AdditionalMeasurementElement* can now be defined based on RAN4 LS R2-2004383. |  |
| 39 | Sec. 4 in [1] | 6.5.12-12  6.5.10-17 | Missing value ranges for *nr-PRS-RSRP-ResultDiff* in IE *NR-Multi-RTT-AdditionalMeasurementElement* can now be defined based on RAN4 LS R2-2004383.  Missing value ranges for *dl-PRS-RSRP-ResultDiff* in IE *NR-DL-TDOA-AdditionalMeasurementElement* can now be defined based on RAN4 LS R2-2004383. |  |
| 40 | Sec. 4 in [1] | 6.4.2-1 | Add PSCell ID information in *CommonIEsRequestAssistanceData* |  |
| 41 | Sec. 4 in [1] | 6.4.3-18 | Remove the *smtc-r16* field from IE *NR-SSB-Config-r16* |  |
| 42 | Sec. 4 in [1] | 6.4.3-19 | Change the field *ssbSubcarrierSpacing-r16* in IE *NR-SSB-Config* to optional present.  The field name should be *ssb-SubcarrierSpacing* with a “-“ |  |
| 43 | Sec. 4 in [1] | 6.4.3-20 | Add field description for the following fields  *trp-ID-r16*  The field description can be determined after the email discussion on trp-id  *nr-DL-PRS-ResourceID-List-r16*  List of resource Ids for the DL PRS resources on the RSTD reference TRP  *nr-DL-PRS-ResourceSetId-r16*)  resource set id for the DL PRS resource set on the RSTD reference TRP |  |
| 44 | Sec. 4 in [1] | 6.4.3-21 | Add field description for the following fields:  ***NR-DL-PRS-ReferenceInfo***  Note that the description is also related to the discussion in Issue 3 above on "assistance data reference TRP" and "RSTD reference TRP". Now, this field description can be FFS.  ***NR-TimeStamp***  Time stamp associated with the DL-TDOA/RSRP/UE rx-tx time difference measurement for DL-TDOA, DL-AOD and multi-RTT  ***NR-SelectedDL-PRS-PerFreq***  DL PRS resource configuerd for a specific frequency layer. |  |
| 45 | Sec. 4 in [1] | 6.4.3-22 | The current definition for *dl-PRS-Periodicity-and-ResourceSetSlotOffset* includes the *scs* of the PRS which is also provided in IE *NR-DL-PRS-PositioningFrequencyLayer.*  Remove the scs from *NR-DL-PRS-Periodicity-and-ResourceSetSlotOffset*. |  |
| 46 | Sec. 4 in [1] |  | Field description Tables do not follow LPP style and/or are missing. |  |
| 47 | Sec. 4 in [1] | 6.4.3-23 | Revise the field description for *dl-PRS-ResourceSlot Offset*  ***dl-PRS-ResourceSlotOffset***  This parameters indicates points to starting slot of DL PRS Resource with respect to corresponding *DL-PRS-ResourceSetSlotOffset* in number of slots***.*** |  |
| 48 | Sec. 4 in [1] | 6.4.3-24 | The field description of *nrARFCNRef-r16* in IE *TRP-ID* is not correct; description depends on the usage of the field. |  |
| 49 | Sec. 4 in [1] | 6.4.3-25 | *NR-SSB-Config* field description:  *ssb-periodicityServingCell* should be changed to *ssb-periodicity*  *ssb-Index* field description: Index of ssb serves as the source reference signal for the QCL relationship for DL PRS. |  |
| 50 | Sec. 4 in [1] |  | In the description for *NR-SelectedDL-PRS-IndexList*: In case of multiple methods, the *NR-DL-PRS-ProvideAssistanceData-r16* may only be present in one of the method (in IE *NR-SelectedDL-PRS-PerFreq-r16*) 🡺 Should be “*NR-DL-PRS-AssistanceData-r16*”.  The IE *DL-PRS-IdInfo* provides IDs provides the IDs of the reference and neighbour TRPs DL-PRS Resources. (in IE *DL-PRS-IdInfo*)  Suggest to change the naming of “*NR-UL-SRS-MeasCapability*” since UE only transmits SRS, for example, can be revised as “*NR-UL-SRS-TransCapability*”. |  |

# 3. Comments on Proposed Conclusions in [1]

Companies are invited to provide any comments on the Proposed Conclusions in [1] and/or their implementation in [2] (i.e., the "green" items listed in the Table in section 2), if any.

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

# 4. Discussion

**The NOTE’s in this section are Rapporteur’s comments/understanding/questions.**

# 4.1 Continuation of [Post109bis-e][948]

|  |  |  |  |
| --- | --- | --- | --- |
|  | Reference | Issue # | Brief Description / Headline |
| 3 | Sec. 3.2.1 in [3] | 6.4.3-2 | Reference TRP Information. The current LPP is unclear about the definition/signalling of "assistance data reference TRP" and "RSTD reference TRP".  Includes also potential issues on nr-DL-PRS-ReferenceInfo and nr-DL-PRS-SFN0-Offset fields, as described. |

Description:

Currently, the "Reference Info" is provided by *DL-PRS-IdInfo* in IE *NR-DL-PRS-AssistanceData:*

NR-DL-PRS-AssistanceData-r16 ::= SEQUENCE {

nr-DL-PRS-ReferenceInfo-r16 DL-PRS-IdInfo-r16 OPTIONAL, -- Need ON

nr-DL-PRS-AssistanceDataList-r16 SEQUENCE (SIZE (1..nrMaxFreqLayers-r16)) OF

NR-DL-PRS-AssistanceDataPerFreq-r16,

nr-SSB-Config-r16 SEQUENCE (SIZE (0..255)) OF NR-SSB-Config-r16,

...

}

The field description for *nr-DL-PRS-ReferenceInfo* defines: "This field indicates the IDs of the reference TRP.". I.e., the field provides the IDs (i.e., plural) which is needed for the "RSTD Reference" candidates. However, for the "Assistance Data Reference", the DL-PRS ID should be sufficient, since (a) expected RSTD is defined for a pair of TRPs, and (b) RTDs can be provided only on DL-PRS ID level (not on Resource Set ID and Resource ID level).

From the discussion/comments in section 3.2 in [1], there appears to be the following options:

Option 1: Distinguish between "assistance data reference TRP" and "RSTD reference TRP". The currently used *DL-PRS-IdInfo* in IE *NR-DL-PRS-AssistanceData* is the (requested/recommended) "RSTD reference TRP" (and can be moved to *NR-DL-TDOA-RequestLocationInformation*), and the "assistance data reference TRP" is indicated separately using a DL-PRS-ID/TRP-ID only (i.e., no Resource Set ID, Resource ID).

Option 2: The assistance data (e.g., *nr-DL-PRS-AssistanceDataList, NR-PositionCalculationAssistance*) are provided as a list of TRPs (as currently defined) and the first entry of the list defines the (assistance data) Reference TRP.

Option 3: "Assistance Data Reference TRP" is the same as "RSTD reference TRP" (i.e., *DL-PRS-IdInfo*), and no change to the specification is needed.

NOTE 3a: An "Assistance Data Reference TRP" seems always needed (to indicate SFN-offset and expected RSTD), whereas a "RSTD reference TRP" would only be needed for UE-assisted DL-TDOA.

NOTE 3b: If Option 3 is desired, it seems the *DL-PRS-IdInfo-r16* should be mandatory present (given NOTE 3a).

NOTE 3c: The "assistance data reference TRP" should be a TRP/cell from which the UE can obtain the SFN. In case of broadcast assistance data, this cell/TRP is the cell from which the UE obtains the posSIB (i.e., each cell would broadcast a different order of the list with Option 2).

|  |  |
| --- | --- |
| Company | Comments |
| Huawei, HiSIlicon | We prefer option3.  WE think there is no need to define two references, i.e., RSTD reference and assisntance data reference.  A clarification on the reference like Option3 is enough, which has the least RAN1 spec impact. |
| vivo | Option 3:  In TS 38.214, there are some related descriptions such as  “The UE may be indicated by the network that a DL PRS resources can be used as the reference for the DL RSTD, DL PRS-RSRP, and UE Rx-Tx time difference measurements in a higher layer parameter *DL-PRS-RstdReferenceInfo*. ”  “For the DL RSTD, DL PRS-RSRP, and UE Rx-Tx time difference measurements the UE can report an associated higher layer parameter *Timestamp*. The *Timestamp* can include the SFN and the slot number for a subcarrier spacing. These values correspond to the reference which is provided by *DL-PRS-RSTDReferenceInfo*.”  Therefor,in our view，the IE “nr-DL-PRS-ReferenceInfo-r16” is same with the IE “DL-PRS-RSTDReferenceInfo”as a common IE in TS38.214. So, we didn’t need change it. |
| CATT | Support Option2.  There is no broadcast issue with Option2 becaue only assistance data of DL-TDOA is broadcast. Neither assistance data of DL-AOD nor Multi-RTT will be broadcast in NR.  The modification of option 2 is less and follows the legency concept in LPP. |
| MediaTek | We don’t see a clear reason why the two reference TRPs should be the same, so we tend to favour either option 1 or 2. Regarding note 3c, is there a real impact? In any case the different cells would broadcast AD with different AD reference TRPs indicated, so they would not be able to broadcast identical assistance data from cell to cell. |
| Ericsson | Option 2 – the first TRP of the first frequency layer in the nr-DL-PRS-AD is the AD Ref TRP.  Also, the DL-PRS-IdInfo (which can be moved to NR-DL-TDOA-RequestLocationInformation), should be reduced to TRP-ID/DL-PRS-ID – no need to specify a resource set ID and even less so a list of DL PRS res IDs. |
| Intel | Option 3. Tend to agree with Huawei. |
| Nokia | Option 1. In LTE, we clearly distinguish between “assistance data reference cell” and “RSTD reference cell”. The former is provided by the server while the latter is selected by the UE and reported to the server when reporting the measurement. Shouldn’t the concept be the same in NR too? Also, in 6.5.10.4 it says “*The measurements are provided as a list of TRPs, where the first TRP in the list is used as reference TRP in case RSTD measurements are reported. The first TRP in the list may or may not be the reference TRP indicated in the NR-DL-PRS-AssistanceData*”  This implies that there should be a distinction between “assistance data reference cell” and “RSTD reference cell”.  Also, the IDs (plural) in the definition of nr-DL-PRS-ReferenceInfo refers to the IDs of resources under one TRP. This need to be clarified. |
| OPPO | Same view as Nokia. |

Issue needs further discussion.

Rapporteur’s Comments:

- The DL-PRS Assistance Data are provided in IE *NR-DL-PRS-AssistanceData*, possibly together with *NR-SelctedDL-PRS-IndexList*. Using Option 2 seems to result in indicating the reference TRP twice:

(a) *nr-DL-PRS-ReferenceInfo*;

(b) first entry in *nr-DL-PRS-AssistanceDataList*.

This seems unnecessary and error prone (i.e., requires unnecessary consistency checking at the UE).

- Option 3 seems to imply that the "RSTD reference TRP" is always the same as the "assistance data reference TRP", which seems against the RAN1 agreement that the UE can select a different reference as provided in the assistance data.

- The general principle seems not different compared to LTE OTDOA: The LMF provides the assistance data with respect to a reference TRP. This reference TRP ("Assistance Data Reference TRP") may or may not be the same the UE selects for RSTD measurements ("RSTD reference TRP").

- In my understanding, the field *nr-DL-PRS-ReferenceInfo-r16* is only applicable to DL-TDOA. Its presence in *NR-DL-PRS-AssistanceData-r16* is probably one reason for the confusion. - Option 1 and 2 may be combined:  
(a) Move the *nr-DL-PRS-ReferenceInfo-r16* to IE *NR-DL-TDOA-RequestLocationInformation*, indicating the requested "RSTD reference TRP" resource(s).  
(b) Define the first entry of the *nr-DL-PRS-AssistanceDataList-r16* as "Assistance Data Reference TRP".

- However, if Option 1 and Option 2 will be combined, the same problem as for *NR-DL-TDOA-MeasElement* will result (items #13-15 further down below):  
If the first element in the list is the reference, what will be the expected RSTD for this first element? An RSTD is the TOA of TRP #*i* minus the TOA of the reference TRP. This seems to imply that for the first entry in the assistance data list, the expected RSTD (and SFN0-offset, etc.) is zero; i.e., TOA-of-Reference-TRP minus TOA-of-Reference-TRP. Is this really the intention to signal a zero?

- Maybe the companies who think the first TRP in the assistance data list is the "Assistance Data Reference TRP" could provide a description.  
The current structure is as follows:

NR-DL-PRS-AssistanceData-r16

{

nr-DL-PRS-ReferenceInfo-r16 trp-ID-r16

nr-DL-PRS-ResourceID-List-r16 (1:64 Resource IDs)

nr-DL-PRS-ResourceSetId-r16

nr-DL-PRS-AssistanceDataList-r16 1:4 of NR-DL-PRS-AssistanceDataPerFreq-r16

}

NR-DL-PRS-AssistanceDataPerFreq-r16

{

nr-DL-PRS-PositioningFrequencyLayer-r16

nr-DL-PRS-AssistanceDataPerFreq-r16 1:64 of NR-DL-PRS-AssistanceDataPerTRP

}

NR-DL-PRS-AssistanceDataPerTRP-r16

{

trp-ID-r16

nr-DL-PRS-SFN0-Offset-r16

nr-DL-PRS-expectedRSTD-r16

nr-DL-PRS-expectedRSTD-uncertainty-r16

nr-DL-PRS-Config-r16

}

Therefore, the first element of *NR-DL-PRS-AssistanceDataPerTRP-r16* of the first element of *NR-DL-PRS-AssistanceDataPerFreq-r16* is assumed to be the "Assistance Data Reference TRP".

What should be the values of *nr-DL-PRS-SFN0-Offset*, *nr-DL-PRS-expectedRSTD, nr-DL-PRS-expectedRSTD-uncertainty* for this first element?

What is the significance of the *nr-DL-PRS-ReferenceInfo-r16*? The field description says: "This field indicates the IDs of the reference TRP." Of which Reference TRP? And what is the DL-PRS configuration of this reference TRP? Why can this reference TRP only have a single Resource Set?

The "Assistance Data Reference TRP" (incl. its *nr-DL-PRS-Config*) should be outside the *nr-DL-PRS-AssistanceDataList*. Something like this:

NR-DL-PRS-AssistanceData-r16

{

ReferenceTRPInfo

{

TRP ID,

nr-DL-PRS-Config-r16,

etc.

}

nr-DL-PRS-AssistanceDataList-r16 1:4 of NR-DL-PRS-AssistanceDataPerFreq-r16

}

NR-DL-PRS-AssistanceDataPerFreq-r16

{

nr-DL-PRS-PositioningFrequencyLayer-r16

nr-DL-PRS-AssistanceDataPerFreq-r16 1:64 of NR-DL-PRS-AssistanceDataPerTRP

}

NR-DL-PRS-AssistanceDataPerTRP-r16

{

trp-ID-r16

nr-DL-PRS-SFN0-Offset-r16

nr-DL-PRS-expectedRSTD-r16

nr-DL-PRS-expectedRSTD-uncertainty-r16

nr-DL-PRS-Config-r16

}

I.e., the *nr-DL-PRS-SFN0-Offset*, *nr-DL-PRS-expectedRSTD, nr-DL-PRS-expectedRSTD-uncertainty* is between a TRP in the *NR-DL-PRS-AssistanceDataPerTRP-r16* list and the ReferenceTRPInfo.

I.e., essentially the same basic structure as for LTE OTDOA.

Additional comments (if any):

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Reference | Issue # | Brief Description / Headline |
| 5 | Sec. 3.2.2b in [3] | 6.4.3-5 | For the indication of SSB as PRS QCL, currently the field PCI is mandatory, however, it is unnecessary when the SSB and PRS locate on the same frequency layer. |

Description:

*pci* should be OPTIONAL in IE *DL-PRS-QCL-Info*, with conditional present tag that if the SSB is on the same frequency layer as the PRS, the field is absent.

DL-PRS-QCL-Info-r16 ::= CHOICE {

ssb-r16 SEQUENCE {

nr-ARFCNRSource-r16 ARFCN-ValueNR-r15

OPTIONAL, -- Cond NotSameAsPRS-FreqLayer

pci-r16 NR-PhysCellId-r16

OPTIONAL, -- Cond NotSameAsPRS-FreqLayer

ssb-Index-r16 INTEGER (0..63),

rs-Type-r16 ENUMERATED {typeC, typeD, typeC-plus-typeD}

},

dl-PRS-r16 SEQUENCE {

qcl-dl-PRS-ResourceId-r16 NR-DL-PRS-ResourceId-r16,

qcl-dl-PRS-ResourceSetId-r16 NR-DL-PRS-ResourceSetId-r16

}

}

|  |  |
| --- | --- |
| Company | Comments |
| Huawei, HiSilicon | TRP id already incldues pci, thus it can be optional and use the PCI for the PRS.  While for ARFCN, it is already provided under NR-SSB-CONfig. With PCI, the UE can get the configured ARFCN for the SSB. Hence, there may not be need for addition of nr-ARFCNSource.  We wonder is there really the case that two SSB have the same PCI while different ARFCN? |
| vivo | 1. Frequency layer does not mean same PCI.And the UE doesn’t know the PCI to which the PRS belongs. So it is mandatory. 2. The SSB configuration information includes the ARFCN, we don’t think it needs to be reconfigured. |
| CATT | OK.  The scenario that SSBs are transmitted from a TRP in multiple carriers, and UE needs to know the SSB is associated to which one, would require ARFCN. |
| MediaTek | We understand from the email discussion in RAN2#109bis-e that this issue was modified by the proponent and the intention is now to have the pci field omitted if it is the same as the PCI providing the PRS (“Cond NotSameAsPRS-PCI”). In this form it saves a bit of signalling overhead by omitting a redundant field, so it seems OK. |
| Ericsson | The majority of companies were in favor of splitting up the complex IE TRP-ID into separate fields where needed, so PCI is not part of TRP-ID per se.  The decision depends on the TRP-ID email discussion outcome, where currently there are quite different opinions about whether PCI is needed per TRP. Some comments:   * Frequency layer does not mean same PCI so conditional presence formulation is incorrect * PCI should be mandatory in SSB Config   + - It is natural that PCI comes with the SSB Config in order to make it well defined     - In our understanding, there is no need for a PCI per TRP (LTE PCI was used for PRS sequences prior to Rel 14 and are not needed with NR TRPs) |
| Intel | Agree Huawei’s suggestions. |
| Nokia | We have the same question as Vivo. If the PRS and SSB are on the same frequency layer does it mean the SSB from any cell can be used as the QCL of PRS and in this case we do not have to include the PCI? What MediaTek explains above is the cell providing the PRS and SSB are the same (not different cells in the same frequency layer). Keeping it mandatory is fine with us. |
| OPPO | PCI info should be needed (can be optional if considering the presence of TRP-ID), we do not see the reson why it can be saved if at frequency layer.  ARFCN can be save since it is in SSB configuration. |

Issue needs further discussion.

Rapporteur’s Comments:

- The Proposal seems not changing the functionality. The PCI/ARFCN would not need to be repeated in *DL-PRS-QCL-Info* if it is the same as provided in the *NR-DL-PRS-AssistanceDataPerTRP (*field *trp-id)* (which is provided per frequency layer); therefore, the proposal reduces some overhead.

- I believe the PCI alone is not sufficient, since there may be SSBs on multiple carrier. Can it be ensured that they always have different PCIs?

Additional comments (if any):

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Reference | Issue # | Brief Description / Headline |
| 6 | Sec. 3.2.5 in [3] | 6.4.3-8 | Need codes are currently missing in IE TRP-ID and the existing condition is confusing/wrong.  Issue depends on the conclusion related to TRP-ID. |

Issue depends on the conclusion related to TRP-ID. See "[Post109bis-e][947][POS] TRP-ID structure (Ericsson)".

|  |  |  |  |
| --- | --- | --- | --- |
|  | Reference | Issue # | Brief Description / Headline |
| 7 | Sec. 3.2.6 in [1] | 6.4.3-9 | Conditional presence of trp-id field in IE NR-TimeStamp is confusing/wrong. |

Description:

Conditional presence of *trp-id* field in IE *NR-TimeStamp* is confusing/wrong.

NR-TimeStamp-r16 ::= SEQUENCE {

trp-ID-r16 TRP-ID-r16 OPTIONAL, -- Cond NotSameAsRefServ0

nr-SFN-r16 INTEGER (0..1023),

nr-Slot-r16 CHOICE {

scs15-r16 INTEGER (0..9),

scs30-r16 INTEGER (0..19),

scs60-r16 INTEGER (0..39),

scs120-r16 INTEGER (0..79)

},

...

}

From the discussion/comments in section 3.2.6 in [1], there appears to be the following options:

Option 1: Remove the conditional presence of *trp-ID* in IE *NR-TimeStamp*.

Option 2: Remove the *trp-ID* in IE *NR-TimeStamp*.

NOTE 7a: TRP-ID here means some ID of the TRP for which the SFN is valid (i.e., final name depends on solution of TRP issue)

NOTE 7b: Option 2 assumes the *trp-ID* is the same as the (assistance data) reference TRP, and therefore, it is not needed.

NOTE 7c: If Option 2 is desired, what should happen if the UE can not obtain the SFN from the (assistance data) reference TRP? E.g., reference TRP is not the same as serving cell anymore (e.g., after cell change)? Not report any measurements, or not report any time stamp for the measurements (which may effectively be the same)?

|  |  |
| --- | --- |
| Company | Comments |
| Huawei, HiSilicon | Option2. There is no need for the field in the NR-TimeStamp based on the above discussion on assistance data reference TRP. |
| vivo | Option2.We think the IE NR-TimeStamp is defined for a timing stamp which shouldn’t include the TRP information. We should indicate the reference TRP that NR-TimeStamp corrsponds to on the outside of the IE. |
| CATT | Option1.  *NR-TimeStamp* provide the time stamp for the location estimate (UE-based) in NR-DL-TDOA-LocationInformation-r16/ NR-DL-AoD-LocationInformation-r16(UE-based report). |
| MediaTek | Huawei in [1] quoted a RAN1 agreement that seems to imply the timestamp is always reported relative to the AD reference TRP. However, it doesn’t consider the possibility in Note 7c and we think it is in RAN2 remit to handle this situation. It looks like it would work to change the condition to “mandatory if not the same as the AD reference TRP”. I guess this is a version of option 1. |
| Ericsson | It seems better to include the relevant fields in NR-timeStamp. Note that the majority of companies were in favour of splitting up the complex TRP-ID in favor of separate fields, so the separate fields are needed to be introduced here, which seems to be at least PCI and maybe also NCGI |
| Intel | We tend to agree that NOTE7c is the valid point. But then the conclusion should be existing condition is correct, i.e. the ID is only needed if not same as AD reference TRP. |
| Nokia | When the time stamp provided is in terms of radio frame timing, then we need to know which TRP frame timing is used. So, the TRP ID seem to be required. However, if the TRP ID is always included outside the NR-TimeStamp, it is fine but it need to be clarified in the field description of NR-TimeStamp. The proposal from MediaTek looks fine to us i.e. leave it as conditionally mandatory depending on whether the timing is that of AD reference TRP or not. |
| OPPO | We tend to share the view from above that NOTE 7c needs to be taken into account, and seems the current condition is correct. |

Issue needs further discussion.

Rapporteur’s Comments:

- A conditional presence "mandatory if not the same as the AD reference TRP" seems to require that an LMF which receives the measurements/location estimate always knows what the "AD reference TRP" in the UE was. This may not always be the case if the assistance data were obtained via broadcast or via MO-LR, and the UE just reports measurements/location estimate to an LMF.

- The conditional presence description currently says:

| Conditional presence | Explanation |
| --- | --- |
| *NotSameAsRefServ0* | The field is mandatory present if the SFN is not from the reference TRP; otherwise it is not present. |

- Which reference TRP?

- For DL-TDOA, the UE can select a different "RSTD reference TRP" than the "Assistance Data reference TRP".

- For DL-AoD, Multi-RTT, there is no "RSTD reference TRP".

- Should it be the "Assistance Data reference TRP" also for DL-TDOA? Even if different from "RSTD reference TRP"?

- This also seems to indicate that we need to differentiate "Assistance Data reference TRP" and "RSTD reference TRP" more precisely (the latter should only be applicable to DL-TDOA).

Additional comments (if any):

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Reference | Issue # | Brief Description / Headline |
| 12 | Sec. 5.1 in [3] | 6.5.10-1 | There is currently no complete description/explanation for the sharing of the assistance data provided in IE NR DL PRS AssistanceData and NR-SelectedDL-PRS-IndexList.  DL-PRS AssistanceData placement in the LPP message structure. |

Description:

In case of multiple Provide Assistance Data IEs for multiple NR positioning methods, the IE *NR-DL-PRS-AssistanceData* for the TRPs would need to be provided only once. There were essentially two remaining options identified in [1],[2]:

Option 1: Keep the current LPP structure and add proper field description.

Option 2: Move the *NR-DL-PRS-AssistanceData* to the Message Body IEs.

Option 1: (DL-TDOA as example; the same applies to DL-AoD and Multi-RTT)

-- ASN1START

NR-DL-TDOA-ProvideAssistanceData-r16 ::= SEQUENCE {

nr-DL-PRS-AssistanceData-r16 NR-DL-PRS-AssistanceData-r16 OPTIONAL, -- Need ON

nr-SelectedDL-PRS-IndexList-r16 NR-SelectedDL-PRS-IndexList-r16 OPTIONAL, -- Cond Shared

nr-PositionCalculationAssistance-r16

NR-PositionCalculationAssistance-r16

OPTIONAL, -- Cond UEB

nr-DL-TDOA-Error-r16 NR-DL-TDOA-Error-r16 OPTIONAL, -- Need ON

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *UEB* | The field is optionally present for UE based NR DL-TDOA; otherwise it is not present. |
| *Shared* | The field is optionally present if not all DL-PRS Resources provided in *nr‑DL‑PRS‑AssistanceData* are applicable for this *NR-DL-TDOA-ProvideAssistanceData* message, or if the IE *NR-DL-PRS-AssistanceData* is provided in IE *NR‑Multi‑RTT‑ProvideAssistanceData* or *NR-DL-AoD-ProvideAssistanceData*. |

| *NR-DL-TDOA-ProvideAssistanceData* field descriptions |
| --- |
| ***nr-DL-PRS-AssistanceData***  This field specifies the assistance data reference and neighbour TRPs and provides the DL-PRS configuration for the TRPs. If this field is absent but the *nr-SelectedDL-PRS-IndexList* field is present, the *nr-DL-PRS-AssistanceData* is provided in IE *NR-Multi-RTT-ProvideAssistanceData* or *NR-DL-AoD-ProvideAssistanceData*. |
| ***nr-SelectedDL-PRS-IndexList***  This field specifies the DL-PRS Resources which are applicable for this *NR-DL-TDOA-ProvideAssistanceData* message. |
| ***nr-PositionCalculationAssistanceData***  This field provides TRP location and timing information for the TRPs provided in *nr-DL-PRS-AssistanceData* or *nr‑SelectedDL-PRS-IndexList* to enable UE-based DL-TDOA. |
| ***nr-DL-TDOA-Error***  This field provides DL-TDOA error reasons. |

Option 2: (DL-TDOA as example; the same applies to DL-AoD and Multi-RTT)

-- ASN1START

NR-DL-TDOA-ProvideAssistanceData-r16 ::= SEQUENCE {

nr-SelectedDL-PRS-IndexList-r16 NR-SelectedDL-PRS-IndexList-r16 OPTIONAL, -- Need ON

nr-PositionCalculationAssistance-r16

NR-PositionCalculationAssistance-r16

OPTIONAL, -- Cond UEB

nr-DL-TDOA-Error-r16 NR-DL-TDOA-Error-r16 OPTIONAL, -- Need ON

...

}

-- ASN1STOP

ProvideAssistanceData ::= SEQUENCE {

criticalExtensions CHOICE {

c1 CHOICE {

provideAssistanceData-r9 ProvideAssistanceData-r9-IEs,

spare3 NULL, spare2 NULL, spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

ProvideAssistanceData-r9-IEs ::= SEQUENCE {

commonIEsProvideAssistanceData CommonIEsProvideAssistanceData OPTIONAL, -- Need ON

a-gnss-ProvideAssistanceData A-GNSS-ProvideAssistanceData OPTIONAL, -- Need ON

otdoa-ProvideAssistanceData OTDOA-ProvideAssistanceData OPTIONAL, -- Need ON

epdu-Provide-Assistance-Data EPDU-Sequence OPTIONAL, -- Need ON

...,

[[

sensor-ProvideAssistanceData-r14 Sensor-ProvideAssistanceData-r14 OPTIONAL, -- Need ON

tbs-ProvideAssistanceData-r14 TBS-ProvideAssistanceData-r14 OPTIONAL, -- Need ON

wlan-ProvideAssistanceData-r14 WLAN-ProvideAssistanceData-r14 OPTIONAL -- Need ON

]],

[[

nr-DL-PRS-AssistanceData-r16 NR-DL-PRS-AssistanceData-r16 OPTIONAL, -- Need ON

nr-Multi-RTT-ProvideAssistanceData-r16

NR-Multi-RTT-ProvideAssistanceData-r16

OPTIONAL, -- Need ON

nr-DL-AoD-ProvideAssistanceData-r16

NR-DL-AoD-ProvideAssistanceData-r16 OPTIONAL, -- Need ON

nr-DL-TDOA-ProvideAssistanceData-r16

NR-DL-TDOA-ProvideAssistanceData-r16

OPTIONAL -- Need ON

]]

}

|  |  |
| --- | --- |
| Company | Comments |
| Huawei, HiSilicon | We suggest to have a common PRS configuration in *NR-DL-PRS-AssistanceData* promoted outside positioning methods and in parellel to *NR-DL-TDOA-ProvideAssistanceData-r16*, *NR-DL-AoD-ProvideAssistanceData-r16*, and *NR-Multi-RTT-ProvideAssistanceData-r16*, as it is likely we are going to have common PRS processing capabilities.  The field *nr-SelectedDL-PRS-IndexList* can still be conditional present, if not all DL-PRS Resources provided in *nr-DL-PRS-AssistanceData* are applicable for this *NR-DL-TDOA-ProvideAssistanceData* message, and there is no need to say shared assistance data.  For *nr-SelectedDL-PRS-IndexList*, we do not think it needs to have 2-stage perFreq + TRP indication, and the field *nr-SelectedDL-PRS-FrequencyLayerIndex-r16* and the field *nr-SelectedTRP-Index-r16* are useless. For the selection of TRP/DL PRS resource set/DL PRS resources, we simply needs to provide the TRP-ID, selected resource set IDs, and selected resource IDs.  For example (changes are based on R2-2003350):  NR-SelectedDL-PRS-IndexList-r16 ::= SEQUENCE (SIZE (1..256)) OF  NR-SelectedTRP-r16  NR-SelectedTRP-r16 ::= SEQUENCE {  trp-ID-r16 TRP-ID-r16,  dl-SelectedPRS-ResourceSetIndexList-r16 SEQUENCE (SIZE (1..nrMaxSetsPerTrp-r16)) OF  DL-SelectedPRS-ResourceSetIndex-r16  OPTIONAL, --Need ON  ...  }  DL-SelectedPRS-ResourceSetIndex-r16 ::= SEQUENCE {  nr-DL-SelectedPRS-ResourceSetIndex-r16 INTEGER (0..nrMaxSetsPerTrp-r16-1),  dl-SelectedPRS-ResourceIndexList-r16 SEQUENCE (SIZE (1..nrMaxResourcesPerSet-r16)) OF  DL-SelectedPRS-ResourceIndex-r16  OPTIONAL --Need ON  }  DL-SelectedPRS-ResourceIndex-r16 ::= SEQUENCE {  nr-DL-SelectedPRS-ResourceIdIndex-r16 INTEGER (0..nrMaxNumDL-PRS-ResourcesPerSet-1-r16),  ...  } |
| vivo | Option1  In addition, according to the above description:  ‘The field nr-SelectedDL-PRS-IndexList is conditional present, if not all DL-PRS Resources provided in nr-DL-PRS-AssistanceData are applicable for this NR-DL-TDOA-ProvideAssistanceData message, or if the IE NR-DL-PRS-AssistanceData is provided in IE NR Multi RTT ProvideAssistanceData or NR-DL-AoD-ProvideAssistanceData’,  We can find that as long as one of above conditions is met, the field nr-SelectedDL-PRS-IndexList will be present. But as our understanding, if only the second condition is satisfied, the field nr-SelectedDL-PRS-IndexList may not be present when all DL-PRS Resources provided in nr-DL-PRS-AssistanceData are applicable. So we suggest to change the description as  ’The field nr-SelectedDL-PRS-IndexList is conditional present, if not all DL-PRS Resources provided in nr-DL-PRS-AssistanceData are applicable for this NR-DL-TDOA-ProvideAssistanceData message and the IE nr-DL-PRS-AssistanceData is also provided in IE NR Multi RTT ProvideAssistanceData or NR-DL-AoD-ProvideAssistanceData. |
| CATT | Support Option1. The description clarifies where the shared DL-PRS-AssistanceData is when multi positioning methods.  Please note, *NR-DL-TDOA-ProvideAssistanceData* field descriptions should apply to DL-AoD and Multi-RTT.  Option2 is not effiecient when there is single positioning method which happens sometimes.  *NR-DL-PRS-AssistanceData-r16* is more efficient than *nr-SelectedDL-PRS-IndexList-r16* when in single positioning method. |
| MediaTek | No strong view and both options look acceptable. We do think option 1 can be done more cleanly by just making the field Need OP, and specifying in the field description “if absent for all positioning methods, all resources are applicable”. However, this would still result in dependencies across the different methods. |
| Ericsson | Option 2 is much clearer. We share the view of Huawei where the frequency layer level is removed in the selectedTRP etc.  Option 1 will become a mess, and it is very unlogical to let one positioning method refer to fields that is provided with another positioning method, unclear which. Can DL-PRS only be provided in one of the positioning methods? Obviously yes. The why shall it be placed under a positioning method if it anyway is shared between methods.  In email discussion 602, Qualcomm commented that placing the IE in the parent IE would break the convention with fields only per positioning method (not true – CommonIEsProvideAssistanceData is not a positioning method, and that it does not have a pair in the Request AD structure. That is also easily fixed du combining all the requests for DL-PRS, which makes the request clear as well: |
| – *NR-DL-PRS-RequestAssistanceData*  The IE *NR-DL-PRS-RequestAssistanceData* is used by the target device to request NR DL-PRS assistance data from a location server.  -- ASN1START  NR-DL-PRS-RequestAssistanceData-r16 ::= SEQUENCE {  nr-PhysCellId-r16 NR-PhysCellId-r16 OPTIONAL,  nr-AdType-r16 BIT STRING { dl-prs (0), locInfo (1), beamInfo (2), rtdInfo (3) } (SIZE (1..8)),  ...  }  -- ASN1STOP   | ***NR-DL-PRS-RequestAssistanceData* field descriptions** | | --- | | ***nr-PhysCellId***  This field specifies the NR physical cell identity of the current primary cell of the target device. | | ***nr-AdType***  This field indicates the requested assistance data. *dl-prs* means requested assistance data is *NR-DL-PRS-AssistanceData*, *locInfo* means requested assistance data is *NR-TRP-LocationInfo*, *beamInfo* means requested assistance data is *NR-DL-PRS-BeamInfo* and *rtdInfo* means requested assistance data is *NR-RTD-Info* for UE based positioning. | | |
| Intel | Both options can work. But slightly prefer option 1 since it gives the option to LMF, not use “nr-SelectedDL-PRS-IndexList” at all. |
| Nokia | Option 1 seem to cross reference other positioning methods IE under a particular positioning method field description. Option 2 looks more weird because the ProvideAssistanceData IE contains a bunch of assistance data for different methods when all of a sudden you see the PRS specific assistance data included in it. We wonder if it is possible to include the DL-PRS-AssistanceData inside CommonIEsProvideAssistanceData where it references to more than one positioning method can be made in the field description? |
| OPPO | No strong view and both options look acceptable. |

Issue needs further discussion.

Rapporteur’s Comments:

- Difficult to conclude:  
- Option 1: vivo, CATT, Intel (slightly)  
- Option 2: Huawei, Ericsson  
- No strong view: MTK, OPPO

- The *NR-DL-PRS-AssistanceData* is neither common assistance data (i.e., applicable to all methods, as currently defined) nor a "positioning method".

- Similar cross-reference of IEs in different positioning methods (as in Option 1/current specification) is already used in LPP (e.g., Sensors and OTDOA).

- Although, there may be common PRS processing capabilities, the concurrent NR positioning methods may also be a UE capability. Option 2 seems to imply that concurrent NR positioning methods is the rule.

- It seems both Options can provide the functionality. However, I believe Option 2 starts creating the "mess" since it deviates from current LPP and mixes shared assistance data with positioning methods.

- I suggest making a simple majority decision at RAN2#110e.

Additional comments (if any):

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Reference | Issue # | Brief Description / Headline |
| 13 | Sec. 5.3.1 in [3] | 6.5.10-3 | DL-PRS RSRP measurements can optionally be provided for DL-TDOA positioning. However, there is currently confusion, since RSTD is a measurement for a pair of TRPs, but the RSRP is a single TRP measurement only. |

Description:

DL-PRS RSRP can provide an auxiliary measurement for DL-TDOA, e.g., to indicate an additional quality for the DL‑PRS measurement, etc.. However, with the current measurement results structure for DL-TDOA, the RSRP for the reference TRP cannot be provided.

It was proposed adding the RSRP measurements for the RSTD Reference TRP to the IE *NR-DL-TDOA-SignalMeasurementInformation*:

NR-DL-TDOA-SignalMeasurementInformation-r16 ::= SEQUENCE {

dl-PRS-ReferenceInfo-r16 DL-PRS-IdInfo-r16,

nr-PRS-RSRP-ResultRef-r16 INTEGER (FFS) OPTIONAL,

nr-DL-TDOA-MeasList-r16 NR-DL-TDOA-MeasList-r16,

...

}

NR-DL-TDOA-MeasList-r16 ::= SEQUENCE (SIZE(1..nrMaxTRPs-r16)) OF NR-DL-TDOA-MeasElement-r16

NR-DL-TDOA-MeasElement-r16 ::= SEQUENCE {

trp-ID-r16 TRP-ID-r16,

nr-DL-PRS-ResourceId-r16 NR-DL-PRS-ResourceId-r16 OPTIONAL,

nr-DL-PRS-ResourceSetId-r16 NR-DL-PRS-ResourceSetId-r16 OPTIONAL,

nr-TimeStamp-r16 NR-TimeStamp-r16,

nr-RSTD-r16 INTEGER (0..ffs), -- FFS on the value range

nr-AdditionalPathList-r16 NR-AdditionalPathList-r16 OPTIONAL,

nr-TimingMeasQuality-r16 NR-TimingMeasQuality-r16,

nr-PRS-RSRP-Result-r16 INTEGER (FFS) OPTIONAL,

-- FFS, value range to be decided in RAN4.

nr-DL-TDOA-AdditionalMeasurements-r16

NR-DL-TDOA-AdditionalMeasurements-r16 OPTIONAL,

...

}

|  |  |
| --- | --- |
| Company | Comments |
| Huawei, HiSilicon | It is our understanding that the measurement results for the reference TRP is also included one *NR-DL-TDOA-MeasElement-r16* provided by the list *nr-DL-TDOA-MeasList-r16*. Therefore, we consider the change not needed. The only change that requires discussion is handle of nr-RSTD-r16 for the reference TRP. |
| vivo | We are fine with this change. In addition, for the measurement and report of a reference TRP, other measurements such as additional path and AdditionalMeasurement (e.g. additional measurements from resources different from the reference resource) should also be included. |
| CATT | Support. The RSRP for the reference TRP can help LMF make the decision. |
| MediaTek | We have the same understanding as Huawei that the RSTD reference TRP is included in the measurement list—from the IE description of NR-DL-TDOA-SignalMeasurementInformation: “The measurements are provided as a list of TRPs, where the first TRP in the list is used as reference TRP in case RSTD measurements are reported.” So the change seems not needed. |
| Ericsson | We have the same understanding as Huawei and MediaTek. If the reference cell would be handled separately, then we also need additional path, and timingMeasQuality for the reference cell added. |
| Intel | Same view as Huawei and Mediatek. |
| Nokia | The IE description referenced by MediaTek talks only about RSTD measurement of reference TRP. Nothing is mentioned about RSRP measurement of reference TRP. The proposal here is to include PRS RSRP for the reference TRP. We are fine with the proposal to add RSRP for reference TRP. If in doubt as to whether it is useful to have this RSRP for reference TRP, we can always check with RAN1 and RAN4. |
| OPPO | Same view as Nokia. |

Issue needs further discussion.

Rapporteur’s Comments:

- The key question in this context is indeed what is the RSTD measurement result for the reference TRP? How can a RSTD for a single TRP (i.e., reference TRP) be included in *NR-DL-TDOA-MeasElement-r16*?

- The introcuction sentence for this IE indeed states:  
"The measurements are provided as a list of TRPs, where the first TRP in the list is used as reference TRP in case RSTD measurements are reported."   
Is there really a case for DL-TDOA where RSTD measurements are *not* reported? At least the current ASN.1 has the *nr-RSTD-r16* mandatory present.

- Essentially the same basic issue/question as item #3 above. What is an RSTD of a single (reference) TRP?

Additional comments (if any):

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Reference | Issue # | Brief Description / Headline |
| 14 | Sec. 5.3.2 in [3] | 6.5.10-4 | The IE NR-TimingMeasQuality is used to provide the quality of the RSTD measurement. However, the quality of the reference TRP TOA used for RSTD cannot be provided. Further, the quality of the additional RSTD measurements per TRP pair (up to 3) can also not be provided. |

Description:

The RSTD measurement is a TDOA measurement, and the quality of the RSTD can be indicated by the IE *NR‑TimingMeasQuality.* The RSTD quality would only be the main diagonal element of a weighting matrix for TDOA; the off-diagonal elements of the weighting matrix are determined by the quality of the reference TRP TOA measurement used for the TDOA (see also LTE OTDOA in LPP). E.g., the selection of the RSTD reference TRP affects all the RSTD (TDOA) measurements.

The issue was also discussed at RAN1#100bis-e, with the following conclusion [5]:

Conclusion:

* It is RAN1 understanding that the NR-TimingMeasQuality is the quality for time of arrival measurements
* NR-TimingMeasQuality is left up to UE implementation
* Notes:
  + No RAN1 specification changes are required.
  + NR-TimingMeasQuality measurement is also applicable for the reference timing used in RSTD measurements

Therefore, the *NR‑TimingMeasQuality* is not the quality of the RSTD, but the quality of the TOA which is used to calculate the RSTD. I.e., there are two qualities needed for a single RSTD measurement (reference quality and neighbour quality):

NR-DL-TDOA-SignalMeasurementInformation-r16 ::= SEQUENCE {

dl-PRS-ReferenceInfo-r16 DL-PRS-IdInfo-r16,

nr-TOA-Ref-Quality-r16 NR-TimingMeasQuality-r16,

nr-DL-TDOA-MeasList-r16 NR-DL-TDOA-MeasList-r16,

...

}

NR-DL-TDOA-MeasList-r16 ::= SEQUENCE (SIZE(1..nrMaxTRPs-r16)) OF NR-DL-TDOA-MeasElement-r16

NR-DL-TDOA-MeasElement-r16 ::= SEQUENCE {

trp-ID-r16 TRP-ID-r16,

nr-DL-PRS-ResourceId-r16 NR-DL-PRS-ResourceId-r16 OPTIONAL,

nr-DL-PRS-ResourceSetId-r16 NR-DL-PRS-ResourceSetId-r16 OPTIONAL,

nr-TimeStamp-r16 NR-TimeStamp-r16,

nr-RSTD-r16 INTEGER (0..ffs), -- FFS on the value range

nr-AdditionalPathList-r16 NR-AdditionalPathList-r16 OPTIONAL,

nr-TOA-Quality-r16 NR-TimingMeasQuality-r16,

nr-PRS-RSRP-Result-r16 INTEGER (FFS) OPTIONAL,

-- FFS, value range to be decided in RAN4.

nr-DL-TDOA-AdditionalMeasurements-r16

NR-DL-TDOA-AdditionalMeasurements-r16 OPTIONAL,

...

}

NR-DL-TDOA-AdditionalMeasurements-r16 ::= SEQUENCE (SIZE (1..3)) OF

NR-DL-TDOA-AdditionalMeasurementElement-r16

NR-DL-TDOA-AdditionalMeasurementElement-r16 ::= SEQUENCE {

nr-DL-PRS-ResourceId-r16 NR-DL-PRS-ResourceId-r16 OPTIONAL,

nr-DL-PRS-ResourceSetId-r16 NR-DL-PRS-ResourceSetId-r16 OPTIONAL,

nr-TimeStamp-r16 NR-TimeStamp-r16,

nr-RSTD-ResultDiff-r16 INTEGER (0..ffs),

-- FFS on the value range to be decided in RAN4

nr-TOA-Quality-r16 NR-TimingMeasQuality-r16,

dl-PRS-RSRP-ResultDiff-r16 INTEGER (FFS) OPTIONAL,

-- FFS on the value range to be decided in RAN4

nr-AdditionalPathList-r16 NR-AdditionalPathList-r16 OPTIONAL,

...

}

|  |  |
| --- | --- |
| Company | Comments |
| Huawei/HiSilicon | It is our understanding that the measurement results for the reference TRP is also included one *NR-DL-TDOA-MeasElement-r16* provided by the list *nr-DL-TDOA-MeasList-r16*. Therefore, we consider the change not needed. |
| vivo | In general we agree with the intention, but we worry the naming of nr-TOA-Quality makes the confusion about RSTD and TOA.We prefer put the IE NR-TimingMeasQuality-r16 under NR-DL-TDOA-SignalMeasurementInformation-r16。 |
| CATT | Support. |
| MediaTek | Agree with Huawei. |
| Ericsson | To use TOA quality in the same is an improvement in readability no matter where the field is. We think letting the first element of the list to be the ref TRP is easiest. |
| Intel | Agree with Huawei. |
| Nokia | The referenced RAN1#100bis-e conclusion, if it is a firm agreement in RAN1, then the proposed changes is fine with us. This RAN1 conclusion clarifies that it is the quality of TOA measurement and not TDOA measurement. The point mentioned by Huawei is about RSTD measurement only. |
| OPPO | Support |

Issue needs further discussion.

Rapporteur’s Comments:

- Same basic question/issue as for #13 (Issue 6.5.10-3) above.

- The RAN1 conclusion defines the *NR-TimingMeasQuality* (now *NR-TimingQuality* per Proposed Conclusion 2) as a "single link" (TOA) quality indicator, which is now slightly different compared to LTE.

Additional comments (if any):

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Reference | Issue # | Brief Description / Headline |
| 15 | Sec. 5.3.5 in [13] | 6.5.10-7 | The IE NR-DL-TDOA-MeasElement provides the RSTD measurements for up to 256 TRPs. However, since the RSTD measurement is between a pair of TRPs, only up to 255 report elements for IE NR-DL-TDOA-MeasElement are possible. |

Description:

The IE *NR-DL-TDOA-MeasElement* provides the DL-TDOA measurements for one TRP. Assistance data can be provided for up to 256 TRPs. This implies that there can be up to 255 TRPs for RSTD measurements.

NOTE 15: Note, in [1] some companies think the measurements for the RSTD reference TRP are included in one *NR-DL-TDOA-MeasElement*. However, it is unclear what an RSTD (TDOA) of a single (reference) TRP is.

NR-DL-TDOA-SignalMeasurementInformation-r16 ::= SEQUENCE {

dl-PRS-ReferenceInfo-r16 DL-PRS-IdInfo-r16,

nr-DL-TDOA-MeasList-r16 NR-DL-TDOA-MeasList-r16,

...

}

NR-DL-TDOA-MeasList-r16 ::= SEQUENCE (SIZE(1..nrMaxTRPs-1-r16)) OF NR-DL-TDOA-MeasElement-r16

NR-DL-TDOA-MeasElement-r16 ::= SEQUENCE {

trp-ID-r16 TRP-ID-r16,

nr-DL-PRS-ResourceId-r16 NR-DL-PRS-ResourceId-r16 OPTIONAL,

nr-DL-PRS-ResourceSetId-r16 NR-DL-PRS-ResourceSetId-r16 OPTIONAL,

nr-TimeStamp-r16 NR-TimeStamp-r16,

nr-RSTD-r16 INTEGER (0..ffs), -- FFS on the value range

nr-AdditionalPathList-r16 NR-AdditionalPathList-r16 OPTIONAL,

nr-TimingMeasQuality-r16 NR-TimingMeasQuality-r16,

nr-PRS-RSRP-Result-r16 INTEGER (FFS) OPTIONAL,

-- FFS, value range to be decided in RAN4.

nr-DL-TDOA-AdditionalMeasurements-r16

NR-DL-TDOA-AdditionalMeasurements-r16 OPTIONAL,

...

}

nrMaxTRPs-1-r16 INTEGER ::= 255

|  |  |
| --- | --- |
| Company | Comments |
| Huawei/HiSilicon | It is our understanding that the measurement results for the reference TRP is also included as one *NR-DL-TDOA-MeasElement-r16* provided by the list *nr-DL-TDOA-MeasList-r16*. Therefore, we consider the change may not be needed. |
| vivo | We are fine with this change. |
| CATT | Support. Prefer to report measurement of reference and neighbor TRP separately. |
| MediaTek | Agree with Huawei. |
| Ericsson | Agree with Huawei and Mediatek |
| Intel | Agree with Huawei. |
| Nokia | Interesting. Rapporteur descriptions makes sense but in this case the IE description that says the first measurement is for the reference TRP needs to be revisited. This issue is worth confirming with RAN1. |
| OPPO | Agree with Huawei. |

Issue needs further discussion.

Rapporteur’s Comments:

- Same basic question/issue as for #13 (Issue 6.5.10-3) above.

Additional comments (if any):

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Reference | Issue # | Brief Description / Headline |
| 19 | Sec. 6.1 in [3] | 6.5.11-1 | Same as 6.5.10-1, but for DL-AoD |

It is assumed the same solution for 12 (#6.5.10-1) will apply for DL-AoD as well.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Reference | Issue # | Brief Description / Headline |
| 21 | Sec. 6.6 in [3] | 6.5.11-8 | nr-DL-PRS-RxBeamIndex-r16: a single bit of information, viz. Boolean may be enough. May be no need to report the ID of the RX beam used. |

Description:

The field *nr-DL-PRS-RxBeamIndex* in *NR-DL-AoD-MeasElement* is currently used to indicate which (of the up to 8) DL-PRS RSRP measurements have been made with the same RX beam by the UE. I.e., the RSRP measurements in *NR-DL-AoD-MeasList* which have been made with the same RX beam will get the same value of *nr-DL-PRS-RxBeamIndex*:

-- ASN1START

NR-DL-AoD-SignalMeasurementInformation-r16 ::= SEQUENCE {

nr-DL-AoD-MeasList-r16 NR-DL-AoD-MeasList-r16,

...

}

NR-DL-AoD-MeasList-r16 ::= SEQUENCE (SIZE(1..nrMaxTRPs-r16)) OF NR-DL-AoD-MeasElement-r16

NR-DL-AoD-MeasElement-r16 ::= SEQUENCE {

trp-ID-r16 TRP-ID-r16,

nr-DL-PRS-ResourceId-r16 NR-DL-PRS-ResourceId-r16 OPTIONAL,

nr-DL-PRS-ResourceSetId-r16 NR-DL-PRS-ResourceSetId-r16 OPTIONAL,

nr-TimeStamp-r16 NR-TimeStamp-r16,

nr-PRS-RSRP-Result-r16 INTEGER (FFS) OPTIONAL,

-- Need RAN4 inputs on value range

nr-DL-PRS-RxBeamIndex-r16 INTEGER (1..8),

nr-DL-Aod-AdditionalMeasurements-r16

NR-DL-AoD-AdditionalMeasurements-r16 OPTIONAL,

...

}

NR-DL-AoD-AdditionalMeasurements-r16 ::= SEQUENCE (SIZE (1..7)) OF

NR-DL-AoD-AdditionalMeasurementElement-r16

NR-DL-AoD-AdditionalMeasurementElement-r16 ::= SEQUENCE {

nr-DL-PRS-ResourceId-r16 NR-DL-PRS-ResourceId-r16 OPTIONAL,

nr-DL-PRS-ResourceSetId-r16 NR-DL-PRS-ResourceSetId-r16 OPTIONAL,

nr-TimeStamp-r16 NR-TimeStamp-r16,

nr-PRS-RSRP-ResultDiff-r16 INTEGER (FFS) OPTIONAL,

-- Need RAN4 inputs on value range

nr-DL-PRS-RxBeamIndex-r16 INTEGER (1..8),

...

}

-- ASN1STOP

Some other understanding of the RAN1 agreement is just to indicate whether the same RX beam has been used for all measurements for AoD or not. So, a single bit of information, viz. Boolean is enough. No need to report the ID of the RX beam used. [1]

RAN 1 Agreement:

* When the UE reports DL-PRS RSRP measurements on DL-PRS resources from one DL-PRS Resource Set, the UE may indicate in the measurement report for each TRP which DL-PRS RSRP measurements, if any, have been measured using the same Rx beam.

NOTE 21: For the Rapporteur, it is unclear how the measurement report should be structured with a single-bit indicator for one resource set, so an ASN.1 example would be needed. It seems the *NR-DL-PRS-ResourceSetId* in *NR-DL-AoD-AdditionalMeasurementElement* is not needed, and another SEQUENCE for 1:2 *NR-DL-PRS-ResourceSetId*’s may be required.

|  |  |
| --- | --- |
| Company | Comments |
| Huawei, HiSilicon | We agree that this is needed based on the agreement from RAN1. But the indiation does not necessarily need to be a per-beam index indication. We think that an indication with boolean value would be sufficent: for measElement with ture, they belong to the same reception beam, while for those with fales, they belong to the remaining set of beams. |
| vivo | Not needed. |
| CATT | Support a single bit of information.  Boolean parameter cannot indicate two or more RSRP measurement groups with different Rx beam in the 8 RSRP measurements for DL-AoD.  For example, if RSRP measurement 1~4 were measured using Rx beam 1 and RSRP measurement 5~8 using Rx beam 2. If we use Boolean parameter, which is a binary reporting field, it will be FALSE if it is sent per PRS resource set. And even it is sent per PRS resource, it can only indicate RSRP measurement 1~4 were measured using the same Rx beam, but it cannot indicate RSRP measurement 5~8 also using the same Rx beam.  On the contrary, the single bit of information can indicate up to 8 RSRP measurement groups with different Rx beam. |
| MediaTek | Agree with the rapporteur’s note. It seems simpler just to include the beam ID; we don’t fully understand CATT’s comment above, where the example seems to show that a single-bit indicator can’t fully capture the information. |
| Ericsson | Beam ID is fine. What about if half of the RSRPs are with one RX beam and the other half with another RX beam. Not possible to say “same” only – has to be same as which. |
| Intel | Tend to agree, beam ID is simpler solution. |
| Nokia | Apparently, RAN1 also discussed this issue in the last meeting and is still planning to discuss in the next meeting. We can leave it to RAN1 to confirm what their original intent was for this Rx Beam Index (single bit Boolean or an ID of 8 values). If RAN2 can make the decision on this issue then we think a single bit Boolean value is what RAN1 originally intended. Agree with Huawei that we just need a Boolean to indicate if all PRS RSRP measurements from one PRS resource set used the same Rx beam or not. Even if we use the current signaling definition then the UE will be reporting the same Rx Beam Index/ID if all PRS RSRP measurements from one PRS resource set are from the same Rx beam. If not, it will report different Rx Beam Index/ID to LMF and from this the LMF can understand that the PRS RSRP measurements are NOT from the same Rx beam. The LMF has use for the UE Rx beam index/ID. Having a single bit also reduces signaling overhead as this index is per element in a list. |
| OPPO | Using 1-bit Boolean might not work in some case. For example, UE reports RSRPs a/b/c/d/e/f. And the UE use one same Rx beam to measure RSRP a/b and use one same Rx beam (but another one) to measure RSRP c/d.  So no need for this change. |

Issue needs further discussion.

Rapporteur’s Comments:

- Agreement from RAN1#101e:

Agreement:

* When the UE reports DL PRS-RSRP measurement on DL PRS resources from one DL PRS resource set, the UE may report the *nr-DL-PRS-RxBeamIndex* to associate with each of the RSRP measurement in the report if for each *nr-DL-PRS-RxBeamIndex* reported there are at least 2 RSRP measurements associated with it within the DL PRS resource set.
* The DL PRS-RSRP measurements for a TRP reported with the same *nr-DL-PRS-RxBeamIndex* have been received using the same Rx beam.
* Note: In the current LPP spec, *nr-DL-PRS-RxbeamIndex* is only reported for DL-AoD measurement.

Additional comments (if any):

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Reference | Issue # | Brief Description / Headline |
| 22 | Sec. 7.1 in [1] | 6.5.12-1 | Same as 6.5.10-1, but for Multi-RTT |

It is assumed the same solution for 12 (#6.5.10-1) will apply for Multi-RTT as well.

# 4.2 Additional Issues in [1], section 4.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 25 | Sec. 4 | | 6.5.10-12 | Add a request for posSIBs to LPP Request Assistance Data*.* | |
| Company | | Description/Problem | | | Proposed Solution | |
| Ericsson | | We can include the posSIB that UE requires in the LPP request assistance data message. If NW is already broadcasting, posSIBType6-1 and posSIBType6-2; UE may only request posSIBType6-3 from the NW. The request assistance data can be aligned to reflect the posSIB categorizations.   |  |  |  | | --- | --- | --- | | NR DL-TDOA/DL-AoD Assistance Data (clause 7.4.2) | *posSibType6-1* | *NR-DL-Measurement-AD* | | *posSibType6-2* | *NR-UEB-TRP-LocationData* | | *posSibType6-3* | *NR-UEB-TRP-RTD-Info* | | | | *NR-DL-TDOA-RequestAssistanceData* The IE *NR-DL-TDOA-RequestAssistanceData* is used by the target device to request assistance data from a location server.  -- ASN1START  NR-DL-TDOA-RequestAssistanceData-r16 ::= SEQUENCE {  nr-PhysCellId-r16 NR-PhysCellId-r16 OPTIONAL,  nr-AdType-r16 BIT STRING { dl-prs (0),  posCalc (1),  posSibType6-1 (2),  posSibType6-2 (3),  posSibType6-3 (4) } (SIZE (1..8)),  ...  }  -- ASN1STOP   | *NR-DL-TDOA-RequestAssistanceData* field descriptions | | --- | | ***nr-PhysCellId***  This field specifies the NR physical cell identity of the current primary cell of the target device. | | ***nr-AdType***  This field indicates the requested assistance data. dl-prs means requested assistance data is *nr-DL-PRS-AssistanceData*, posCalc means requested assistance data is *nr-PositionCalculationAssistanceData* for UE based positioning*. posSibType6-1* means requested assistance data *NR-DL-Measurement-AD,* posSibType6-2 means requested assistance data *NR-UEB-TRP-LocationData,* *posSibType6-3* means requested assistance data *NR-UEB-TRP-RTD-Info.* | | |

Rapporteur’s Comments:

- Not quite clear what the problem is. Looks like On Demand SI via LPP. In any case, does not look like an ASN.1 issue.

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 26 | Sec. 4 | | 6.4.3-13 | The *DL-PRS-NumSymbols-r16* should be moved under *NR-DL-PRS-Resource-r16.* | |
| vivo | | dl-PRS-NumSymbols-r16 which is now under IE NR-DL-PRS-ResourceSet-r16. But the description of dl-PRS-NumSymbol indicates “This parameter indicates the number of symbols per DL PRS Resource within a slot”. | | | So we think dl-PRS-NumSymbols-r16 should be moved under NR-DL-PRS-Resource-r16. |

Rapporteur’s Comments:

- *dl-PRS-NumSymbols* is a property of the DL-PRS Resource (defines the number of symbols per DL-PRS Resource within a slot). It seems all DL-PRS Resources in a set have the same value of *dl-PRS-NumSymbols.* However, I couldn’t find the corresponding RAN1 reference.

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 27 | Sec. 4 | | 6.5.12-7 | Add a *nr-DL-PRS-UE-Rx-Tx-MeasurementInfoRequest* to *NR-Multi-RTT-RequestLocationInformation*, analogous to *nr-DL-PRS-RstdMeasurementInfoRequest* for DL-TDOA. | |
| vivo | | It is noted that the parameter nr-DL-PRS-UE-Rx-Tx-MeasurementInfoRequest is not captured in the latest version of TS 37.355. But the parameter nr-DL-PRS-UE-Rx-Tx-MeasurementInfoRequest was already in the parameter list [R1-1913674], similar to nr-DL-PRS-RstdMeasurementInfoRequest. So, we think that is an oversight of RAN2.  In 38.214:  “The UE can be configured in higher layer parameter *UE Rx-Tx Time-MeasRequestInfo* to report multiple UE Rx-Tx time difference measurements corresponding to a single configured SRS resource or resource set for positioning. Each measurement corresponds to a single received DL PRS resource or resource set which can be in difference positioning frequency layers.” | | | Add nr-DL-PRS-UE-Rx-Tx-MeasurementInfoRequest in NR-Multi-RTT-RequestLocationInformation  The IE *NR-Multi-RTT-RequestLocationInformation* is used by the location server to request NR Multi-RTT location measurements from a target device.  -- ASN1START  NR-Multi-RTT-RequestLocationInformation-r16 ::= SEQUENCE {  nr-DL-PRS-UE-Rx-Tx-MeasurementInfoRequest-r16 ENUMERATED { true } OPTIONAL, -- Need ON  nr-RequestedMeasurements-r16 BIT STRING { prsrsrpReq (0)} (SIZE(1..8)),  nr-AssistanceAvailability-r16 BOOLEAN,  nr-Multi-RTT-ReportConfig-r16 NR-Multi-RTT-ReportConfig-r16,  additionalPaths-r16 ENUMERATED { requested } OPTIONAL, -- Need ON  ...  }  NR-Multi-RTT-ReportConfig-r16 ::= SEQUENCE {  maxDL-PRS-RxTxTimeDiffMeasPerTRP-r16 INTEGER (1..4) OPTIONAL,  timingReportingGranularityFactor-r16 INTEGER (FFS) OPTIONAL,  -- FFS in RAN4  ...  }  -- ASN1STOP   | *NR-Multi-RTT-RequestLocationInformation* field descriptions | | --- | | *nr-AssistanceAvailability*  This field indicates whether the target device may request additional PRS assistance data from the server. TRUE means allowed and FALSE means not allowed. | | *maxDL-PRS-RxTxTimeDiffMeasPerTRP*  This field specifies the maximum number of UE-Rx-Tx time difference measurements for different DL PRS resources or DL PRS resource sets per TRP. | | *timingReportingGranularityFactor*  This field specifies the reporting granularity for the UE timing measurements (DL RSTD, the UE Rx-Tx time difference). | | nr-DL-PRS-UE-Rx-Tx-MeasurementInfoRequest  This field indicates whether the target device is requested to report DL PRS Resource ID(s) or DL PRS Resource Set ID(s) used for determining the timing of each TRP in the UE Rx-Tx time difference measurements. | |

Rapporteur’s Comments:

- Agree, this looks like an oversight.

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 28 | Sec. 4 | | 6.4.3-14 | *integerSubframeOffset-r16* in *nr-DL-PRS-SFN0-Offset-r16* is Need OP, but behaviour on absence is not defined | |
| MediaTek | | integerSubframeOffset-r16 in nr-DL-PRS-SFN0-Offset-r16 is Need OP, but behaviour on absence is not defined | | | Presumably absence means no offset and this could be captured in the field description (0 could also be removed from the range). Alternatively, make the field mandatory within nr-DL-PRS-SFN0-Offset-r16, and if there is no offset it can be set to 0. |

Rapporteur’s Comments:

- Probably simplest making the field mandatory present.

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| *29* | Sec. 4 | | 6.4.3-15 | Muting is considered to be optional in RAN1. | |
| *Intel* | | Muting is considered to be an optional in RAN1. To change  *dl-PRS-MutingPatternList-r16* as optional according to RAN1. | | | dl-PRS-MutingPatternList-r16 SEQUENCE {  mutingOption1-r16 SEQUENCE {  mutingPattern-r16 MutingPattern-r16,  dl-PRS-MutingBitRepetitionFactor-r16 ENUMERATED {n1, n2, n4, n8, ...} OPTIONAL --Need OR  },  mutingOption2-r16 SEQUENCE {  mutingPattern-r16 MutingPattern-r16  }  }OPTIONAL, Need OR |

Rapporteur’s Comments:

- In LPP, muting is OPTIONAL in the latest baseline R2-2005213 [2].

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 30 | Sec. 4 | | 6.4.3-16 | Allow *nr-SSB-Config-r16* for up to 256 TRPs in IE NR-DL-PRS-AssistanceData-r16. | |
| Qualcomm | | SSB Assistance Data:  The SSB Configuration can be provided in *NR-DL-PRS-AssistanceData* as:  NR-DL-PRS-AssistanceData-r16 ::= SEQUENCE {  nr-DL-PRS-ReferenceInfo-r16 DL-PRS-IdInfo-r16 OPTIONAL, -- Need ON  nr-DL-PRS-AssistanceDataList-r16 SEQUENCE (SIZE (1..nrMaxFreqLayers-r16)) OF  NR-DL-PRS-AssistanceDataPerFreq-r16,  nr-SSB-Config-r16 SEQUENCE (SIZE (0..255)) OF NR-SSB-Config-r16,  ...  }  Why up to 255 SSB configurations? Shouldn’t it be the same as the number of TRPs?  Although, 255 SSB configurations should be sufficient, but from a specification/consistency point of view, it may be better to allow the same number as the number of TRPs. | | | Allow *nr-SSB-Config-r16* for up to 256 TRPs:  NR-DL-PRS-AssistanceData-r16 ::= SEQUENCE {  nr-DL-PRS-ReferenceInfo-r16 DL-PRS-IdInfo-r16 OPTIONAL, -- Need ON  nr-DL-PRS-AssistanceDataList-r16 SEQUENCE (SIZE (1..nrMaxFreqLayers-r16)) OF  NR-DL-PRS-AssistanceDataPerFreq-r16,  nr-SSB-Config-r16 SEQUENCE (SIZE (1..nrMaxTRPs-r16)) OF NR-SSB-Config-r16 OPTIONAL,  ...  } |

Rapporteur’s Comments:

- Where is the number 255 currently used in the specification coming from?

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 31 | Sec. 4 | | 6.5.10-13  6.5.11-9  6.5.12-8 | Define a priority of the assistance data for the UE (for DL-TDOA, DL-AoD, and Multi-RTT assistance data). | |
| Qualcomm | | Priority of the assistance data for the UE:  The DL-PRS assistance data are provided via *NR-DL-PRS-AssistanceData* and possibly *NR-SelectedDL-PRS-IndexList* for up to 4 frequency layer, up to 64 TRPs per frequency layer, up to 2 DL-PRS Resource Sets per TRP per frequency layer, and up to 64 DL-PRS Resources per DL-PRS Resource Set per TRP per frequency layer.  The number of supported frequency layer, TRPs per frequency layer, sets per TRP, and resources per set seems to be a UE capability. In case the assistance data provides more frequency layers/TRPs/Sets/Resources than the UE can handle/measure, the UE should assume that the assistance data are sorted in decreasing order of priority (same as for LTE OTDOA). | | | Add a description to DL-TDOA, DL-AoD, and Multi-RTT assistance data, e.g.: – *NR-DL-TDOA-ProvideAssistanceData* The IE *NR-DL-TDOA-ProvideAssistanceData* is used by the location server to provide assistance data to enable UE‑assisted and UE-based NR DL TDOA. It may also be used to provide NR DL TDOA positioning specific error reason. The DL-PRS Resources in IE *NR-DL-PRS-Assistance Data* or *NR-SelectedDL-PRS-IndexList* are grouped in decreasing order of priority for measurement to be performed by the target device, with the first frequency layer in the list of frequency layers being the highest priority for measurements, with the first TRP in the list of TRPs per frequency layer being the highest priority for measurement, with the first set in the list of DL-PRS Resource Sets per TRP and frequency layer being the highest priority for measurement, and with the first DL-PRS Resource in the list of resources in the set per TRP and frequency layer being the highest priority for measurement. |

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 32 | Sec. 4 | | 6.5.12-9 | There is no quality indicator for the *nr-UE-RxTxTimeDiffAdditional-r16* in the IE *NR-Multi-RTT-AdditionalMeasurementElement-r16* | |
| Qualcomm | | There is no quality indicator for the *nr-UE-RxTxTimeDiffAdditional-r16* in the IE *NR-Multi-RTT-AdditionalMeasurementElement-r16* | | | Add the quality indicator for the *nr-UE-RxTxTimeDiffAdditional*:  NR-Multi-RTT-AdditionalMeasurementElement-r16 ::= SEQUENCE {  nr-DL-PRS-ResourceId-r16 NR-DL-PRS-ResourceId-r16 OPTIONAL,  nr-DL-PRS-ResourceSetId-r16 NR-DL-PRS-ResourceSetId-r16 OPTIONAL,  nr-PRS-RSRP-ResultDiff-r16 INTEGER (FFS) OPTIONAL,  -- FFS, value range to be decided in RAN4.  nr-UE-RxTxTimeDiffAdditional-r16 INTEGER (FFS) OPTIONAL,  -- FFS on the value range  nr-AdditionalPathList-r16 NR-AdditionalPathList-r16 OPTIONAL,  nr-TimeStamp-r16 NR-TimeStamp-r16,  nr-TimingQuality-r16 NR-TimingQuality-r16,  ...  } |

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 33 | Sec. 4 | | 6.5.10-14 | Missing value ranges for *nr-rstd* in IE *NR-DL-TDOA-MeasElement* can now be defined based on RAN4 LS R2-2004377/R2-2004383.  Missing value ranges for *timingReportingGranularityFactor* in IE *NR-DL-TDOA-ReportConfig* can now be defined based on RAN4 LS R2-2004377/R2-2004383. | |
| Huawei, HiSilicon | | In R4-2005845, the absolute value of RSTD has the following agreement in RAN4:  Absolute value  The reporting range is from -985024×Tc to +985024×Tc, for FR1 and FR2  The reporting granularity is uniform across the reporting range in each report mapping table (one table per k) and is defined as T = Tc\*2k where  k is from the set {0, 1, 2, 3, 4, 5}  LMF provides a recommended k value (k1). UE selects parameter k (k2) and informs to the LMF (RAN4 will further discuss the relation between UE selected parameter k2 and LMF recommended value k1). The bit-width corresponding to each k is different enabling LMF to identify which k was used.  The number of reportable entities, depending on k, is:  k=0: 1970050  k=1: 985026  k=2: 492514  k=3: 246258  k=4: 123130  k=5: 61566 | | | Adopt the following change for DL-TDOA-MeasElement  NR-DL-TDOA-MeasElement-r16 ::= SEQUENCE {  trp-ID-r16 TRP-ID-r16 OPTIONAL,  nr-DL-PRS-ResourceId-r16 NR-DL-PRS-ResourceId-r16 OPTIONAL,  nr-DL-PRS-ResourceSetId-r16 NR-DL-PRS-ResourceSetId-r16 OPTIONAL,  nr-TimeStamp-r16 NR-TimeStamp-r16,  nr-RSTD-r16 CHOICE {  k0 INTEGER(0..1970049),  k1 INTEGER(0..985025),  k2 INTEGER(0..492513),  k3 INTEGER(0..246257),  k4 INTEGER(0..123129),  k5 INTEGER(0..61565),  }  And, for NR-DL-TDOA-ReportConfig witin NR-DL-TDOA-RequestLocationInformation  NR-DL-TDOA-ReportConfig-r16 ::= SEQUENCE {  maxDL-PRS-RSRP-MeasurementsPerTRP-r16 INTEGER (1..8) OPTIONAL,  maxDL-PRS-RSTD-MeasurementsPerTRPPair-r16 INTEGER (1..4) OPTIONAL  timingReportingGranularityFactor-r16 INTEGER (0..5) OPTIONAL  } |

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 34 | Sec. 4 | | 6.5.10-15 | Missing value ranges for *nr-RSTD-ResultDiff* in IE *NR-DL-TDOA-AdditionalMeasurementElement* can now be defined based on RAN4 LS R2-2004383. | |
| Huawei, HiSilicon | | For differential RSTD, the follwing agreement has been made in RAN4:  Differential RSTD reporting  The reporting range is from 0 to +8191×Tc  Absolute value is reported for the smallest RSTD measurements and the differential reports are for the other RSTD measurements.  The reporting granularity is the same as for absolute value reporting above  The number of reportable entities, depending on k, is:  k=0: 8192  k=1: 4096  k=2: 2048  k=3: 1024  k=4: 512  k=5: 256 | | | Adopt the following change:  NR-DL-TDOA-AdditionalMeasurementElement-r16 ::= SEQUENCE {  nr-DL-PRS-ResourceId-r16 NR-DL-PRS-ResourceId-r16 OPTIONAL,  nr-DL-PRS-ResourceSetId-r16 NR-DL-PRS-ResourceSetId-r16 OPTIONAL,  nr-TimeStamp-r16 NR-TimeStamp-r16,  nr-RSTD-ResultDiff-r16 CHOICE {  k0 INTEGER(0..8191),  k1 INTEGER(0..4095),  k2 INTEGER(0..2047),  k3 INTEGER(0..1023),  k4 INTEGER(0..511),  k5 INTEGER(0..255) |

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 35 | Sec. 4 | | 6.4.3-17 | Missing value ranges for *nr-relativeTimeDifference* in IE *NR-AdditionalPath* can now be defined based on RAN4 LS R2-2004383. | |
| Huawei, HiSilicon | | For additional Path reporting for RSTD and UE Rx-Tx time differenece, the following agrement has been made in RAN4:  AdditionalPath reporting for RSTD and UE Rx-Tx time difference  The reporting range is from -8175×Tc to +8175×Tc  The reporting granularity is the same as for absolute RSTD reporting  The number of reportable entities, depending on k, is:  k=0: 16352  k=1: 8177  k=2: 4089  k=3: 2045  k=4: 1023  k=5: 512 | | | Adopt the following change for NR-AdditionalPath *– NR-AdditionalPath* The IE *NR-AdditionalPath* is used by the target device to provide information about additional paths in association to the TOA measurements associated to NR positioning in the form of a relative time difference and a quality value. The additional path *nr-relativeTimeDifference* is the detected path timing relative to the detected path timing used for the TOA value, and each additional path can be associated with a quality value *nr-path-Quality.*  -- ASN1START  NR-AdditionalPath-r16 ::= SEQUENCE {  nr-relativeTimeDifference-r16 CHOICE {  k0 INTEGER(0..16351),  k1 INTEGER(0..8176),  k2 INTEGER(0..4088),  k3 INTEGER(0..2044),  k4 INTEGER(0..1022),  k5 INTEGER(0..511)  }  nr-path-Quality-r16 NR-TOAMeasQuality-r16 OPTIONAL,  ...  }  -- ASN1STOP |

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 36 | Sec. 4 | | 6.5.12-10 | Missing value ranges for *nr-UE-RxTxTimeDiff* in IE *NR-Multi-RTT-MeasElement* can now be defined based on RAN4 LS R2-2004383.  Missing value ranges for *nr-UE-RxTxTimeDiffAdditional* in IE *NR-Multi-RTT-AdditionalMeasurementElement* can now be defined based on RAN4 LS R2-2004383. | |
| Huawei, HiSilicon | | For UE Rx-Tx difference, the following agreement has been made:  UE Rx-Tx time difference  Absolute value  The same report mapping as for absolute RSTD reporting  Differential value for additional resource reporting  The same report mapping as for differential RSTD reporting | | | Adopt the following change for multi-RTT measurement: – *NR-Multi-RTT-SignalMeasurementInformation* The IE *NR-Multi-RTT-SignalMeasurementInformation* is used by the target device to provide NR Multi-RTT measurements to the location server. The measurements are provided as a list of TRPs, where the first TRP in the list is used as reference TRP.  -- ASN1START  NR-Multi-RTT-SignalMeasurementInformation-r16 ::= SEQUENCE {  nr-Multi-RTT-MeasList-r16 NR-Multi-RTT-MeasList-r16,  ...  }  NR-Multi-RTT-MeasList-r16 ::= SEQUENCE (SIZE(1.. nrMaxTRPs)) OF NR-Multi-RTT-MeasElement-r16  NR-Multi-RTT-MeasElement-r16 ::= SEQUENCE {  trp-ID-r16 TRP-ID-r16 OPTIONAL,  nr-DL-PRS-ResourceId-r16 NR-DL-PRS-ResourceId-r16 OPTIONAL,  nr-DL-PRS-ResourceSetId-r16 NR-DL-PRS-ResourceSetId-r16 OPTIONAL,  nr-UE-RxTxTimeDiff-r16 CHOICE {  k0 INTEGER(0..1970049),  k1 INTEGER(0..985025),  k2 INTEGER(0..492513),  k3 INTEGER(0..246257),  k4 INTEGER(0..123129),  k5 INTEGER(0..61565),  }  OPTIONAL,  nr-AdditionalPathList-r16 NR-AdditionalPathList-r16 OPTIONAL,  nr-TimeStamp-r16 NR-TimeStamp-r16,  nr-TimingMeasQuality-r16 NR-TimingMeasQuality-r16,  nr-PRS-RSRP-Result-r16 INTEGER (0..126) OPTIONAL,  nr-Multi-RTT-AdditionalMeasurements-r16 NR-Multi-RTT-AdditionalMeasurements-r16,  ...  }  NR-AdditionalPathList-r16 ::= SEQUENCE (SIZE(1..2)) OF NR-AdditionalPath-r16  NR-Multi-RTT-AdditionalMeasurements-r16 ::= SEQUENCE (SIZE (1..3)) OF NR-Multi-RTT-AdditionalMeasurementElement-r16  NR-Multi-RTT-AdditionalMeasurementElement-r16 ::= SEQUENCE {  nr-DL-PRS-ResourceId-r16 NR-DL-PRS-ResourceId-r16 OPTIONAL,  nr-DL-PRS-ResourceSetId-r16 NR-DL-PRS-ResourceSetId-r16 OPTIONAL,  nr-PRS-RSRP-ResultDiff-r16 INTEGER (0..61) OPTIONAL,  nr-UE-RxTxTimeDiffAdditional-r16 CHOICE {  k0 INTEGER(0..8191),  k1 INTEGER(0..4095),  k2 INTEGER(0..2047),  k3 INTEGER(0..1023),  k4 INTEGER(0..511),  k5 INTEGER(0..255),  }  OPTIONAL,  nr-AdditionalPathList-r16 NR-AdditionalPathList-r16 OPTIONAL,  nr-TimeStamp-r16 NR-TimeStamp-r16,  ...  }  nrMaxTRPs INTEGER ::= 256 -- Max TRPs |

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 37 | Sec. 4 | | 6.5.10-16  6.5.11-10  6.5.12-11 | Missing value ranges for *nr-PRS-RSRP-Result* in IE *NR-DL-AoD-MeasElement*, *NR-DL-TDOA-MeasElement* and *NR-Multi-RTT-MeasElement* can now be defined based on RAN4 LS R2-2004383. | |
| Huawei, HiSilicon | | For PRS-RSRP, the follwing agreement is made for the absolute value:  Absolute value  The reporting range is from -156dBm to -31dBm  The reporting granularity is 1dB  The number of reportable entities is 127 | | | Adopt the following change for DL-AOD-MeasElement and NR-DL-TDOA-MeasElement  NR-DL-AoD-MeasElement-r16 ::= SEQUENCE {  trp-ID-r16 TRP-ID-r16 OPTIONAL,  nr-DL-PRS-ResourceId-r16 NR-DL-PRS-ResourceId-r16 OPTIONAL,  nr-DL-PRS-ResourceSetId-r16 NR-DL-PRS-ResourceSetId-r16 OPTIONAL,  nr-TimeStamp-r16 NR-TimeStamp-r16,  nr-PRS-RSRP-Result-r16 INTEGER (0..126) OPTIONAL,  nr-DL-PRS-RxBeamIndex-r16 INTEGER (1..8),  nr-TimingMeasQuality-r16 NR-TimingMeasQuality-r16,  nr-DL-Aod-AdditionalMeasurements-r16 NR-DL-AoD-AdditionalMeasurements-r16,  ...  }  NR-DL-TDOA-MeasElement-r16 ::= SEQUENCE {  ==omitted==  nr-AdditionalPathList-r16 NR-AdditionalPathList-r16 OPTIONAL,  nr-TimingMeasQuality-r16 NR-TimingMeasQuality-r16,  nr-PRS-RSRP-Result-r16 INTEGER (0..126) OPTIONAL,  nr-DL-TDOA-AdditionalMeasurements-r16 NR-DL-TDOA-AdditionalMeasurements-r16,  ...  } |

Rapporteur’s Comments:

- Should also apply to *NR-Multi-RTT-MeasElement.*

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 38 | Sec. 4 | | 6.5.11-11 | Missing value ranges for *nr-PRS-RSRP-ResultDiff* in IE *NR-DL-AoD-AdditionalMeasurementElement* can now be defined based on RAN4 LS R2-2004383. | |
| Huawei, HiSilicon | | The following agreement has been made for differential value for DL-AOD  Differential value when reported for DL-AoD  The reporting range is from -30dBm to 0  Absolute value is reported for the largest PRS-RSRP measurement and the differential reports are for the other PRS-RSRP measurements  The reporting granularity is 1dB  The number of reportable entities is 31 | | | Adopt the following change for DL-AOD-MeasusrementElement  NR-DL-AoD-MeasurementElement-r16 ::= SEQUENCE {  nr-DL-PRS-ResourceId-r16 NR-DL-PRS-ResourceId-r16 OPTIONAL,  nr-DL-PRS-ResourceSetId-r16 NR-DL-PRS-ResourceSetId-r16 OPTIONAL,  nr-TimeStamp-r16 NR-TimeStamp-r16,  nr-PRS-RSRP-ResultDiff-r16 INTEGER (0..30) OPTIONAL,  nr-DL-PRS-RxBeamIndex-r16 INTEGER (1..8),  ...  } |

Rapporteur’s Comments:

- Should apply to *NR-DL-AoD-****Additional****MeasurementElement.*

- The field *nr-PRS-RSRP-ResultDiff* in *NR-DL-AoD-AdditionalMeasurementElement* should probably be renamed to *nr-DL-PRS-RSRP-ResultDiff* (to be consistent).

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 39 | Sec. 4 | | 6.5.12-12  6.5.10-17 | Missing value ranges for *nr-PRS-RSRP-ResultDiff* in IE *NR-Multi-RTT-AdditionalMeasurementElement* can now be defined based on RAN4 LS R2-2004383.  Missing value ranges for *dl-PRS-RSRP-ResultDiff* in IE *NR-DL-TDOA-AdditionalMeasurementElement* can now be defined based on RAN4 LS R2-2004383. | |
| Huawei, HiSilicon | | For differential values for DL-TDOA and multi-RTT, the following agreement was amde:  Differential value when reported for DL-TDOA or multi-RTT  The reporting range is from -30dBm to +30dBm  Absolute value is reported for the same PRS resource for which absolute RSTD or absolute UE Rx-Tx time difference is reported  The reporting granularity is 1dB  The number of reportable entities is 62 | | | For multi-RTT-AdditionalMeasurementElement,  NR-Multi-RTT-AdditionalMeasurementElement-r16 ::= SEQUENCE {  nr-DL-PRS-ResourceId-r16 NR-DL-PRS-ResourceId-r16 OPTIONAL,  nr-DL-PRS-ResourceSetId-r16 NR-DL-PRS-ResourceSetId-r16 OPTIONAL,  nr-PRS-RSRP-ResultDiff-r16 INTEGER (0..61) OPTIONAL,  For NR-DL-TDOA-AdditionalMeasurementElement:  NR-DL-TDOA-AdditionalMeasurementElement-r16 ::= SEQUENCE {  ==omitted==  dl-PRS-RSRP-ResultDiff-r16 INTEGER (0..61) OPTIONAL,  nr-AdditionalPathList-r16 NR-AdditionalPathList-r16 OPTIONAL,  ...  } |

Rapporteur’s Comments:

- The field *nr-PRS-RSRP-ResultDiff* in *NR-Multi-RTT-AdditionalMeasurementElement* should probably be renamed to *nr-DL-PRS-RSRP-ResultDiff* (to be consistent).

- The field *dl-PRS-RSRP-ResultDiff* in *NR-DL-TDOA-AdditionalMeasurementElement* should probably be renamed to *nr-DL-PRS-RSRP-ResultDiff* (to be consistent).

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 40 | Sec. 4 | | 6.4.2-1 | Add PSCell ID information in *CommonIEsRequestAssistanceData* | |
| Huawei, HiSilicon | | In R2-2005107, the following issue is explained.  Unlike Rel-15 where E-UTRA RSTD was introduced as an inter-RAT measurement of NR, we did not introduce NR PRS measurement as an inter-RAT measurement of E-UTRA in Rel-16, which means that if UE is connected to E-UTRA with 5GC (option 5), UE does not support NR PRS measurement. This holds even if UE supports ng-ENDC but before ng-ENDC is configured.  **Observation 1: UE does not support NR PRS measurement in Option 5.**  However, when UE if configured with ng-ENDC (option 7), since UE has an NR connection, UE is able to measure NR PRS, as it is no longer an inter-RAT measurement.  **Observation 2: UE support NR PRS measurement in Option 7.**    Figure 1 Illustration of Option 5 and Option 7  The current LPP supports UE reporting the PCell information in the IE *CommonIEsRequestAssistanceData* of the message *RequestAssistanceData*. In Rel-15, considering RAN architecture, the PCell can be either an LTE cell or an NR cell. With this information, LMF cannot distinguish between Option 5 and Option 7, and has no idea whether UE supports NR PRS measurement.  Therefore, we suggest to include PSCell information as an optional field in the request assistance data message so that LMF could have knowledge of the UE NR connectivity, and it further helps LMF to decide whether to instigate NR positioning method or not.  Proposal 1: Introduce PSCell information reporting in *CommonIEsRequestAssistanceData*. | | | Adopt the below change  – *CommonIEsRequestAssistanceData*  The *CommonIEsRequestAssistanceData* carries common IEs for a Request Assistance Data LPP message Type.  -- ASN1START  CommonIEsRequestAssistanceData ::= SEQUENCE {  primaryCellID ECGI OPTIONAL, -- Cond EUTRA  ...,  [[  segmentationInfo-r14 SegmentationInfo-r14 OPTIONAL -- Cond Segmentation  ]],  [[  periodicAssistanceDataReq-r15  PeriodicAssistanceDataControlParameters-r15  OPTIONAL, -- Cond PerADreq  primaryCellID-r15 NCGI-r15 OPTIONAL -- Cond NR  ]]  [[  psCellID-r16 CHOICE {  eutra-r16 ECGI,  nr-16 NCGI-r15  } OPTIONAL,  ]]  }  -- ASN1STOP   | **Conditional presence** | **Explanation** | | --- | --- | | *EUTRA* | The field is mandatory present for E-UTRA or NB-IoT access. The field shall be omitted for non-EUTRA and non-NB-IoT user plane support. | | *Segmentation* | This field is optionally present, need OP, if *lpp-message-segmentation-req* has been received from the location server with bit 1 (*targetToServer*) set to value 1. The field shall be omitted if *lpp‑message‑segmentation-req* has not been received in this location session, or has been received with bit 1 (*targetToServer*) set to value 0. | | *PerADreq* | The field is mandatory present if the target device requests periodic assistance data delivery. Otherwise it is not present. | | *NR* | The field is mandatory present for NR access. The field shall be omitted for non-NR user plane support. |  | ***CommonIEsRequestAssistanceData* field descriptions** | | --- | | ***primaryCellID***  This parameter identifies the current primary cell for the target device. | | ***segmentationInfo***  This field indicates whether this *RequestAssistanceData* message is one of many segments, as specified in clause 4.3.5. | | ***periodicAssistanceDataReq***  This field indicates a request for periodic assistance data delivery, as specified in clause 5.2.1a. | | ***psCellID***  This field indicates Cell ID for the PSCell in case of DC. | |

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 41 | Sec. 4 | | 6.4.3-18 | Remove the *smtc-r16* field from IE *NR-SSB-Config-r16* | |
| Huawei, HiSilicon | | In RAN1 agreements in RAN1#99 and LS [2], SMTC is configured per SSB frequency. However, currently SMTC is provided per SSB cell with all the remaining information to identify the SSB timing already being available. Hence, the use of SMTC is questionable.   |  | | --- | | Agreement:   * For SRS for positioning, if the *spatialRelationInfo* or *pathlossReferenceRS* indicates an SSB, the following information can be provided for the indicated SSB: * PCI of the cell * *ssbFrequency* with values: *ARFCN-ValueNR* * *halfFrameIndex* with values: 0 or 1 * *SSB-periodicity* with values: *ServingCellConfigCommon* IE. * *ssbSubcarrierSpacing* with values: *SubcarrierSpacing* IE * *SFN-SSBoffset* with values: {0,1,2,…15} * *Smtc* per SSB frequency layer with values *: SSB-MTC* * *SFN0 Offset* per physical cell ID: Time offset of the SFN0 slot0 of a given cell with respect to the serving Pcell. * SSB Index * *SS-PBCH-BlockPower* (at least when SSB is used as *pathlossReferenceRS* for an SRS) * Note: SSB frequency layer is determined by ssbFrequency and ssbSubcarrierSpacing * Note: RAN1 assumes that the above information is indicated in RRC |   In addition, procedure-wise there is no description on how UE measures/searches SSB with this SMTC, nor is there any field description of SMTC, although the need code is Need S.  Third, RAN4 agreed that UE is not required to perform additional SSB measurement that serves as PRS QCL source reference signal, which we believe should be extended as well to spatial relation and pathloss reference for SSB.  Therefore, we do not think SMTC should be provided in SSB-Configuration.  Proposal: Delete the fields *smtc-r16* and *duration-r16* from *NR-SSB-Config-r16*. | | | Adopt the below change  *– NR-SSB-Config*  The IE *NR-SSB-Config* defines SSB configuration.  -- ASN1START  NR-SSB-Config-r16 ::= SEQUENCE {    trp-ID-r16 TRP-ID-r16,  ss-PBCH-BlockPower-r16 INTEGER (-60..50),  halfFrameIndex-r16 INTEGER (0..1),  SSB-periodicity-r16 ENUMERATED { ms5, ms10, ms20, ms40, ms80, ms160, ...},  ssb-PositionsInBurst-r16 CHOICE {  shortBitmap-r16 BIT STRING (SIZE (4)),  mediumBitmap-r16 BIT STRING (SIZE (8)),  longBitmap-r16 BIT STRING (SIZE (64))  } OPTIONAL, --Need OR  ssbSubcarrierSpacing-r16 ENUMERATED {kHz15, kHz30, kHz60, kHz120, kHz240, ...},  sfn-SSB-Offset-r16 INTEGER (0..15)  }  }  -- ASN1STOP |

Rapporteur’s Comments:

- Agreement at RAN1#101e:

Remove SMTC from SSB assistance data for DL (PRS processing) and UL (spatial relation info or pathloss reference RS)

• Send an LS to RAN2

• Update the higher layer parameter list

• Note: This reverts the working assumption made in RAN1#99 for DL and the prior agreement made for UL.

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 42 | Sec. 4 | | 6.4.3-19 | Change the field *ssbSubcarrierSpacing-r16* in IE *NR-SSB-Config* to optional present.  The field name should be *ssb-SubcarrierSpacing* with a “-“ | |
| Huawei, HiSilicon | | The subcarrier space of the SSB generally goes with the band. as shown by the following table.  C:\Users\y00397895\AppData\Roaming\eSpace_Desktop\UserData\y00397895\imagefiles\71ED1CFE-A495-40C4-9CCA-49E3B52675D1.png  With ARFCN also in the NR-SSB-Config, the UE could know the band of the SSB, hence the subcarrier spacing. SCS is only needed in special case, e.g., n5 or n41 | | | Change the field s*sbSubcarrierSpacing-r16* under *NR-SSB-Config* to be optional.  also, the field name should *be ssb-SubcarrierSpacing* with a “-“ |

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 43 | Sec. 4 | | 6.4.3-20 |  | |
| Huawei, HiSilicon | | Add field description for *trp-Id, nr-DL-PRS-ResourceID-Lis*t and *nr-DL-PRS-ResoruceSetId* within *DL-PRS-IdInfo* | | | Add field description for the following fields  *trp-ID-r16*  The field description can be determined after the email discussion on trp-id  *nr-DL-PRS-ResourceID-List-r16*  List of resourec Ids for the DL PRS resources on the RSTD reference TRP  *nr-DL-PRS-ResourceSetId-r16*)  resource set id for the DL PRS resource set on the RSTD reference TRP |

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 44 | Sec. 4 | | 6.4.3-21 |  | |
| Huawei, HiSilicon | | The field descriptions of *NR-DL-PRS-ReferenceInfo-r16*, *NR-TimeStamp-r16*, and *NR-SelectedDL-PRS-PerFreq-r16* are missing. | | | Propose the following field descriptions:  ***NR-DL-PRS-ReferenceInfo***  Note that the description is also related to the discussion in Issue 3 above on "assistance data reference TRP" and "RSTD reference TRP". Now, this field description can be FFS.  ***NR-TimeStamp***  Time stamp associated with the DL-TDOA/RSRP/UE rx-tx time difference measurement for DL-TDOA, DL-AOD and multi-RTT  ***NR-SelectedDL-PRS-PerFreq***  DL PRS resource configuerd for a specific frequency layer. |

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 45 | Sec. 4 | | 6.4.3-22 | The current definition for *dl-PRS-Periodicity-and-ResourceSetSlotOffset* includes the *scs* of the PRS which is also provided in IE *NR-DL-PRS-PositioningFrequencyLayer.*  Remove the scs from *NR-DL-PRS-Periodicity-and-ResourceSetSlotOffset*. | |
| Huawei, HiSilicon | | The current configuration for *dl-PRS-Periodicity-and-ResourceSetSlotOffset*  is a bit redundant in that *scs* of the PRS is configured under the frequency layer configuration, which is applicable for all the TRPs and their PRS resources. While, here, the *scs* is configured again.  Prefer to enforce the restirction on the range of values for periodicity and offset with field description.  The field description of *dl-PRS-Periodicity-and-ResourceSetSlotOffset* needs more clarification, accordingly  1) The meaning of nxxx, e.g., n4-r16. | | | Change the name of the field to *dl-PRS-PeriodicityAndResourceSetOffset*  Change the structure of IE *dl-PRS-Periodicity-and-ResourceSetSlotOffset* as follows:  NR-DL-PRS-Periodicity-and-ResourceSetSlotOffset-r16 ::= CHOICE {  n4-r16 INTEGER (0..3),  n5-r16 INTEGER (0..4),  n8-r16 INTEGER (0..7),  n10-r16 INTEGER (0..9),  n16-r16 INTEGER (0..15),  n20-r16 INTEGER (0..19),  n32-r16 INTEGER (0..31),  n40-r16 INTEGER (0..39),  n64-r16 INTEGER (0..63),  n80-r16 INTEGER (0..79),  n128-r16 INTEGER (0..127),  n160-r16 INTEGER (0..159),  n256-r16 INTEGER (0..255),  n320-r16 INTEGER (0..319),  n512-r16 INTEGER (0..511),  n640-r16 INTEGER (0..639),  n1280-r16 INTEGER (0..1279),  n2560-r16 INTEGER (0..2559),  n5120-r16 INTEGER (0..5119),  n10240-r16 INTEGER (0..10239),  n20480-r16 INTEGER (0..20479),  n40960-r16 INTEGER (0..40959),  n81920-r16 INTEGER (0..81919),  ...}  Clarify in the field description.  For PRS periodicity, n4 stands for 4 slots; n5 stands for 5 slots and so on  For Resoruce set slot offset, it configures the offset in number of slots  DL PRS periocidity adopt the following range of values for the corresponding dl-PRS-SubcarrierSpacing configured under NR-DL-PRS-AssistanceData  15khz n4, n5,n8,n10,n16,n20,n32,n40,n64,n80,n160,n320,n640,n1280,n2560,n10240  30khz n8,n10,n16,n20,n32,n40,n64,n80,n160,n320,n640,n1280,n2560,n10240, n20480  60khz n16,n20,n32,n40,n64,n80,n160,n320,n640,n1280,n2560,n10240, n20480, n40960  120khz n32,n40,n64,n80,n160,n320,n640,n1280,n2560,n10240, n20480, n40960, n81920 |

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 46 | Sec. 4 | |  | Field description Tables do not follow LPP style and/or are missing. | |
| Huawei, HiSilicon | | ASN.1 guideline in 38.331 has the following guideline for field description. and the guideline for field descritpion for IE is the same as that for PDU  **This is a general problem for the current LPP spec and the issue includes but not limited to the case of NR-DL-PRS-Config**  The ASN.1 section specifying the contents of a PDU type may be followed by a *field description* table where a further description of, e.g., the semantic properties of the fields may be included. The general format of this table is shown in the example below. The field description table is absent in case there are no fields for which further description needs to be provided e.g. because the PDU does not include any fields, or because an IE is defined for each field while there is nothing specific regarding the use of this IE that needs to be specified.   | ***%PDU-TypeIdentifier%* field descriptions** | | --- | | ***%field identifier%***  Field description. | | ***%field identifier%***  Field description. |   The field description table has one column. The header row shall contain the ASN.1 type identifier of the PDU type.  The following rows are used to provide field descriptions. Each row shall include a first paragraph with a *field identifier* (in ***bold and italic*** font style) referring to the part of the PDU to which it applies. The following paragraphs at the same row may include (in regular font style), e.g., semantic description, references to other specifications and/or specification of value units, which are relevant for the particular part of the PDU.  The parts of the PDU contents that do not require a field description shall be omitted from the field description table. | | | The field description of NR-DL-PRS-Config can be re-organized into 3 blocks for 3 different IEs  o NR-DL-PRS-Config  o NR-DL-PRS-ResourceSet  o NR-DL-PRS-Resource |

Rapporteur’s Comments:

- LPP does not follow the guidelines from 38.331 (it can not, since LPP exists from Rel-9).

- LPP ASN.1 follows (in general) the guidelines from 36.331.

- Field description tables in LPP are (in general) sorted as the field appears in ASN.1.

- Almost all new Field Description Tables may require revisions (as I mentioned before). However, this can also be done when the ASN.1 is stable.

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 47 | Sec. 4 | | 6.4.3-23 |  | |
| Huawei, HiSilicon | | Same as above, the field description of dl-PRS-ResourceSlotOffset needs more clarification, e.g., what does "1" stand for? | | | Revise the field description for dl-PRS-ResourceSlot Offset  ***dl-PRS-ResourceSlotOffset***  This parameters indicates points to starting slot of DL PRS Resource with respect to corresponding DL-PRS-ResourceSetSlotOffset in number of slots***.*** |

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 48 | Sec. 4 | | 6.4.3-24 | The field description of *nrARFCNRef-r16* in IE *TRP-ID* is not correct; description depends on the usage of the field. | |
| Huawei, HiSilicon | | The field description of *nrARFCNRef-r16* is not correct. The current field description is  ***nrARFCNRef***  This field specifies the NRARFCN of the TRP.  While this is not correct at all. ARFCN should indicate the following when included in different fields  NR-SSB-Config: indicate the ARFCN of the SSB  TRP-LocationInforElement: not needed  NR-DL-PRS-BeamInfo: ARFCN fo the PRS  Ref-TRP-TRD-Info: not needed  so on and so forth.  The above also can be a good reason why we should not use a TRP id as a contained for prs-id, AFRFCN, etc. the exact condition for when the field is absent/present is not refleced in the spec. The spec should be clear on this point. | | | Keep an eye on this and wait for the result of the email discussion on TRP id and progress based on that. |

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 49 | Sec. 4 | | 6.4.3-25 |  | |
| Huawei, HiSilicon | | The field description of *NR-SSB-Config field descriptions* needs to be modified according to the following issues：  1) Some fields description are missing, e.g., *TRP-ID*.  2) *ssb-periodicityServingCell* field doesn't exist, which should be aligned with the field name.  3) The field description of *ssb-Index* should be more specific. | | | For TRP id, again, can wait for the result of the email discusion  *ssb-periodicityServingCell* should be changed to *ssb-periodicity*  *ssb-Index* field description: Index of ssb serves as the source reference signal for the QCL relationship for DL PRS. |

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 50 | Sec. 4 | |  |  | |
| Huawei, HiSilicon | |  | | | Some typos need to be revised, e.g.,   * + In the description for *NR-SelectedDL-PRS-IndexList,*  In case of multiple methods, the *NR-DL-PRS-ProvideAssistanceData-r16* may only be present in one of the method (in IE *NR-SelectedDL-PRS-PerFreq-r16*) 🡺 Should be “*NR-DL-PRS-AssistanceData-r16*”.   + The IE *DL-PRS-IdInfo* provides IDs provides the IDs of the reference and neighbour TRPs DL-PRS Resources. (in IE *DL-PRS-IdInfo*)   Suggest to change the naming of “*NR-UL-SRS-MeasCapability*” since UE only transmits SRS, for example, can be revised as “*NR-UL-SRS-TransCapability*”. |

|  |  |
| --- | --- |
| Company | Comments |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

# 5. Others

|  |  |  |
| --- | --- | --- |
| Company | Description/Problem | Proposed Solution |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |