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

Online, June 01 – 12, 2020

**Agenda item:** x.y.z

**Source:** Qualcomm Incorporated

**Title:** Email discussion report: [Post109bis-e][948][POS] LPP ASN.1 review (Qualcomm)

**Document for:**  Discussion and Decision

# 1. Introduction

This document summarizes the following email discussion:

* [Post109bis-e][948][POS] LPP ASN.1 review (Qualcomm)

      Scope: Gather and discuss issues and develop a running CR for ASN.1 corrections, with R2-2003981 as a baseline.

      Intended outcome: Open issues list and CR to next meeting

      Deadline:  Long

Section 2 lists the open issues identified during RAN2#109bis-e [1], [2], [3].

Section 3 collects companies’ views on the open issues. If there were possible options for a solution already identified at RAN2#109bis-e, the options are listed.

Section 4 is for collection of any additional ASN.1 issues. Note, R2-2003981 [4] should be used as baseline for any new issue.

## References

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

[2] R2-2003983, "Email discussion report: [AT109bis-e][602][POS] LPP ASN.1 structural issues", Ericsson.

[3] R2-2003805, "Report of session on Rel-15 and -16 LTE and NR positioning", Session Chair (MediaTek).

[4] R2-2003981, "LPP Clean-Up", Qualcomm Incorporated.

[5] R1-20xxxxx, "RAN1 Chairman’s Notes", RAN1#100bis-e.

# 2. Open Issues List

During RAN2 #109bis-e, the following open issues have been identified [1], [2], [3]:

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|  | Reference | Issue #(digits before -x refer to LPP section) | Brief Description / Headline |
| 1 | Sec. 2.2 in [1] | 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 |
| 2 | Sec. 3.1 in [1] | 6.4.3-1 | Consider renaming the IE NR-TimingMeasQuality. |
| 3 | Sec. 3.2.1 in [1] | 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. |
| 4 | Sec. 3.2.2a in [1] | 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. |
| 5 | Sec. 3.2.2b in [1] | 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 [1] | 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 [1] | 6.4.3-9 | Conditional presence of trp-id field in IE NR-TimeStamp is confusing/wrong. |
| 8 | Sec. 3.3 in [1]Sec. 2.4 in [2] | 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. |
| 9 | Sec. 3.3 in [1] | 6.4.3-11 | The description of ‘nr-DL-PRS-SFN0-Offset’ should be modified for UE-assisted positioning.  |
| 10 | Sec. 2.2 in [2] | 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.  |
| 11 | Sec. 4.1.2 in [1] | 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. |
| 12 | Sec. 5.1 in [1]Sec. 2.5 in [2] | 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 [1] | 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 [1] | 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 [1] | 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 [1] | 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. |
| 17 | Sec. 5.5.1 in [1] | 6.5.10-10 | The capability for periodic reporting cannot be indicated separately for the positioning mode. |
| 18 | Sec. 5.5.2 in [1] | 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) |
| 19 | Sec. 6.1 in [1] | 6.5.11-1 | Same as 6.5.10-1, but for DL-AoD |
| 20 | Sec. 6.4.1 in [1] | 6.5.11-6 | Same as 6.5.10-10, but for DL-AoD |
| 21 | Sec. 6.6 in [1] | 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 [1] | 6.5.12-1 | Same as 6.5.10-1, but for Multi-RTT |
| 23 | Sec. 7.3.1 in [1] | 6.5.12-4 | Same as 6.5.10-8, but for Multi-RTT |
| 24 | Sec. 7.4.1 in [1] | 6.5.12-6 | Same as 6.5.10-11, but for Multi-RTT |

# 3. Discussion

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

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|  | Reference | Issue # | Brief Description / Headline |
| 1 | Sec. 2.2 in [1] | 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 |

Description:

(a) The IE *NR-PhysCellId* is currently defined in section 6.4.1 (Common Lower-Level IEs), but it is currently used for NR Positioning only. It was proposed to move this IE to section 6.4.3 (Common NR Positioning Information Elements).

NOTE 1: A NR Physical Cell ID is already used in Rel-15 (e.g., for GNSS Fine Time Assistance), but not defined as a separate IE. Note also, that section 6.4.1 already defines *ARFCN-ValueNR* and *NCGI* (Common Lower-Level IEs).

(b) The IE *RelativeLocation* is currently defined in section 6.4.3 (Common NR Positioning Information Elements), since only used for NR Positioning. It was proposed to move this IE to section 6.4.1 (Common Lower-Level IEs).

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| Company | Comments |
| Huawei, HiSilicon | The proposed chagne is fine with us. |
| vivo | *NR-PhysCellId* should be put under 6.4.1. NR PCI, ARFCN and CGI should be put in the same place since so far NRARFCN and NRCGI are put under 6.4.1.*RelativeLocation* is fine keep in 6.4.3. |
| CATT | There is no need to move the two IEs, because:* No need to move *NR-PhysCellId* from 6.4.1 (Common Lower-Level IEs) to section 6.4.3 because the IE is not only used in NR positioning.
* No need to move *RelativeLocation* from section 6.4.3 to section 6.4.1 because the IE *RelativeLocation-r16* is used in NR positioning for TRP so far.
 |
| MediaTek | This is about clarity rather than function, so it’s somewhat a matter of opinion. We tend to think both IEs make more sense in 6.4.1, but OK to go with the majority view on both. |
| Ericsson | No strong view, but the decision to collapse 6.4.3 was to make it easier to find the IEs, but it is also reasonable to keep NRARFCN, NCGI and NPCI together. The relativelocation should be in 6.4.1 as it is RAT agnostic, and it is more clear to keep common attributes in the common section 6.4.1.Same view as MediaTek, both IEs in 6.4.1 make most sense. |
| Intel | Agree with MediaTek, it is matter of taste. Ok to go with the majority view.  |
| Nokia | No strong opinion as to which section the IEs are placed but the RelativeLocation seems to be used in both NR-TRP-LocationInfo IE and GNSS-SSR-ListOfCorrectionPoints-r16. Since both RelativeLocation-r16 and RelativeLocation contains delta latitude and delta longitude, we could have extended the existing RelativeLocation? If so, the IE is common to both NR RAT dependent methods use the TRP information and PPP-RTK method. |
| OPPO | Share the view from MediaTek and Intel. |
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|  | Reference | Issue # | Brief Description / Headline |
| 2 | Sec. 3.1 in [1] | 6.4.3-1 | Consider renaming the IE NR-TimingMeasQuality. |

Description:

The IE *NR-TimingMeasQuality* is currently used in

- *NR-AdditionalPathList*

- *NR-RTD-Info*

- *NR-DL-TDOA-SignalMeasurementInformation*

- *NR-Multi-RTT-SignalMeasurementInformation*

Given that not all usages may be considered as "measurements", it was proposed to consider changing the name of the IE; for example, *NR-TimingQuality.*

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| Company | Comments |
| Huawei, HiSIlicon | Agree with the agrument above.  |
| vivo | We think the parameter is defined by RAN1 for meaurement. We don’t think the reused in other place is accurately (such as in *NR-RTD-Info*).if not appropriate, we shouldn’t reuse it other than change the name. |
| CATT | Ok. |
| MediaTek | NR-TimingQuality seems to match the function of the IE better. |
| Ericsson | Agree |
| Intel | Agree the proposal.  |
| Nokia | This parameter representing the quality of timing measuremet is sent as measurement quality from UE to LMF, but it is also sent from LMF to UE as the quality of timing information (relative time difference, RTD). So, not only we have to change the IE name (suggested name above is fine) we must also update the IE description in 6.4.3.2. In 6.4.3.2 it is assuming the quality represents only the timing measurement quality. Also, the timing measurement need to be clarified as to what specific measurement it is i.e TOA? RSTD? RTOA? |
| OPPO | Share the view from Nokia. |
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|  | Reference | Issue # | Brief Description / Headline |
| 3 | Sec. 3.2.1 in [1] | 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:

(a) Reference TRP Information

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).

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| 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. |
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(b) *nr-DL-PRS-SFN0-Offset*

The definition of the SFN0-offset (*nr-DL-PRS-SFN0-Offset-r16*) also requires definition of a "assistance data reference TRP". The field is currently misplaced in IE *NR-DL-PRS-Config-r16* (which has no notion of a "assistance data reference TRP" whatsoever). It should appear at the same level as the expected RSTD:

-- ASN1START

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

 nr-DL-PRS-ResourceSetList-r16 SEQUENCE (SIZE (1..nrMaxSetsPerTrp-r16)) OF

 NR-DL-PRS-ResourceSet-r16,

 ...

}

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

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

 dl-PRS-Periodicity-and-ResourceSetSlotOffset-r16

 NR-DL-PRS-Periodicity-and-ResourceSetSlotOffset-r16,

 dl-PRS-ResourceRepetitionFactor-r16 ENUMERATED {n1, n2, n4, n6, n8, n16, n32, ...},

 dl-PRS-ResourceTimeGap-r16 ENUMERATED {s1, s2, s4, s8, s16, s32, ...},

 dl-PRS-NumSymbols-r16 ENUMERATED {n2, n4, n6, n12, ...},

 dl-PRS-MutingOption1-r16 DL-PRS-MutingOption1-r16 OPTIONAL, -- Need OP

 dl-PRS-MutingOption2-r16 DL-PRS-MutingOption2-r16 OPTIONAL, -- Need OP

 dl-PRS-ResourcePower-r16 INTEGER (-60..50),

 dl-PRS-ResourceList-r16 SEQUENCE (SIZE (1..nrMaxResourcesPerSet-r16)) OF

 NR-DL-PRS-Resource-r16,

 ...

}

-- ASN1START

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,

 ...

}

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

 nr-DL-PRS-PositioningFrequencyLayer-r16

 NR-DL-PRS-PositioningFrequencyLayer-r16,

 nr-DL-PRS-AssistanceDataPerFreq-r16 SEQUENCE (SIZE (1..nrMaxTRPsPerFreq-r16)) OF

 NR-DL-PRS-AssistanceDataPerTRP-r16,

 ...

}

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

 trp-ID-r16 TRP-ID-r16,

 nr-DL-PRS-SFN0-Offset-r16 NR-DL-PRS-SFN0-Offset-r16,

 nr-DL-PRS-expectedRSTD-r16 INTEGER (-3841..3841),

 nr-DL-PRS-expectedRSTD-uncerainty-r16 INTEGER (-246..246),

 nr-DL-PRS-Config-r16 NR-DL-PRS-Config-r16,

 ...

}

NR-DL-PRS-SFN0-Offset-r16 ::= SEQUENCE {

 sfn-Offset-r16 INTEGER (0..1023),

 integerSubframeOffset-r16 INTEGER (0..9) OPTIONAL, -- Need OP

 ...

}

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| Company | Comments |
| Huawei, HiSilicon | We als think that the nr-DL-PRS-SFN0-Offset should be moved under NR-DL-PRS-AssistanceDataPerTRP. But, in this case, there is only one field within the IE NR-DL-PRS-Config. Maybe there is no need to define the IE NR-DL-PRS-Config, but use the field nr-DL-PRS-ResourceSetList directly.  |
| vivo | Agree with this change. |
| CATT | Support to move TRP level, according to the RAN1 LS:“Defines time offset of the SFN0 slot 0 for given TRP with respect to SFN0 slot 0”  |
| MediaTek | This change seems to make sense. |
| Ericsson | Agree. Regardig the suggestion by Huawei about removing the NR-DL-PRS-Config IE. We think it is motivated to keep, since the IE also defines the finer structures of DL-PRS resource set and resource. However, for better consistency with LTE, the IE name should be changed to NR-DL-PRS-Info |
| Intel | The changes is ok.  |
| Nokia | Agree. |
| OPPO | Agree |
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|  | Reference | Issue # | Brief Description / Headline |
| 4 | Sec. 3.2.2a in [1] | 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. |

Description:

*dl-PRS-ResourceRepetitionFactor* and *dl-PRS-ResourceTimeGap* are mandatory present. If there is typically no repetition, the fields could be optional present (with default interpretation when absent):

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

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

 dl-PRS-Periodicity-and-ResourceSetSlotOffset-r16

 NR-DL-PRS-Periodicity-and-ResourceSetSlotOffset-r16,

 dl-PRS-ResourceRepetitionFactor-r16 ENUMERATED {n1, n2, n4, n6, n8, n16, n32, ...}

 OPTIONAL, -- Need OP

 dl-PRS-ResourceTimeGap-r16 ENUMERATED {s1, s2, s4, s8, s16, s32, ...}

 OPTIONAL, -- Need OP

 dl-PRS-NumSymbols-r16 ENUMERATED {n2, n4, n6, n12, ...},

 dl-PRS-MutingOption1-r16 DL-PRS-MutingOption1-r16 OPTIONAL, -- Need OP

 dl-PRS-MutingOption2-r16 DL-PRS-MutingOption2-r16 OPTIONAL, -- Need OP

 dl-PRS-ResourcePower-r16 INTEGER (-60..50),

 dl-PRS-ResourceList-r16 SEQUENCE (SIZE (1..nrMaxResourcesPerSet-r16)) OF

 NR-DL-PRS-Resource-r16,

 ...

}

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| Company | Comments |
| Huawei, HiSilicon | SupportBut also, if this is optional, the field value n1 and s1 are not necessary and can thus be removed.  |
| vivo | We’re OK with need OP. |
| CATT | dl-PRS-ResourceRepetitionFactor-r16 = 1 means no resource repetition. n1 can be removed if dl-PRS-ResourceRepetitionFactor-r16 is OP. If the IE is not included, it means dl-PRS-ResourceRepetitionFactor-r16 =n1;s1 also can be removed as well if dl-PRS-ResourceTimeGap-r16 is OP. |
| MediaTek | It’s already clear from the field description that dl-PRS-ResourceTimeGap should be OPTIONAL (the description says it is provided only if the repetition factor is greater than 1). We tend to think no default behaviour on absence is needed; the field can be described in a condition as mandatory when dl-PRS-ResourceRepetitionFactor is greater than 1, and absent otherwise. With this approach we would still need the value s1, since absence of the field means “not applicable” rather than “value 1”. Alternatively, as suggested by others above, we could eliminate s1, but at the cost of having slightly more complex behaviour on absence (absent means “n/a” if dl-PRS-ResourceRepetitionFactor>1, or “s1” otherwise).For dl-PRS-ResourceRepetitionFactor, no strong view, but if we introduce the default behaviour we should remove n1 from the range (we don’t need two different ways to indicate “no repetition”). |
| Ericsson | Agree with MediaTek |
| Intel | Agree with MediaTek.  |
| Nokia | We tend to think that we should keep the value range provided by RAN1 or at least check with RAN1 before altering the value ranges. In case we just change the fields as Optional Need OP without any value range changes, then UE behavior needs to be specified on absence of the fields. |
| OPPO | Agree with MediaTek |
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|  | Reference | Issue # | Brief Description / Headline |
| 5 | Sec. 3.2.2b in [1] | 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

 }

}

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| 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. |
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|  | Reference | Issue # | Brief Description / Headline |
| 6 | Sec. 3.2.5 in [1] | 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)".

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|  | 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)?

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| 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. |
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|  | Reference | Issue # | Brief Description / Headline |
| 8 | Sec. 3.3 in [1]Sec. 2.4 in [2] | 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. |

Description:

Currently, all IEs needed for UE-based only are collected in a single IE:

-- ASN1START

NR-PositionCalculationAssistance-r16 ::= SEQUENCE {

 nr-trp-LocationInfo-r16 NR-TRP-LocationInfo-r16 OPTIONAL, -- Need ON

 nr-dl-prs-BeamInfo-r16 NR-DL-PRS-BeamInfo-r16 OPTIONAL, -- Need ON

 nr-rtd-Info-r16 NR-RTD-Info-r16 OPTIONAL, -- Need ON

 ...

}

-- ASN1STOP

This IE is then included in the *XXX-ProvideAssistanceData* messages; e.g.:

-- 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, -- 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

It was proposed to split the *NR-PositionCalculationAssistance* into two IEs (analogous to posSIBs):

-- 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, -- Need ON

 nr-UEB-TRP-LocationData-r16 NR-UEB-TRP-LocationData-r16 OPTIONAL, -- Cond UEB

 nr-UEB-TRP-RTD-Info-r16 NR-UEB-TRP-RTD-Info-r16 OPTIONAL, -- Cond UEB

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

 ...

}

-- ASN1STOP

The *NR-UEB-TRP-LocationData* and *NR-UEB-TRP-RTD-Info* are currently defined outside the *LPP-PDU-Definitions* (as basic production for posSIBs) and would have to be moved to section 6.4.3 (Common NR Positioning Information Elements).

NOTE 8: If the above split is desired, should the same apply to both, DL-TDOA and DL-AoD? I.e., should the *NR-UEB-TRP-RTD-Info* also be present for DL-AoD? With the current structure, the option exists at least.

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| Company | Comments |
| Huawei, HiSilicon | We cannot see a clear motivation for this while for posSIB, there is a clear motivation.  |
| vivo | It should be same for DL-TDOA and DL-AoD because posSibType6 is both for DL-TDOA and DL-AoD. |
| CATT | Share the same view as Huawei. Need a motivation to triger it. |
| MediaTek | This seems like a distinction without a difference. We prefer not to change unless there is a practical reason (does something not work with the current structure?). |
| Ericsson | At RAN2-109bis, email discussion 602, the following companies were in favor of using the same IEs in broadcast and unicast:Intel, Apple, Huawei/HiSilicon, vivo, EricssonWhile only Qualcomm did not see the issueAs we are now making the specification clear and easy to read, while following the example of LTE, where we did not introduce dedicated IEs to group information for the purpose of pos SIBs, but reused existing grouping.If we are collapsing subsections and moving other things to give a logical structure in LPP, we should be consistent with this one as well.The same should of course apply to all positioning methods, but there is also a separate discussion about grouping the DL-PRS AD at a higher level which is logical. |
| Intel | Same as others. Would like to see the real motivation on the changes.  |
| Nokia | We prefer to leave the current definitions as it is. It is more intuitive to know that the position calculation assistance data is optionally used for UE-based positioning. |
| OPPO | No need for the change. |
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|  | Reference | Issue # | Brief Description / Headline |
| 9 | Sec. 3.3 in [1] | 6.4.3-11 | The description of ‘nr-DL-PRS-SFN0-Offset’ should be modified for UE-assisted positioning.  |

Description:

The description of *nr-DL-PRS-SFN0-Offset* should be modified for UE-assisted positioning. This parameter is used for the UE to obtain the timing of TRPs. If the UE doesn’t known the timing of reference TRP, this parameter makes no sense.

Option 1: Change "reference TRP" to "serving cell".

Option 2: Add a description like "The location server should include at least one TRP for which the SFN can be obtained by the target device, e.g. a TRP from the serving cell", so that the UE may also obtain the timing of each TRP.

Option 3: Providing absolute SFN0 timing of reference TRP for the UE.

NOTE 9a: There may not always be a "serving cell" (e.g., broadcast), and a serving cell may change during a positioning session.

NOTE 9b: The *nr-DL-PRS-SFN0-Offset* is always needed for PRS processing (i.e., not only for UE-assisted mode).

NOTE 9c: Option 2 was sufficient for LTE, but is it also sufficient for NR? I.e., in LTE, there is no SFN offset.

NOTE 9d: The issue seems related to 3 (#6.4.3-2; Reference TRP Information) and 7 (#6.4.3-9; trp-id field in IE NR-TimeStamp).

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| Company | Comments |
| Huawei, HiSilicon | We agree with the rapporteur that the issue is related to the definition of assistance data reference trp and RSTD reference TRP. We think these two references can be the same while the description in option2 added tha thte offset is with respect to the reference TRP.  |
| vivo | Option1 or Option2 are prefered.agreement in RAN1#98bis.

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| Agreement:* A higher layer parameter, DL-PRS-SFN0-Offset, is configured
	+ Defines time offset of the SFN0 slot 0 for given TRP with respect to SFN0 slot 0 of FFS for RAN2 WG 1) serving TRP or 2) serving cell 3) etc.
	+ FFS values
 |

 |
| CATT | The issue can be discussed in #6.4.3-2; Reference TRP Information. The *nr-DL-PRS-SFN0-Offset* should always be required in PRS processing. |
| MediaTek | Option 2 seems still valid; can’t the SFN offset just be applied relative to the obtained SFN? |
| Intel | Option 2 is same as legacy.  |
| Nokia | So far in NR we seem to be using TRP instead of cell. So, option 1 is not OK. Option 2 is fine with us. |
| OPPO | Option-2 |
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|  | Reference | Issue # | Brief Description / Headline |
| 10 | Sec. 2.2 in [2] | 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.  |

Description:

Direction/angle information is currently provided as a single field with 0.1 degrees resolution:

DL-PRS-BeamInfoElement-r16 ::= SEQUENCE {

 dl-PRS-Azimuth-r16 INTEGER (0..3599),

 dl-PRS-Elevation-r16 INTEGER (0..1800) OPTIONAL, -- Need ON

 ...

}

LCS-GCS-Translation-Parameter-r16 ::= SEQUENCE {

 alpha-r16 INTEGER (0..3599),

 beta-r16 INTEGER (0..3599),

 gamma-r16 INTEGER (0..3599),

 ...

}

It was proposed to use 1-degree resolution together with a 0.1-degree delta-field:

DL-PRS-BeamInfoElement-r16 ::= SEQUENCE {

 dl-PRS-Azimuth-r16 INTEGER (0..359),

 dl-PRS-Azimuth-fine-r16 INTEGER (0..9) OPTIONAL, -- Need OP

 dl-PRS-Elevation-r16 INTEGER (0..180) OPTIONAL, -- Need ON

 dl-PRS-Elevation-fine-r16 INTEGER (0..9) OPTIONAL, -- Need OP

 ...

}

LCS-GCS-Translation-Parameter-r16 ::= SEQUENCE {

 alpha-r16 INTEGER (0..359),

 alpha-fine-r16 INTEGER (0..9) OPTIONAL, -- Cond AzElFine

 beta-r16 INTEGER (0..359),

 beta-fine-r16 INTEGER (0..9) OPTIONAL, -- Cond AzElFine

 gamma-r16 INTEGER (0..359),

 gamma-fine-r16 INTEGER (0..9) OPTIONAL, -- Cond AzElFine

 ...

}

|  |  |
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| Company | Comments |
| Huawei, HiSilicon | we also think 0.1 degree resolution is desirable.  |
| vivo | If 1 degree is a normal case, then we are OK with this change. |
| CATT | We are OK to use 1-degree resolution together with a 0.1-degree delta-field. |
| MediaTek | This gains 2 bits per dimension in case the delta field is not used: 0..3599 is 12 bits, while 0..359+optionality bit is 10 bits. It costs 3 bits per dimension when the delta field is used (12 bits vs. 10+4+optionality bit). The tradeoff hinges on whether 1-degree resolution is really the normal case—if so, the change makes sense. We tend to think this is reasonable. |
| Ericsson | In the email discussion 602 at the last meeting we provided message sizes for PER-encoded ASN.1 for the two alternatives, where a significant IE size reduction of 18% could be seen if only 1-degree information was available, while there was a negligible overhead if 0.1 information was available. Therefore, this is a very reasonable change. |
| Intel | It is related to whether 1 degree is normal case or not.  |
| Nokia | If the motivation is to save 2 bits then it does not seem like a strong justification to make this change. We would like to understand what the consequence will be if this change is not done. Reporting at 0.1 degrees granularity seems better than reporting at 0.1 degrees as an optional capability. |
| OPPO | Same view as Nokia. |
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|  | Reference | Issue # | Brief Description / Headline |
| 11 | Sec. 4.1.2 in [1] | 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. |

Description:

The system frame number in IE *NR-ECID-SignalMeasurementInformation* is currently mandatory present. However, since the measurement element is used for all measured cells/TRPs (i.e., also for neighbour TRPs), a SFN of the measured cell may not always be available at the target device (as also clarified by the field description):

NR-ECID-SignalMeasurementInformation-r16 ::= SEQUENCE {

 nr-PrimaryCellMeasuredResults-r16 NR-MeasuredResultsElement-r16,

 nr-MeasuredResultsList-r16 NR-MeasuredResultsList-r16 OPTIONAL,

 ...

}

NR-MeasuredResultsList-r16 ::= SEQUENCE (SIZE(1..32)) OF NR-MeasuredResultsElement-r16

NR-MeasuredResultsElement-r16 ::= SEQUENCE {

 systemFrameNumber-r16 BIT STRING (SIZE (10)),

 trp-ID-r16 TRP-ID-r16 OPTIONAL,

 resultsSSB-Cell-r16 MeasQuantityResults-r16 OPTIONAL,

 resultsCSI-RS-Cell-r16 MeasQuantityResults-r16 OPTIONAL,

 resultsSSB-Indexes-r16 ResultsPerSSB-IndexList-r16 OPTIONAL,

 resultsCSI-RS-Indexes-r16 ResultsPerCSI-RS-IndexList-r16 OPTIONAL,

 ...

}

| *NR-ECID-SignalMeasurementInformation* field descriptions |
| --- |
| ***systemFrameNumber***This field specifies the system frame number of the measured cell during which the measurements have been performed. The target device shall include this field if it was able to determine the SFN of the cell at the time of measurement. |

The above ASN.1 looks like a typo and should be:

NR-ECID-SignalMeasurementInformation-r16 ::= SEQUENCE {

 nr-PrimaryCellMeasuredResults-r16 NR-MeasuredResultsElement-r16,

 nr-MeasuredResultsList-r16 NR-MeasuredResultsList-r16 OPTIONAL,

 ...

}

NR-MeasuredResultsList-r16 ::= SEQUENCE (SIZE(1..32)) OF NR-MeasuredResultsElement-r16

NR-MeasuredResultsElement-r16 ::= SEQUENCE {

 systemFrameNumber-r16 BIT STRING (SIZE (10)) OPTIONAL,

 trp-ID-r16 TRP-ID-r16,

 resultsSSB-Cell-r16 MeasQuantityResults-r16 OPTIONAL,

 resultsCSI-RS-Cell-r16 MeasQuantityResults-r16 OPTIONAL,

 resultsSSB-Indexes-r16 ResultsPerSSB-IndexList-r16 OPTIONAL,

 resultsCSI-RS-Indexes-r16 ResultsPerCSI-RS-IndexList-r16 OPTIONAL,

 ...

}

NOTE 11: TRP-ID here means some ID of the TRP for which the measurements are provided (i.e., final name depends on solution of TRP issue).

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| Company | Comments |
| Huawei, HiSilicon | Support in general. For the trp-ID, since E-CID does not measure PRS, there is no need and no way to report PRS-ID for E-CID.For SFN, as the rapporteur has observed, the field should not be mandatory and should only be present when the UE can obtain the SFN for the corresponding measure element |
| vivo | Agree with this change. |
| CATT | Support. The SFN is not mandatory. |
| MediaTek | Agree with the rapporteur; this looks like a typo. |
| Ericsson | Agree, SFN should not be mandatory. Regarding identifiers – a majority of companies were oin favor of splitting up into individual fields, and here the relevant fields are PCI, NCGI and NRARFCN, and should follow the RRC measResult to facilitate for the UE |
| Intel | Agree |
| Nokia | Agree with the change. |
| OPPO | Agree |
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|  | Reference | Issue # | Brief Description / Headline |
| 12 | Sec. 5.1 in [1]Sec. 2.5 in [2] | 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

 ]],

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 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

 ]]

}

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| 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-r16NR-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 | Option1In 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.-- ASN1STARTNR-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.  |
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|  | Reference | Issue # | Brief Description / Headline |
| 13 | Sec. 5.3.1 in [1] | 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,

 ...

}

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| 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. |
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|  | Reference | Issue # | Brief Description / Headline |
| 14 | Sec. 5.3.2 in [1] | 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,

 ...

}

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| 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 |
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|  | Reference | Issue # | Brief Description / Headline |
| 15 | Sec. 5.3.5 in [1] | 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

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| 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. |
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|  | Reference | Issue # | Brief Description / Headline |
| 16 | Sec. 5.4.1 in [1] | 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. |

Description:

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.

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

 nr-DL-PRS-RstdMeasurementInfoRequest-r16 ENUMERATED { true } OPTIONAL, -- Need ON

 nr-DL-PRS-RSRP-Requested ENUMERATED { requested } OPTIONAL, -- Need ON

 nr-AssistanceAvailability-r16 BOOLEAN,

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

 additionalPaths-r16 ENUMERATED { requested } OPTIONAL, -- Need ON

 ...

}

NOTE16a: In [1], some companies think that reserving 8-bits is more future proof. However, how likely is it that 7 additional DL-TDOA measurements will be defined? And even if so, they can be added in the same way as a single bit.

NOTE 16b: This item seems also contingent on RAN1 capabilities discussions. If the capability for the DL-PRS RSRP measurement will be removed, the *nr-RequestedMeasurements* or *nr-DL-PRS-RSRP-Requested* will not be needed.

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| Company | Comments |
| Huawei/HiSilicon | It is our understanding it is intentionaly reserved by the rapporteur for future extension. |
| vivo | Not needed, maybe more RS will be introduced in the further release. |
| CATT | No strong view. |
| MediaTek | We’ve always used the BIT STRING (SIZE(1..8)) idiom for requested measurements, even in cases where only one measurement is defined and there seems no immediate pressure for extension (e.g. Bluetooth). This is a question of three bits (length indicator + prsrsrpReq bit, vs. one optionality bit) in dedicated signalling; we tend to think the consistency is worth the overhead and we should keep the BIT STRING. |
| Ericsson | Agree with MediaTek, consistency is king |
| Intel | Same view as MediaTek. |
| Nokia | No strong view. |
| OPPO | Same view as MediaTek. |
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|  | Reference | Issue # | Brief Description / Headline |
| 17 | Sec. 5.5.1 in [1] | 6.5.10-10 | The capability for periodic reporting cannot be indicated separately for the positioning mode. |

Description:

The capability for periodic reporting can be different for UE-based and UE-assisted mode; e.g., may be supported by a UE for UE-based but not for UE-assisted or vice versa. Currently, there is no differentiation in the DL-TDOA capabilities:

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

 nr-DL-TDOA-Mode-r16 PositioningModes,

 nr-DL-TDOA-MeasCapability-r16 NR-DL-PRS-MeasCapability-r16 OPTIONAL,

 nr-DL-TDOA-MeasSupported-r16 BIT STRING { prsrsrpSup (0)} (SIZE(1..8)),

 additionalPathsReport-r16 ENUMERATED { supported } OPTIONAL,

 periodicalReporting-r16 ENUMERATED { supported } OPTIONAL,

 ...

}

It was proposed replacing the "ENUMERATED { supported }" for the field *periodicalReporting* in IE *NR-DL-TDOA-ProvideCapabilities* with field "*PositioningModes*".

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

 nr-DL-TDOA-Mode-r16 PositioningModes,

 nr-DL-TDOA-MeasCapability-r16 NR-DL-PRS-MeasCapability-r16 OPTIONAL,

 nr-DL-TDOA-MeasSupported-r16 BIT STRING { prsrsrpSup (0)} (SIZE(1..8)),

 additionalPathsReport-r16 ENUMERATED { supported } OPTIONAL,

 periodicalReporting-r16 PositioningModes OPTIONAL,

 ...

}

NOTE 17: This is the same as for all other LPP methods which support multiple positioning modes.

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| Company | Comments |
| Huawei/HiSilicon | It seems by change to *PositioningModes*, the periodic reporting capability is separate for UE-based and UE-assisted, but we are not clear why they need differentiation. |
| vivo | We’re fine with the change. |
| CATT | Ok. |
| MediaTek | Align with other methods and change to PositioningModes. |
| Ericsson | We are fine with the change, consistency is queen  |
| Intel | Ok. |
| Nokia | We prefer to keep the periodical reporting capability of the UE same for both modes. In UE-based mode, the periodical reporting is the position estimate while in UE-assisted it will be the measurement. If UE can support periodical reporting for UE-assisted (i.e. meaurements) it should also be able to report position estimates periodically. If UE can support periodical reporting for UE-based (i.e. position estimates) it does not make sense for the UE to be able to do this while not supporting periodical measurements to LMF for periodic position estimation. |
| OPPO | We are fine with this change. |
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|  | Reference | Issue # | Brief Description / Headline |
| 18 | Sec. 5.5.2 in [1] | 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) |

Description:

For the indication of DL-PRS RSRP support, a single-bit ENUMERATED { supported } would be sufficient.

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

 nr-DL-TDOA-Mode-r16 PositioningModes,

 nr-DL-TDOA-MeasCapability-r16 NR-DL-PRS-MeasCapability-r16 OPTIONAL,

 nr-DL-PRS-RSRP-MeasSupported-r16 ENUMERATED { supported } OPTIONAL,

 additionalPathsReport-r16 ENUMERATED { supported } OPTIONAL,

 periodicalReporting-r16 ENUMERATED { supported } OPTIONAL,

 ...

}

NOTE 18: NOTEs 16a/b apply here as well

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| Company | Comments |
| Huawei/HiSilicon | It is our understanding it is intentionaly reserved by the rapporteur for future extension. |
| vivo | Not needed, maybe more RS will be introduced in the further release. |
| CATT | No strong view. |
| MediaTek | Same comment as before; we prefer to keep consistency with how we’ve done it elsewhere. |
| Ericsson | Agree with MediaTek – shall be consistent and keep the BIT STRING |
| Intel | Agree with MediaTek. |
| Nokia | No strong view. |
| OPPO | Agree with MediaTek. |
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|  | Reference | Issue # | Brief Description / Headline |
| 19 | Sec. 6.1 in [1] | 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.

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|  | Reference | Issue # | Brief Description / Headline |
| 20 | Sec. 6.4.1 in [1] | 6.5.11-6 | Same as 6.5.10-10, but for DL-AoD |

It is assumed the same solution for 17 (#6.5.10-10) will apply for DL-AoD as well.

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|  | Reference | Issue # | Brief Description / Headline |
| 21 | Sec. 6.6 in [1] | 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. |
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| --- | --- | --- | --- |
|  | 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.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Reference | Issue # | Brief Description / Headline |
| 23 | Sec. 7.3.1 in [1] | 6.5.12-4 | Same as 6.5.10-8, but for Multi-RTT |

It is assumed the same solution for 16 (#6.5.10-8) will apply for Multi-RTT as well.

|  |  |  |  |
| --- | --- | --- | --- |
|  | Reference | Issue # | Brief Description / Headline |
| 24 | Sec. 7.4.1 in [1] | 6.5.12-6 | Same as 6.5.10-11, but for Multi-RTT |

It is assumed the same solution for 18 (#6.5.10-11) will apply for Multi-RTT as well.

# 4. Additional Issues

Any additional ASN.1 issues please (not new features).

|  |  |  |
| --- | --- | --- |
| 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.-- ASN1STARTNR-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.* |

 |
| 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. |
| 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-RequestLocationInformationThe IE *NR-Multi-RTT-RequestLocationInformation* is used by the location server to request NR Multi-RTT location measurements from a target device.-- ASN1STARTNR-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-MeasurementInfoRequestThis 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. |

 |
| MediaTek | Formatting of the IE NR-PhysCellId-r16 is wrong and interferes with the navigation pane structure. | Change style from “PL + Pattern: 10%” to “PL + Pattern: Clear (Gray-10%)” |
| 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. |
| MediaTek | Typo in NR-DL-PRS-AssistanceDataPerTRP-r16: “nr-DL-PRS-expectedRSTD-uncerainty-r16” | Change “uncerainty" to “uncertainty”. |
| MediaTek | Typo “Aod” for “AoD” in nr-DL-Aod-AdditionalMeasurements-r16 under NR-DL-AoD-MeasElement-r16 | Change “Aod” to “AoD” |
| MediaTek | Section 7.1 refers to the wrong IE names for 38.331 | For 38.331, “SystemInformationBlockPos” should be “SIBpos”, and “PosSystemInformation-r15-IEs” should be “PosSystemInformation-r16-IEs” |
| 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 |
| 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, ...} |
| 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. |
| 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-MeasElementNR-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-RequestLocationInformationNR-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 } |
| 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) |
| 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.*-- ASN1STARTNR-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 |
| 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.-- ASN1STARTNR-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-r16NR-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-r16NR-Multi-RTT-AdditionalMeasurements-r16 ::= SEQUENCE (SIZE (1..3)) OF NR-Multi-RTT-AdditionalMeasurementElement-r16NR-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 |
| 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-MeasElementNR-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, ...} |
| 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-MeasusrementElementNR-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), ...} |
| Huawei, HiSilicon | For differential values for DL-TDOAandmulti-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,...} |
| Huawei, HiSilicon | In R2-2005107, the following issue is explained.2.1 Information in the AD requestUnlike 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.**5GCE-UTRANRUEOption 55GCE-UTRANRUEOption 7Figure 1 Illustration of Option 5 and Option 7The 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.-- ASN1STARTCommonIEsRequestAssistanceData ::= 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 ]]}-- ASN1STOPTherefore, 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*.*** **The changes are included in the TP in section 5.1.**
 | Adopt the below change5.1 TP to support PSCell/SCell information report (Section 2.1)------------------------------------------------------- UNCHANGED PARTS -------------------------------------------------------6.4.2 Common Positioning------------------------------------------------------- UNCHANGED PARTS -------------------------------------------------------– *CommonIEsRequestAssistanceData*The *CommonIEsRequestAssistanceData* carries common IEs for a Request Assistance Data LPP message Type.-- ASN1STARTCommonIEsRequestAssistanceData ::= 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. |

------------------------------------------------------- UNCHANGED PARTS ------------------------------------------------------- |
| Huawei, HiSilicon | SSB configuration currently captures SMTC as follows.

|  |
| --- |
| SSB-Configuration-r16 ::= SEQUENCE { carrierFreq-r16 ARFCN-ValueNR, halfFrameIndex-r16 ENUMERATED {zero, one}, ssbSubcarrierSpacing-r16 SubcarrierSpacing, ssb-periodicity-r16 ENUMERATED { ms5, ms10, ms20, ms40, ms80, ms160, spare2,spare1 } OPTIONAL, -- Need S smtc-r16 SSB-MTC OPTIONAL, -- Need S sfn-Offset-r16 INTEGER (0..maxNrofFFS-r16), sfn-SSB-Offset-r16 INTEGER (0..15), ss-PBCH-BlockPower-r16 INTEGER (-60..50) OPTIONAL -- Cond Pathloss} |

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 2: Delete the fields *smtc-r16* and *duration-r16* from *NR-SSB-Config-r16*.*** **The changes are included in the TP in section 5.2.**
 | Adopt the below change------------------------------------------------------- UNCHANGED PARTS -------------------------------------------------------6.4.2.1 Common NR assistance data Information Elements------------------------------------------------------- UNCHANGED PARTS -------------------------------------------------------*– NR-SSB-Config*The IE *NR-SSB-Config* defines SSB configuration.-- ASN1STARTNR-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------------------------------------------------------- UNCHANGED PARTS ------------------------------------------------------- |
| Huawei, HiSilicon | Correct the miscellaneous issues in LPP | * **Change some fields to be optional.**
	+ E.g.,

*mutingOption2-r16, dl-PRS-MutingPatternList-r16, ssbSubcarrierSpacing-r16,* *nr-DL-TDOA-AdditionalMeasurements-r16*.* **Add the conditional presence tag for some fields, e.g.,**
	+ For *DL-PRS-IdInfo-r16* filed, conditional presence tag for the inter-dependency between the three fields (i.e., *trp-ID-r16, nr-DL-PRS-ResourceID-List-r16, nr-DL-PRS-ResourceSetId-r16*) is required.
* **Add/Specify the field description for some IEs, e.g.,**
	+ The field descriptions of *DL-PRS-IdInfo-r16, NR-TimeStamp-r16, ,* and *NR-SelectedDL-PRS-PerFreq-r16* are missing.
	+ The field description of *dl-PRS-Periodicity-and-ResourceSetSlotOffset* needs more clarification, including:

1) Whether the scs configuration here should be the same as the scs configuration in frequency layer.2) The meaning of nxxx, e.g., n4-r16.* + The field description of *dl-PRS-ResourceSlotOffset* needs more clarification, e.g., what does "1" stand for?
	+ The field description of *nrARFCNRef-r16* is not correct.
	+ 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 deleted.3) The field description of *ssb-Index* should be more specific.* **Some typos need to be revised, e.g.,**
	+ nr-dl-PRS-ResourceSetList-r16 SEQUENCE (SIZE (1..nrMaxSetsPerTRP)) DL-PRS-ResourceSet-r16 (in IE *NR-DL-PRS-Config*)🡺 “SEQUENCE … OF”.
	+ Bitmap size values: 2, 4, 6, 8, 16, 32 bits (in *NR-DL-PRS-Config* field descriptions)🡺 “The length of bitmap size”.
	+ 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*) 🡺 “*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*”.
* **Other corrections:**
	+ In IE *NR-AdditionalPath*, *NR-TOAMeasQuality-r16* field is not defined in the spec., which should be *nr-TimingMeasQuality*.
 |
| Huawei, HiSilicon |  |  |
| Huawei, HiSilicon |  |  |