3GPP TSG-RAN WG2 Meeting #109bis-e***R2-20xxxxx***

Online, April 20 – 30, 2020

**Agenda item:** 6.8.2.4

**Source:** Qualcomm Incorporated

**Title:** Email discussion report: [AT109bis-e][601][POS] LPP ASN.1 issue gathering and easy agreements (Qualcomm)

**Document for:**  Discussion and Decision

# 1. Introduction

This document summarizes the following email discussion:

* [AT109bis-e][601][POS] LPP ASN.1 issue gathering and easy agreements (Qualcomm)

Status: Started

Scope: Collect the issues from the contributions in agenda item 6.8.2.4, excluding R2-2003143 and R2-2003144

Intended outcome: Endorsed baseline CR starting from R2-2003350 (R2-2003981) and list of open issues (R2-2003982) for continuing ASN.1 review after this meeting

Deadline: Comments by Monday 2020-04-27 1000 UTC; final output documents by Wednesday 2020-04-29 1000 UTC

The ASN.1 issues raised in the following contributions (and not already corrected in R2-2003350 [5]) are collected in this document:

[1] R2-2002915, "Clarification on SFN0-Offset and DL-AoD report in LPP ASN.1", CATT.

[2] R2-2003066, "DraftCR for NR-DL-PRS-Config", Huawei, HiSilicon.

[3] R2-2003067, "Miscellaneous Corrections to LPP ASN.1", Huawei, HiSilicon.

[4] R2-2003349, "Various Corrections to NR Positioning", Qualcomm Incorporated.

[5] R2-2003350, "LPP clean-up", Qualcomm Incorporated.

[6] R2-2003781, "CR 37.355 V16.0.0, Corrections to the introduction of NR positioning", Ericsson.

NOTE: The corrections proposed in [6] are already included in [5].

# 2. Common Lower-Level IEs (clause 6.4.1)

## 2.1 NR-PhysCellId

### 2.1.1 Problem

A new IE *NR-PhysCellId* is defined as common lower-level IE. However, this is unnecessarily defined as a Sequence including a single Integer only.

### 2.1.2 Description

The current definition of *NR-PhysCellId* is as follows:

-- ASN1START

NR-PhysCellId-r16 ::= SEQUENCE {

PhysCellId-r16 INTEGER (0..1007)}

-- ASN1STOP

The SEQUENCE in the above definition is unnecessary.

### 2.1.3 Proposal

**Proposal 1 (Ref [4]):** Remove the SEQUENCE in IE *NR-PhysCellId*.

-- ASN1START

NR-PhysCellId-r16 ::= INTEGER (0..1007)

-- ASN1STOP

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| Issue 6.4.1-1 | |
| Company | Comments |
| Huawei/HiSilicon | Support. |
| Ericsson | Ok |
| Apple | Support |
| vivo | OK |
| CATT | Support |
| Intel | Ok |
|  |  |

## 2.2 Other "Common Lower-Level IEs (clause 6.4.1) " Issues

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| Company | Issue |
| Ericsson | Some structural changes:   * The definition of NR-PhysCellId-r16 would fit better in the new collapsed 6.4.3 * The new IE RelativeLocation-r16 would fit better in the common section 6.4.1.   The RelativeLocation-r16 is also related to the suggested structural change to introduce two possible relativelocation options via a choice structure – either relative in lat-long-height or relative in cartesian XYZ, which is a much better fit to the studied Rel 16 use cases (macro and urban micro for long-lat and IOO for XYZ) |
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# 3. Common NR Positioning Information Elements(clause 6.4.3)

## 3.1 Section Structure

### 3.1.1 Problem

The new subclause 6.4.3 contains common NR positioning information elements which are currently structured as (a) common assistance data IEs, (b) common report information IEs, and (c) common capability information IEs. However, this structure is confusing and partly wrong.

### 3.1.2 Description

A classification of common IEs into assistance data, location information, and capabilities is not always possible (hence, common IEs). For example, TRP-ID, DL-PRS Resource Set ID, and DL-PRS Resource ID are classified as common assistance data IEs (clause 6.4.3.1). However, these IEs are also used in report information IEs. On the other hand, *NR-TimingMeasQuality* is classified as report information IEs. However, it is also used in the assistance data. Other IEs such as *NR-AdditionalPath* are classified as "assistance data" which is questionable. There is no need to further group common IEs into these subsets, since these are *common* IEs (i.e., common to NR positioning and not necessarily common to assistance data only, etc.).

### 3.1.3 Proposal

**Proposal 2 (Ref [4]):** Remove the sub-clauses below clause 6.4.3 and sort the IEs in 6.4.3 alphabetically.

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| Issue 6.4.3-1 | |
| Company | Comments |
| Huawei/HiSilicon | OK. But if the IE NR-TimingMeasQuality is also used in the assistance data, probably we should consider to rename the IE. |
| Ericsson | Ok |
| Apple | Support. |
| vivo | OK |
| CATT | Ok |
| Intel | Ok. |
|  |  |

## 3.2. *NR-DL-PRS-AssistanceData* Issues

### 3.2.1 Reference TRP Information

#### 3.2.1.1 Problem

The current LPP is unclear about the definition/signalling of "assistance data reference TRP" and "RSTD reference TRP".

#### 3.2.1.2 Description

According to 3GPP TS 38.214:

"The **UE may** be indicated by the network that a **DL PRS resources can be used as the reference for the RSTD measurement** in a higher layer parameter *DL-PRS-RstdReferenceInfo*. […] This reference time provided by *DL-PRS-RstdReferenceInfo* **may include an [ID], a PRS resource set ID, and optionally a single PRS resource ID or a list of PRS resource IDs.** The UE may use different DL PRS resources or a different DL PRS resource set to determine the reference time for the RSTD measurement as long as the condition that the DL PRS resources used belong to a single DL PRS resource set is met. If the UE chooses to use a different reference time than indicated by the network, then it is expected to report the DL PRS resource ID(s) or the DL PRS resource set ID used to determine the reference.

[…]

The **UE expects to be configured** with higher layer parameter *DL-PRS-expectedRSTD*, which defines the time difference with respect to the received DL subframe timing the UE is expected to receive DL PRS, and *DL-PRS-expectedRSTD-uncertainty*, which defines a search window around the expectedRSTD."

Therefore, similar to LTE OTDOA, there is a need for a "assistance data reference TRP" to indicate the expected RSTD/uncertainty as well as the SFN0-offset, and a "RSTD reference TRP" to indicate to the UE which DL-PRS ID/Set ID/Resource ID(s) should be used as "RSTD reference TRP".

Note, that a "assistance data reference TRP" is always needed, whereas a "RSTD reference TRP" is needed for UE-assisted DL‑TDOA only (i.e., not needed for UE-based DL-TDOA. It may also not be needed for the broadcast of assistance data).

This is currently implemented as follows:

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)) 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-AssistanceDataPerFreq SEQUENCE (SIZE (1..nrMaxTRPsPerFreq)) OF

NR-DL-PRS-AssistanceDataPerTRP-r16,

nr-DL–PRS-PositioningFrequencyLayer-r16

NR-DL–PRS-PositioningFrequencyLayer-r16

OPTIONAL, --Need ON

...

}

The "RSTD reference TRP" IE *DL-PRS-IdInfo-r16* includes the DL-PRS ID, a PRS resource set ID, and a list of PRS resource IDs (according to RAN1 specification/requirement shown above):

-- ASN1START

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

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

nr-DL-PRS-ResourceID-List-r16 SEQUENCE (SIZE (1..nrMaxResourceIDs)) OF

NR-DL-PRS-ResourceId-r16 OPTIONAL,

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

}

-- ASN1STOP

Note also, that this information (*nr-DL-PRS-ReferenceInfo-r16*) does not really belong to DL-PRS Assistance Data; it rather belongs to DL-TDOA measurement instructions (LPP Request Location Information), since it defines the requested reference for the RSTD measurements. Indeed, the *DL-PRS-IdInfo-r16* is currently also used in *NR-DL-TDOA-SignalMeasurementInformation-r16* to indicate the *used* reference IDs for the RSTD measurements*.*

Therefore, the "RSTD reference TRP" info can be provided. However, in case of e.g., DL-AoD or Multi-RTT or UE-based, this information is not needed (i.e., it is currently optional present). An indication of the "assistance data reference TRP" can currently not be provided, which however, is always needed as summarized above.

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).

Reference [1] proposes that the first entry in the *nr-DL-PRS-AssistanceDataList-r16* can serve as a "assistance data reference TRP".

### 3.2.1.3 Proposal

**Proposal 3a: (Ref [1]):** Add the wording below in *NR-DL-AoD-ProvideAssistanceData* and *NR-Multi-RTT-ProvideAssistanceData*.  
"The *ProvideAssistanceData* are provided as a list of TRPs, where the first TRP in the list is used as reference TRP. "

NOTE: See Annex 1b for example implementation.

**Proposal 3b (Ref [4]):** Distinguish between "assistance data reference TRP" and "RSTD reference TRP":

- Indicate the "assistance data reference TRP" explicitly in IE *NR-DL-PRS-AssistanceData*.

- Move the *nr-DL-PRS-ReferenceInfo* field from IE *NR-DL-PRS-AssistanceData* to the IE *NR‑DL‑TDOA‑RequestLocationInformation.*

- Move the field *nr-DL-PRS-SFN0-Offset* from IE *NR-DL-PRS-Config* to IE *NR‑DL‑PRS‑AssistanceData*.

NOTE: See Annex 1a for example implementation.

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| Issue 6.4.3-2 | |
| Company | Comments |
| Huawei/HiSilicon | To us, it is clearly understood the assistance data reference is the same as the reference in the so called “measurement instruction” specifically for DL RSTD. If they can be different, it will further confuses time stamp reporting.  Also, based on our understanding, IEs/fields used in NR positioning are different from LTE, in that both reference TRP and non-reference TRP have the same structure in term of assistance data, and measurement, while LTE OTDOA has different hierarchies for AD reference cell and AD neighbour cell, and for RSTD reference cell and RSTD neighbour cell. The result of such an NR structure would introduce some unuseful field for the reference TRP, like expected RSTD, expected RSTD uncertainty, RSTD measurement, but we think this can be fixed by ASN.1.  Therefore, we do not see the need for Proposal 3a or 3b for the particular handling of reference TRP.  Nevertherless, for other changes in 3b, we support in principle. One suggestion is related to the following IE. We also think SFN0 should be removed from NR-DL-PRS-COnfig  NR-DL-PRS-Config-r16 ::= SEQUENCE {  nr-DL-PRS-ResourceSetList-r16 SEQUENCE (SIZE (1..nrMaxSetsPerTRP-r16))  NR-DL-PRS-ResourceSet-r16,  ...  }  Now NR-DL-PRS-Config has a single field, which we believe should be also included the parent IE *NR-DL-PRS-AssistanceDataPerTRP-r16*. For example  NR-DL-PRS-Config ::= 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-ResourceSetList-r16 SEQUENCE (SIZE (1..nrMaxSetsPerTRP-r16)) NR-DL-PRS-ResourceSet-r16,  ...  } |
| Ericsson | Proposal 3a is OK; except that the DL-PRS information is provided in a hierarchy with the frequency layer on top, and resource set and resources below. Therefore, the text needs to reflect this fact so that the first TRP of the first frequency layer is the assistance data reference TRP.  For Proposal 3b, the encoding of the information can be made more efficient. As per Proposal 3a, there is no need to indicate the AD reference TRP explicitly. Alternatively, the RSTD reference TRP, if not present, is the assistance data TRP.  The same strategy can be applied to the PRS resource set – if not present, consider the first PRS resource set of the assistance data reference TRP as the reference PRS resource set  We start to enter the discussion and TRP-ID and PRS-ID. It seems reasonable that we can decide when PCI/CGI/ARFCN would be needed and when only PRS-ID and use that knowledge to include only PCI/CG/ARFCN in the IEs when they can be considered needed. |
| Apple | OK with proposal 3a.  For Proposal 3b, we do not think there is a need to distinguish Assistacne Data reference TRP from RSTD reference TRP. For DL-TDOA, those two shall be the same. So, the optional “nr-DL-PRS-ReferenceInfo-r16” need to be removed. And UE can just use the first PRS resource of the Assistacne Data reference TRP as the reference PRS for RSTD. Also, there is another issue with the current ASN.1 define for PRS assistance data :  NR-DL-PRS-AssistanceDataPerTRP-r16 ::= SEQUENCE {  nr-DL-PRS-expectedRSTD-r16 INTEGER (-3841..3841),  nr-DL-PRS-expectedRSTD-uncerainty-r16 INTEGER (-246..246),  trp-ID-r16 TRP-ID-r16 OPTIONAL,  nr-DL-PRS-Config-r16 NR-DL-PRS-Config-r16,  ...  }  For field “nr-DL-PRS-expectedRSTD-r16” and “nr-DL-PRS-expectedRSTD-uncerainty-r16”, those two shall not be mandatory included because they are not needed for Multi-RTT and DL-AoD. |
| vivo | We don’t see the need of 3a and 3b.  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 RSTD measurement 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*”  In our view，it is better to change this IE “*DL-PRS-RSTDReferenceInfo*” to “*nr-DL-PRS-ReferenceInfo-r16*” as a common IE in TS38.214. |
| CATT | Support proposal 3a  Proposal 3a follows the rule in measurement report of LPP protocol. We can follow this rule in stage3 as a default: if not present, provided as a list of xx, where the first data in the list is used as reference data.  Not only the assistant data but also measurement reports need the reference data to save signaling overhead in all positioning methods. It’s better to follow the same rule to indicate the reference data in LPP protocol. |
| Intel | Do not see the strong need for 3a/3b, but agree some changes are needed for “SFN0-offset (*nr-DL-PRS-SFN0-Offset-r16*)”. Tend to agree Huawei’s suggestion. |
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### 3.2.2 Optional IEs

#### 3.2.2.1 Problem

The IE *NR-DL-PRS-AssistanceData* includes some optional IEs/fields, which however, must be mandatory present.

#### 3.2.2.2 Description

The IE *NR-DL–PRS-PositioningFrequencyLayer-r16* is currently optional present in IE *NR‑DL‑PRS‑AssistanceDataPerFreq-r16.*

The IE *NR-DL–PRS-PositioningFrequencyLayer-r16* contains the information of subcarrier spacing, resource bandwidth, comb-size, etc. which are always needed for each frequency layer.

The IE *NR-DL-PRS-AssistanceDataPerTRP-r16* contains the *TRP-ID* for each element, which includes the DL-PRS ID. This ID is always needed to identify the DL-PRS Resources.

#### 3.2.2.3 Proposal

**Proposal 4a (Ref [4]):** The IEs *NR-DL–PRS-PositioningFrequencyLayer* and *TRP-ID* should be mandatory present in IE *NR‑DL-PRS-AssistanceDataPerFreq* and *NR-DL-PRS-AssistanceDataPerTRP*, respectively.

NOTE: See Annex 1a for example implementation.

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| Issue 6.4.3-3 | |
| Company | Comments |
| Huawei/HiSilicon | Support |
| Ericsson | * The IE *NR-DL–PRS-PositioningFrequencyLayer-r16* shall be mandatory in the IE *NR‑DL-PRS-AssistanceDataPerFreq* – agree * It is more clear to move the elements of the current IE TRP-ID to the IEs where they are needed instead of always group them. dl-PRS-ID-r16 is also a confusing name, since it is not an ID of a DL-PRS – it is an ID of the TRP. Therefore, TRP-ID should be represented by the integer (0-255) just as it is in RRC. |
| Apple | OK. |
| vivo | OK |
| CATT | Support in principle. But perhaps it will be changed if TRP-ID structure is agreed to update. |
| Intel | Ok, but TRP-ID issue is related to the structure of TRP-ID. |
|  |  |

### 3.2.2a Mandatory IEs

#### 3.2.2a.1 Problem

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 repetion. The same rationale also goes for *dl-PRS-ResourceTimeGap.*

#### 3.2.2a.2 Proposal

**Proposal 4b (Ref [2]):** Add OPTIONAL need OR for *dl-PRS-ResourceRepetitionFactor*, *dl-PRS-ResourceTimeGap.*

NOTE: See Annex 1c for example implementation.

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| Issue 6.4.3-4 | |
| Company | Comments |
| Huawei/HiSilicon | Support. |
| Ericsson | Agree, but the field description is not correct for the repetition factor (one repetition means two transmissions etc), and there should be a default value specified. Suggested field description:  ***dl-PRS-ResourceRepetitionFactor***  This parameter controls how many times each DL-PRS Resource is transmitted for a single instance of the DL-PRS Resource Set. It is applied to all resources of DL PRS Resource Set. Each instance of the repeated resource occurs in consecutive slots from the initial occurrence of the resource.  If not present, each DL-PRS resource is transmitted once   for a single instance of the DL-PRS Resource Set. |
| Apple | Support. Also, for field “nr-DL-PRS-expectedRSTD-r16” and “nr-DL-PRS-expectedRSTD-uncerainty-r16”, those two shall not be mandatory included because they are not needed for Multi-RTT and DL-AoD. |
| vivo | OK |
| Intel | Ok. |
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### 3.2.2b DL-PRS QCL Info

#### 3.2.2b.1 Problem

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.

#### 3.2.2b.2 Proposal

**Proposal 4c (Ref [2]):** *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.

NOTE: See Annex 1c for example implementation.

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| Issue 6.4.3-5 | |
| Company | Comments |
| Huawei/HiSilicon | We slightly modified our description, as frequency layer does not mean same PCI. The conditional present tag can be modified by  -- Cond NotSameAsPRS-PCI  Note that *TRP-ID* in the assistance data also include the PCI of the TRP, so if *pci-r16* in DL-PRS-QCL-Info-r16 is not same as *nr-PhysCellId-r16* in TRP-ID, it should be present. |
| Ericsson | I do not understand the logic behind this statement that it is not needed if on the same PFL? OK, the UE is aware and monitoring the SSBs for mobility, but the PCI is needed to make a proper reference to the SSB/cell. Wouldn’t it be more natural to include the PCI of the SSB but omit the PCI of the DL\_PRS? |
| Apple | Not sure why PCI is always same if frequency layer is the same between SSB and PRS. |
| vivo | OK with Huawei’s modification. |
| CATT | Is the motive of proposal 4c to save signalling overhead if the PCI is the same as PRS?  If so, the proposal can save some signalling overhead considering the IE is the resource level.  Support. |
| Intel | Agree,It can save some signaling overhead based on the modification version from Huawei. |
|  |  |

### 3.2.3 DL-PRS Resource Set ID and DL-PRS Resource ID

#### 3.2.3.1 Problem

The IEs *NR-DL-PRS-ResourceID-r16* and *NR-DL-PRS-ResourceSetID-r16* are defined within IE *NR-DL-PRS-Config*. However, these IEs are used at multiple places.

#### 3.2.3.2 Description

The IEs *NR-DL-PRS-ResourceID-r16* and *NR-DL-PRS-ResourceSetID-r16* are used together with the DL-PRS ID to define a DL-PRS Resource at multiple places in the specification; e.g., assistance data, measurement reports, etc. Therefore, they should be defined as separate IEs.

#### 3.2.3.3 Proposal

**Proposal 5 (Ref [4]):** Define the IEs *NR-DL-PRS-ResourceID* and *NR-DL-PRS-ResourceSetID* as separate (common) IEs (see also Proposal 2).

NOTE: See Annex 1a for example implementation.

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| Issue 6.4.3-6 | |
| Company | Comments |
| Huawei/HiSilicon | Support |
| Ericsson | Ok |
| Apple | Support |
| vivo | OK |
| CATT | Support |
| Intel | Ok |
|  |  |

### 3.2.4 Muting Information

#### 3.2.4.1 Problem

The IE *NR-DL-PRS-Config* includes the Option 1 and Option 2 muting information, which however, is not correctly defined.

#### 3.2.4.2 Description

The definition of the DL-PRS muting information in IE *NR-DL-PRS-Config* is currently as follows:

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

}

},

The two nested SEQUENCEs are both mandatory present. However, Option 1 and Option 2 muting may be used individually, or together.

The *dl-PRS-MutingBitRepetitionFactor* is optional present, with need code OR. If optional present, it should be with need OP, with a default interpretation when absent (e.g., *n1* could be the default).

#### 3.2.4.3 Proposal

**Proposal 6 (Ref [4], [2]):** Replace the current *dl-PRS-MutingPatternList* with two optional IEs: *dl-PRS-MutingOption1* and *dl‑PRS‑MutingOption2* to allow Option 1 muting, Option 2 muting, and Option 1+2 muting.

NOTE: See Annex 1a/c for example implementation.

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| Issue 6.4.3-7 | |
| Company | Comments |
| Huawei/HiSilicon | We support the change in Annex 1a; but we found that the need codes in Annex 1a and Annex 1c are different, one is Need OP, and the other is Need OR. |
| Ericsson | Ok |
| Apple | Support |
| vivo | OK |
| Intel | Ok to use OP, but based on the definition of OP “The UE behaviour on absence should be captured either in the procedural text or in the field description.”. We need to add the description to clarify the UE behavior. |
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### 3.2.5 Need Codes for IE *TRP-ID*

#### 3.2.5.1 Problem

Need codes are currently missing in IE *TRP-ID* and the existing condition is confusing/wrong.

#### 3.2.5.2 Description

The definition of the IE TRP-ID is currently as follows:

-- ASN1START

TRP-ID-r16 ::= SEQUENCE {

dl-PRS-ID-r16 INTEGER (0..255) OPTIONAL,

nr-PhysCellId-r16 NR-PhysCellId-r16 OPTIONAL,

nr-CellGlobalId-r16 NCGI-r15 OPTIONAL, -- Need ON

nrARFCNRef-r16 ARFCN-ValueNR-r15 OPTIONAL -- Cond NotSameAsRefServ0

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *NotSameAsRefServ0* | The field is mandatory present if the NR-EARFCN is not the same as for the assistance data reference TRP; otherwise it is not present. |

The IE *TRP-ID* is used at multiple places and is a collection of possible TRP/cell identifiers. The presence/absence of the optional IEs depend on the parent IE and cannot be generally defined as part of a common IE. The conditional presence is not correct, since the *ARFCN-ValueNR* may be included in e.g., E-CID etc. measurement reports.

#### 3.2.5.3 Proposal

**Proposal 7 (Ref [4]):** Change the need code for the optional fields of IE *TRP-ID* to "ON".

NOTE: See Annex 1a for example implementation.

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| Issue 6.4.3-8 | |
| Company | Comments |
| Huawei/HiSilicon | Support the change in general, but we strongly recommend to change TRP-ID name to whichever else does not create any confusion between RAN2 and RAN3. |
| Ericsson | TRP-ID needs to be thoroughly discussed as commented above, since there are several issues. |
| Apple | Support a comprehensive discussion of TRP ID used in this spec and whether there is a need of name change |
| vivo | Agree with Ericsson. TRP ID needs a sufficient discussion to considere all the existed issues. |
| CATT | Prefer no TRP-ID structure. |
| Intel | It is related to TRP-ID structure discussion. |
|  |  |

### 3.2.6 Need Codes for IE *NR-TimeStamp*

#### 3.2.6.1 Problem

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

#### 3.2.6.2 Description

The definition of the IE *NR-TimeStamp* is currently as follows (which is currently used in uplink messages only):

-- ASN1START

NR-TimeStamp-r16 ::= SEQUENCE {

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

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

nr-Slot-r16 CHOICE {

scs15 INTEGER (0..9),

scs30 INTEGER (0..19),

scs60 INTEGER (0..39),

scs120 INTEGER (0..79)

},

...

}

-- ASN1STOP

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

The field *TRP-ID* is needed whenever a receiver cannot identify the TRP/cell for which the SFN/slot is applicable. The applicable TRP/cell may not necessarily always be a reference TRP. Typically, it would be the SFN of a serving TRP/cell, which may or may not be a reference TRP ("assistance data reference TRP" and/or "RSTD reference TRP").

#### 3.2.6.3 Proposal

**Proposal 8 (Ref [4]):** Remove the conditional presence of trp-ID in IE *NR-TimeStamp*.

NOTE: See Annex 1a for example implementation.

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| Issue 6.4.3-9 | |
| Company | Comments |
| Huawei/HiSilicon | According RAN1 agreement in RAN1#99.  Agreement:  Modify the previous agreement on the definition of the time stamp as follows:  A UE measurement can be associated with a time stamp. For UE RSTD, DL PRS RSRP and UE Rx-Tx time difference measurement report, the time stamp can include the SFN, as well as the slot number for a subcarrier spacing. These values correspond to the reference provided by the DL-PRS-RstdReferenceInfo.  We do not need to explicitly report trp-ID, as it is always the assistance data reference according to the RAN1 agreement. So we suggest to remove the field trp-ID-r16 from *NR-TimeStamp*. |
| Ericsson | We have the same view as Huawei |
| Apple | We have the same view as Huawei and Ericsson |
| vivo | OK to remove. |
| CATT | We understand *the TimeStamp* always is reported together with TRP-ID to LMF, in not only DL-TDOA but also DL-AOD and Multi-RTT methods. so **Proposal 8** is reasonable.  But also noticed that there is always TRP-ID together in all measurement report message which includes IE *NR-TimeStamp.* It seems the TRP-ID is duplicated in measurement report.  In summary, the TRP-ID in *NR-TimeStamp* is not required except in NR-DL-TDOA-LocationInformation-r16/ NR-DL-AoD-LocationInformation-r16(UE-based).  So suggest to modify the conditional presence of trp-ID in IE *NR-TimeStamp* as”-- Cond UEB”. |
| Intel | Agree with Huawei. Do not understand the comment from CATT, why it is needed for UEB? |
|  |  |

## 3.3 Other "Common NR Positioning Information Elements(clause 6.4.3)" Issues

|  |  |
| --- | --- |
| Company | Issue |
| Ericsson | The IE *NR-PositionCalculationAssistance* is not needed. It is better to move the IE definitions of *NR-UEB-TRP-LocationData* and *NR-UEB-TRP-RTD-Info* from 7.4.2 to 6.4.3.  This means that we follow the model adopted up until now that the broadcast pos SIBs are just brought from existing IEs.  It is then natural to include instances of these two optional IEs (conditionally present for UEB based on what is requested) together with NR-DL-PRS-AssistanceData-r16. Then this information, which is common to all NR positioning methods based on DL-PRS, can be placed as part of either CommonIEProvideAssistanceData or a new NR-DL-PRS-ProvideAssistanceData under the ProvideAssistanceData |
| vivo | The description of ‘***nr-DL-PRS-SFN0-Offset***’ should be modified for UE-assist positioning. We think 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.   |  | | --- | | ***nr-DL-PRS-SFN0-Offset***  Defines time offset of the SFN0 slot 0 for given TRP with respect to SFN0 slot 0 of the serving cell. |   One option is to change ‘reference TRP’ to ‘the serving cell’, which aligns with RAN1 agreement in RAN1#98bis.   |  | | --- | | 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 |   Another option is to 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.  The third option is providing absolute SFN0 timing of reference TRP for the UE.  In our view, the first option or the second option is preferred. |
|  |  |
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|  |  |

# 4. NR E-CID Positioning(clause 6.5.9)

## 4.1 *NR-ECID-SignalMeasurementInformation* Issues

### 4.1.1 Measurements Results List

#### 4.1.1.1 Problem

The IE *NR-MeasuredResultsElement* contains unnecessary nested SEQUENCEs each with several (redundant) levels of optional elements.

#### 4.1.1.2 Description

The IE *NR-MeasuredResultsElement* includes the *measResultsNR* field currently defined as follows:

measResultNR-r16 SEQUENCE {

cellResults-r16 SEQUENCE{

resultsSSB-Cell-r16 MeasQuantityResults-r16 OPTIONAL,

resultsCSI-RS-Cell-r16 MeasQuantityResults-r16 OPTIONAL

},

rsIndexResults-r16 SEQUENCE{

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

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

} OPTIONAL

},

MeasQuantityResults-r16 ::= SEQUENCE {

nr-RSRP-r16 INTEGER (0..127) OPTIONAL,

nr-RSRQ-r16 INTEGER (0..127) OPTIONAL

}

ResultsPerSSB-IndexList-r16::= SEQUENCE (SIZE (1..64)) OF ResultsPerSSB-Index-r16

ResultsPerSSB-Index-r16 ::= SEQUENCE {

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

ssb-Results-r16 MeasQuantityResults-r16 OPTIONAL

}

ResultsPerCSI-RS-IndexList-r16::= SEQUENCE (SIZE (1..64)) OF ResultsPerCSI-RS-Index-r16

ResultsPerCSI-RS-Index-r16 ::= SEQUENCE {

csi-RS-Index-r16 INTEGER (0..95),

csi-RS-Results-r16 MeasQuantityResults-r16 OPTIONAL

}

Each results list (*resultsSSB-Cell*, *resultsCSI-RS-Cell*, *resultsSSB-Indexes*, *resultsCSI-RS-Indexes*) is optional present, with each included measurement (*nr-RSRP*, *nr-RSRQ*) being optional present. For the beam-level results, the *rsIndexResults* and the *MeasQuantityResults* are optional as well.

#### 4.1.1.3 Proposal

**Proposal 9 (Ref [4]):** Remove the nested SEQUENCEs for the *measResultNR* field in IE *NR-MeasuredResultsElement.* Change the presence ofthe *MeasQuantityResults* in *ResultsPerSSB-Index* and *ResultsPerCSI-RS-Index* to mandatory present.

NOTE: See Annex 2 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.9-1 | |
| Company | Comments |
| Huawei/HiSilicon | Support. |
| Ericsson | Yes, there can be confusion about all the optionality about this. The reason for this structure is to copy the exact structure from RRC to allow the UE to reuse the same compiled IE. The RRC IE also includes the PCI – again to minimize efforts on the UE-side, the same IE as in RRC can be beneficial to use also in LPP. |
| Apple | Support |
| vivo | Yes, it is not needed |
| Intel | Ok |
|  |  |
|  |  |

### 4.1.2 Presence of TRP-ID and SFN

#### 4.1.2.1 Problem

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 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).

#### 4.1.2.2 Description

The TRP-ID in IE *NR-ECID-SignalMeasurementInformation* defines the TRP/cell for which the measurements are applicable:

NR-MeasuredResultsElement-r16 ::= SEQUENCE {

systemFrameNumber BIT STRING (SIZE (10)),

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

measResultNR-r16 SEQUENCE {

[parts omitted]

...

}

The TRP ID would always be needed, otherwise the server would not know for which TRP/cell the measurements are valid.

The *systemFrameNumber* can usually only be included if the *NR-MeasuredResultsElement* is provided for a serving cell.

#### 4.1.2.3 Proposal

**Proposal 10 (Ref [4]):** Change the *trp-ID* field in IE *NR-MeasuredResultsElement* for E-CID to mandatory present; change the *systemFrameNumber* in IE *NR-MeasuredResultsElement* to optional present.

NOTE: See Annex 2 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.9-2 | |
| 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.  Should it be handled by a discussion generically treating the TRP-ID issue, or should it be handled here? |
| Ericsson | This is related to both the TRP-ID discussion as well as the relevance of reusing the RRC structure. The RRC R15 structure should at least have has PCI as mandatory, but even that is optional. It could be relevant to define the scope as what the UE has available from RRC. |
| Apple | Not sure if the TRP ID is a cell ID or a PRS ID. If the latter, than it cannot be mandatory |
| vivo | Agree with Huawei in case this is only related to isuee of TRP for E-CID,otherwise TRP-ID need a survey consideraion. |
| CATT | Support |
| Intel | Agree with Ericssion. To our understanding pci, CGI and ARFCN are needed for ECID. dl-PRS-ID is not needed. |
|  |  |

## 4.2 Other "NR E-CID Positioning(clause 6.5.9)" Issues

|  |  |
| --- | --- |
| Company | Issue |
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|  |  |
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# 5. NR DL-TDOA Positioning(clause 6.5.10)

## 5.1 Assistance Data sharing

### 5.1.1 Problem

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*.

### 5.1.2 Description

In case of multiple Provide Assistance Data IEs for multiple NR positioning methods, the DL-PRS assistance data for the TRPs would need to be provided only once. This is implemented using the IE *nr‑SelectedDL‑PRS‑IndexList-r16:*

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

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

nr-SelectedDL-PRS-IndexList-r16 SEQUENCE (SIZE (1..nrMaxFreqLayers)) OF

NR-SelectedDL-PRS-PerFreq-r16 OPTIONAL,-- Need ON

nr-PositionCalculationAssistanceData-r16

NR-PositionCalculationAssistanceData-r16

OPTIONAL,-- Cond UEB

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

...

}

However, the description for this is currently not complete.

### 5.1.3 Proposal

**Proposal 11 (Ref [4]):** Add field description to IE *NR-DL-TDOA-ProvideAssistanceData* as follows:

- In case of DL-PRS assistance for multiple NR positioning methods the field *nr-DL-PRS-AssistanceData* need to be present in either *NR-DL-TDOA-ProvideAssistanceData* or *NR-Multi-RTT-ProvideAssistanceData* or *NR-DL-AoD-ProvideAssistanceData.*

- 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*.

NOTE: See Annex 3 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.10-1 | |
| Company | Comments |
| Huawei/HiSilicon | We suggest to have a common PRS configuration in *NR-DL-PRS-AssistanceData* promoted outside positioning methods and in parellel to *NR-DL-TDOA-ProvideAssistanceData-r16*, *NR-DL-AoD-ProvideAssistanceData-r16*, and *NR-Multi-RTT-ProvideAssistanceData-r16*, as it is likely we are going to have common PRS processing capabilities.  The field *nr-SelectedDL-PRS-IndexList* can still be conditional present, if not all DL-PRS Resources provided in *nr-DL-PRS-AssistanceData* are applicable for this *NR-DL-TDOA-ProvideAssistanceData* message, and there is no need to say shared assistance data.  For *nr-SelectedDL-PRS-IndexList*, we do not think it needs to have 2-stage perFreq + TRP indication, and the field *nr-SelectedDL-PRS-FrequencyLayerIndex-r16* and the field *nr-SelectedTRP-Index-r16* are useless. For the selection of TRP/DL PRS resource set/DL PRS resources, we simply needs to provide the TRP-ID, selected resource set IDs, and selected resource IDs.  For example (changes are based on R2-2003350):  NR-SelectedDL-PRS-IndexList-r16 ::= SEQUENCE (SIZE (1..256)) OF  NR-SelectedTRP-r16  NR-SelectedTRP-r16 ::= SEQUENCE {  trp-ID-r16 TRP-ID-r16,  dl-SelectedPRS-ResourceSetIndexList-r16 SEQUENCE (SIZE (1..nrMaxSetsPerTrp-r16)) OF  DL-SelectedPRS-ResourceSetIndex-r16  OPTIONAL, --Need ON  ...  }  DL-SelectedPRS-ResourceSetIndex-r16 ::= SEQUENCE {  nr-DL-SelectedPRS-ResourceSetIndex-r16 INTEGER (0..nrMaxSetsPerTrp-r16-1),  dl-SelectedPRS-ResourceIndexList-r16 SEQUENCE (SIZE (1..nrMaxResourcesPerSet-r16)) OF  DL-SelectedPRS-ResourceIndex-r16  OPTIONAL --Need ON  }  DL-SelectedPRS-ResourceIndex-r16 ::= SEQUENCE {  nr-DL-SelectedPRS-ResourceIdIndex-r16 INTEGER (0..nrMaxNumDL-PRS-ResourcesPerSet-1-r16),  ...  } |
| Ericsson | Judging from the complexity of this description it is clear that it is much better to list out the instance of the IE NR-DL-PRS-AssistanceData-r16 above the positioning methods, either in the common part or as a separate ProvideAD IE only for NR-DL-PRS  This also means that an error message associsated to the DL-PRS AD and UEB AD can be handled separately, which makes it more clear |
| Apple | It is unclear to readers that there is an underlaying assumption that “In case of multiple Provide Assistance Data IEs for multiple NR positioning methods, the DL-PRS assistance data for the TRPs would need to be provided only once.”, when each positioning method has this common part included in its own dedicated IE. So, I agree with Huawei to define a separate common IE and make it our of any positioning methods. |
| vivo | According to the above description，can I understand that the nr-DL-PRS-AssistanceData need to be present at least one time with the same values in TDOA,AOD and multi-RTT? And nr-SelectedDL-PRS-IndexList is conditional present with different values in TDOA,AOD and multi-RTT? If it is, we’re fine with this changes.  In addition, according to the above description:  ‘The field nr-SelectedDL-PRS-IndexList is conditional present, if not all DL-PRS Resources provided in nr-DL-PRS-AssistanceData are applicable for this NR-DL-TDOA-ProvideAssistanceData message, or if the IE NR-DL-PRS-AssistanceData is provided in IE NR Multi RTT ProvideAssistanceData or NR-DL-AoD-ProvideAssistanceData’,  We can find that as long as one of above conditions is met, the field nr-SelectedDL-PRS-IndexList will be present. But as our understanding, if only the second condition is satisfied, the field nr-SelectedDL-PRS-IndexList may not be present when all DL-PRS Resources provided in nr-DL-PRS-AssistanceData are applicable. So we suggest to change the description as  ’The field nr-SelectedDL-PRS-IndexList is conditional present, if not all DL-PRS Resources provided in nr-DL-PRS-AssistanceData are applicable for this NR-DL-TDOA-ProvideAssistanceData message and the IE nr-DL-PRS-AssistanceData is also provided in IE NR Multi RTT ProvideAssistanceData or NR-DL-AoD-ProvideAssistanceData. ‘’ |
| CATT | Proposal 11 is not what we discussed last meeting.  We suggest that:   1. When there are multi-NR positioning methods, put all configed DL-PRS data in one container(*NR-DL-PRS-AssistanceData*) which can be put in one of the positioning method.   Further more, it would be better if the *NR-DL-PRS-AssistanceData* can be in in parellel to *NR-DL-TDOA-ProvideAssistanceData-r16*, *NR-DL-AoD-ProvideAssistanceData-r16*, and *NR-Multi-RTT-ProvideAssistanceData-r16.*   1. Set the selected TRP, selected resource Set, selected resource ID into the nr-SelectedDL-PRS-IndexList-r16 for each involved positioning methods. |
| Intel | Agree the proposal. |
|  |  |

## 5.2 Need Codes in IE *NR-DL-TDOA-ProvideAssistanceData*

### 5.2.1 Problem

Currently, the presence of the IE *NR-PositionCalculationAssistanceData* is mandatory in case of UE-based DL‑TDOA (cond UE-based). However, the IE *NR-DL-TDOA-ProvideAssistanceData* is also used to provide an error reason, in which case the *NR-PositionCalculationAssistanceData* may not be present for UE-based. Also, in case of broadcast of assistance data, the IE *NR-PositionCalculationAssistanceData* may not be present.

### 5.2.2 Description

The presence of the IE *NR-PositionCalculationAssistanceData* is currently specified as follows:

-- ASN1START

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

[...]

nr-PositionCalculationAssistanceData-r16

NR-PositionCalculationAssistanceData-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 mandatory present for the UE based DL-TDOA; otherwise it is not present. |

However, the field may not be present for UE-based if *nr-DL-TDOA-Error* is present (or if the *NR‑PositionCalculationAssistanceData* are available via broadcast).

### 5.2.3 Proposal

**Proposal 12 (Ref [4]):** Change the conditional presence of the IE *NR-PositionCalculationAssistanceData* to optional present for UE-based mode DL-TDOA.

NOTE: See Annex 3 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.10-2 | |
| Company | Comments |
| Huawei/HiSilicon | Support. |
| Ericsson | The handling of the assistance data for NR needs to be more clear and parts should be lifted to IEs common for NR positioning |
| Apple | Support |
| vivo | OK |
| Intel | Ok. |
|  |  |
|  |  |

## 5.3 *NR-DL-TDOA-SignalMeasurementInformation* Issues

### 5.3.1 RSRP Measurements

#### 5.3.1.1 Problem

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.

#### 5.3.1.2 Description

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

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)) OF NR-DL-TDOA-MeasElement-r16

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

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

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

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

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

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

nr-TimingMeasQuality-r16 NR-TimingMeasQuality-r16,

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

nr-DL-TDOA-AdditionalMeasurements-r16 NR-DL-TDOA-AdditionalMeasurements-r16,

...

}

#### 5.3.1.3 Proposal

**Proposal 13 (Ref [4]):** Add the RSRP measurements for the RSTD Reference TRP to the IE *NR-DL-TDOA-SignalMeasurementInformation*.

NOTE: See Annex 3 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.10-3 | |
| 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. |
| Ericsson | Agree. Furthermore, it is not only the RSRP that is needed for the reference cell – also the additional paths.  Since the reference information is the same as for the neighbor TRPs, it can be easier easier to let the first element in the list of TRPs to represent the reference TRP. OK, the cost is the optionality bit of the RSTD, so no strong view |
| Apple | Unable to figure out which part of Annex 3 is related to this proposal |
| 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 | Could you please specify why the RSRP of reference TRP is required?  Why does LMF need RSRP of reference TRP? Is there any agreement from RAN1 about it? |
| Intel | Same view as Huawei. |
|  |  |

### 5.3.2 RSTD Quality Indicator

#### 5.3.2.1 Problem

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.

#### 5.3.2.2 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.

#### 5.3.2.3 Proposal

**Proposal 14 (Ref [4]):** Add the *NR-TimingMeasQuality* of the Reference TRP TOA measurement used for calculation of RSTDs to IE *NR-DL-TDOA-SignalMeasurementInformation*.

Add the *NR-TimingMeasQuality* to the *NR-DL-TDOA-AdditionalMeasurements* list.

NOTE: See Annex 3 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.10-4 | |
| 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. |
| Ericsson | Ok  Also additional paths of the reference TRP should be there |
| Apple | Not sure why this is needed. As Huawei pointed out, this IE is already included in the measurement as part of “NR-DL-TDOA-MeasElement-r16” |
| vivo | OK |
| CATT | Don’t support the first proposal: “*Add the NR-TimingMeasQuality of the Reference TRP TOA measurement used for calculation of RSTDs to IE NR-DL-TDOA-SignalMeasurementInformation.”*  Because there is no such agreement from RAN1 about the quality of TOA of reference TRP.  But support the second proposal:” Add the *NR-TimingMeasQuality* to the *NR-DL-TDOA-AdditionalMeasurements* list”, considering there is an agreement from RAN1 on it during this e-meeting. |
| Intel | Same view as Huawei. |
|  |  |

### 5.3.3 TRP Identity for the *NR-DL-TDOA-MeasElement*

#### 5.3.3.1 Problem

The TRP-ID in IE *NR-DL-TDOA-MeasElement* is currently optional present. However, an identifier for the measured TRP is always needed.

#### 5.3.3.2 Description

The IE *NR-DL-TDOA-MeasElement* provides the DL-TDOA measurements for one TRP. The TRP for the measurement must be identified to enable position calculation at an LMF:

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

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

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

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

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

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

nr-TimingMeasQuality-r16 NR-TimingMeasQuality-r16,

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

nr-DL-TDOA-AdditionalMeasurements-r16

NR-DL-TDOA-AdditionalMeasurements-r16,

...

}

#### 5.3.3.3 Proposal

**Proposal 15 (Ref [4]):** Change the presence of the *TRP-ID* in IE *NR-DL-TDOA-MeasElement* to mandatory present.

NOTE: See Annex 3 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.10-5 | |
| Company | Comments |
| Huawei/HiSilicon | Support. |
| Ericsson | Ok (unless we agree to let the first element represent the reference TRP) |
| Apple | OK |
| vivo | OK |
| CATT | Support |
| Intel | Ok, it is also related to TRP-ID structure discussion. |
|  |  |

### 5.3.4 Additional RSTD Measurements

#### 5.3.4.1 Problem

The additional RSTD measurements are currently mandatory present in IE *NR-DL-TDOA-MeasElement.*

#### 5.3.4.2 Description

A UE may report up to 3 additional RSTD measurements for a pair of TRPs (between different Resources). According to current RAN1 discussions, this is supposed to be a UE capability and can specifically be requested in a LPP Request Location Information message. However, the additional RSTD measurements are currently mandatory present in IE *NR-DL-TDOA-MeasElement:*

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

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

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

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

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

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

nr-TimingMeasQuality-r16 NR-TimingMeasQuality-r16,

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

nr-DL-TDOA-AdditionalMeasurements-r16

NR-DL-TDOA-AdditionalMeasurements-r16,

...

}

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

NR-DL-TDOA-AdditionalMeasurementElement-r16

#### 5.3.4.3 Proposal

**Proposal 16 (Ref [4]):** Change the presence of the *NR-DL-TDOA-AdditionalMeasurements* in IE *NR-DL-TDOA-MeasElement* to optional present.

NOTE: See Annex 3 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.10-6 | |
| Company | Comments |
| Huawei/HiSilicon | Support. |
| Ericsson | Ok – we also need a clear field description of NR-DL-TDOA-AdditionalMeasurements |
| Apple | OK |
| vivo | OK |
| CATT | Ok |
| Intel | Ok |
|  |  |

### 5.3.5 Number of TRPs for DL-TDOA measurements

#### 5.3.5.1 Problem

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.

#### 5.3.5.2 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.

#### 5.3.5.3 Proposal

**Proposal 17 (Ref [4]):** The *NR-DL-TDOA-MeasList* in IE *NR-DL-TDOA-SignalMeasurementInformation* should provide RSTD measurements for up to 255 TRPs.

NOTE: See Annex 3 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.10-7 | |
| 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. |
| Ericsson | Or if the first element is the reference TRP and correspondinf interpretations, the list can contain all 256 elements |
| Apple | Agree with Huawei |
| vivo | In general, we agree and also please find our opinion in 5.3.1.3 that the additonal path and AdditionalMeasurement of the reference TRP should also be considered. |
| CATT | Support **Proposal 17**. There is no measurement on reference TRP in the list *nr-DL-TDOA-MeasList-r16,* per our understanding. |
| Intel | Agree with Huawei. |
|  |  |

## 5.4 *NR-DL-TDOA-RequestLocationInformation* Issues

### 5.4.1 Requested Measurements

#### 5.4.1.1 Problem

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.

#### 5.4.1.2 Description

Currently, the following structure is used to request the (optional) DL-PRS RSRP measurements:

nr-RequestedMeasurements-r16 BIT STRING { prsrsrpReq (0)

} (SIZE(1..8)),

This can be more efficiently replaced by a single-bit ENUMERATED { requested }.

#### 5.4.1.3 Proposal

**Proposal 18 (Ref [4]):** Change the *nr-RequestedMeasurements* in IE *NR-DL-TDOA-RequestLocationInformation* from BIT STRING to ENUMERATED { requested }.

NOTE: See Annex 3 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.10-8 | |
| Company | Comments |
| Huawei/HiSilicon | It is our understanding it is intentionaly reserved by the rapporteur for future extension. |
| Ericsson | Disagree -  The specification style adopted in the past for other positioning methods is to use a bit string, even is there can only be one bit in this release, see for example TBS and Bluetooth where only one bit in the bit string can be set this far. Therefore, it is better to maintain the coding style of the past and continue using a bit string. |
| Apple | No strong view. Either way is fine. |
| vivo | OK |
| CATT | It should be reserved for the future extension. So prefer no change here. |
| Intel | No strong view. Follow LPP Rapporteur’s view. |
|  |  |

### 5.4.2 Number of Requested RSRP Measurements

#### 5.4.2.1 Problem

The number of requested DL-PRS RSRP measurements per TRP is larger than the requested RSTD measurements and what can be reported for DL-TDOA in IE *NR-DL-TDOA-RequestLocationInformation*.

#### 5.4.2.2 Description

As mentioned in section 5.3.1.2 above, the DL-PRS RSRP is an auxiliary measurement for DL-TDOA positioning. The UE would not e.g. use a fixed RX-beam for measuring multiple DL-PRS Resources for the same TRP as for DL-AoD positioning. The RSRP indicates the RSRP of the signal used for the RSTD measurement, and therefore, it cannot be larger than the number of RSTD measurements reported:

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

maxDL-PRS-RSRP-MeasurementsPerTRP-r16 INTEGER (1..8) OPTIONAL,

maxDL-PRS-RSTD-MeasurementsPerTRPPair-r16 INTEGER (1..4) OPTIONAL

timingReportingGranularityFactor-r16 I NTEGER (FFS) OPTIONAL -- FFS in RAN4

}

#### 5.4.2.3 Proposal

**Proposal 19 (Ref [4]):** Remove the *maxDL-PRS-RSRP-MeasurementsPerTRP* field from IE *NR-DL-TDOA-ReportConfig*.

NOTE: See Annex 3 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.10-9 | |
| Company | Comments |
| Huawei/HiSilicon | Support. |
| Ericsson | Agree |
| Apple | Support |
| vivo | OK. For DL-TDOA method, the number of RSRP measurement reported cannot be larger than the number of RSTD measurement reported. Removing the *maxDL-PRS-RSRP-MeasurementsPerTRP* field may reduce ambiguty. |
| CATT | Support |
| Intel | Ok |
|  |  |

## 5.5 DL-TDOA Capability Information Issues

### 5.5.1 Periodic Reporting Capability

#### 5.5.1.1 Problem

The capability for periodic reporting cannot be indicated separately for the positioning mode.

#### 5.5.1.2 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,

...

}

#### 5.5.1.3 Proposal

**Proposal 20 (Ref [4]):** Replace the "ENUMERATED { supported }" for the field *periodicalReporting* in IE *NR-DL-TDOA-ProvideCapabilities* with field "*PositioningModes*".

NOTE: See Annex 3 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.10-10 | |
| 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. |
| Ericsson | Agree – aigned with how it is represented in legacy |
| Apple | Support |
| vivo | OK |
| CATT | Support |
| Intel | Ok. |
|  |  |

### 5.5.2 DL-PRS RSRP measurement capability

#### 5.5.2.1 Problem

Similar to issue 5.4.1 above, a BIT STRING Size 1..8 is used for indicating support for DL-PRS RSRP measurements for DL-TDOA positioning.

#### 5.5.2.2 Description

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

#### 5.5.2.3 Proposal

**Proposal 21 (Ref [4]):** Change the *nr-DL-TDOA-MeasSupported* in IE *NR-DL-TDOA-ProvideCapabilities* from BIT STRING to ENUMERATED { supported } for DL-PRS RSRP.

NOTE: See Annex 3 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.10-11 | |
| Company | Comments |
| Huawei/HiSilicon | It is our understanding it is intentionaly reserved by the rapporteur for future extension. |
| Ericsson | Disagree -  The specification style adopted in the past for other positioning methods is to use a bit string, even is there can only be one bit in this release, see for example TBS and Bluetooth where only one bit in the bit string can be set this far. Therefore, it is better to maintain the coding style of the past and continue using a bit string. |
| Apple | No strong view. Either way is fine. |
| vivo | OK |
| CATT | It should be reserved for the future extension. So prefer no change here. |
| Intel | It is for future extension as what we did for legacy. But ok to follow LPP Rapporteur’s view. |
|  |  |

## 5.6 DL-TDOA Target Device Error Causes

### 5.6.1 Measurements Not Possible

#### 5.6.1.1 Problem

The IE *NR-DL-TDOA-TargetDeviceErrorCauses* currently includes the *nr-PRS-RSRPMeasurementNotPossible* and *nr‑RSTDMeasurementNotPossible*, which appears to be a copy-and-paste error.

#### 5.6.1.2 Description

An indication of not possible measurements is not needed for DL-TDOA positioning. The available error codes are sufficient (e.g., this is not best effort E-CID positioning).

#### 5.6.1.3 Proposal

**Proposal 22 (Ref [4]):** Remove the fields *nr-PRS-RSRPMeasurementNotPossible* and *nr‑RSTDMeasurementNotPossible* in IE *NR-DL-TDOA-TargetDeviceErrorCauses*.

NOTE: See Annex 3 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.10-12 | |
| Company | Comments |
| Huawei | Support |
| Ericsson | It is also better to introduce a separate error message for DL-PRS to allow the UE to report common DL-PRS problems |
| Apple | OK |
| vivo | OK |
| CATT | Support |
| Intel | Ok. |
|  |  |

## 5.7 Other "NR DL-TDOA Positioning (clause 6.5.10)" Issues

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| Company | Issue |
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# 6. NR DL-AoD Positioning(clause 6.5.11)

## 6.1 Assistance Data sharing

Same issue as described in section 5.1 above for DL-TDOA; same solution applies here as well.

**Proposal 23 (Ref [4]):** Add field description to IE *NR-DL-AoD-ProvideAssistanceData* as follows:

- In case of DL-PRS assistance for multiple NR positioning methods the field *nr-DL-PRS-AssistanceData* need to be present in either *NR-DL-TDOA-ProvideAssistanceData* or *NR-Multi-RTT-ProvideAssistanceData* or *NR-DL-AoD-ProvideAssistanceData.*

- 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-AoD-ProvideAssistanceData* message, or if the IE *NR-DL-PRS-AssistanceData* is provided in IE *NR-Multi-RTT ProvideAssistanceData* or *NR-DL-TDOA-ProvideAssistanceData*.

NOTE: See Annex 4 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.11-1 | |
| Company | Comments |
| Huawei/HiSilicon | We suggest to have a common PRS configuration in *NR-DL-PRS-AssistanceData* promoted outside positioning methods and in parellel to *NR-DL-TDOA-ProvideAssistanceData-r16*, *NR-DL-AoD-ProvideAssistanceData-r16*, and *NR-Multi-RTT-ProvideAssistanceData-r16*, as it is likely we are going to have common PRS processing capabilities.  The field *nr-SelectedDL-PRS-IndexList* can still be conditional present, if not all DL-PRS Resources provided in *nr-DL-PRS-AssistanceData* are applicable for this *NR-DL-TDOA-ProvideAssistanceData* message, and there is no need to say shared assistance data.  For *nr-SelectedDL-PRS-IndexList*, we do not think it needs to have 2-stage perFreq + TRP indication, and the field *nr-SelectedDL-PRS-FrequencyLayerIndex-r16* and the field *nr-SelectedTRP-Index-r16* are useless. For the selection of TRP/DL PRS resource set/DL PRS resources, we simply needs to provide the TRP-ID, selected resource set IDs, and selected resource IDs.  For example (changes are based on R2-2003350):  NR-SelectedDL-PRS-IndexList-r16 ::= SEQUENCE (SIZE (1..256)) OF  NR-SelectedTRP-r16  NR-SelectedTRP-r16 ::= SEQUENCE {  trp-ID-r16 TRP-ID-r16,  dl-SelectedPRS-ResourceSetIndexList-r16 SEQUENCE (SIZE (1..nrMaxSetsPerTrp-r16)) OF  DL-SelectedPRS-ResourceSetIndex-r16  OPTIONAL, --Need ON  ...  }  DL-SelectedPRS-ResourceSetIndex-r16 ::= SEQUENCE {  nr-DL-SelectedPRS-ResourceSetIndex-r16 INTEGER (0..nrMaxSetsPerTrp-r16-1),  dl-SelectedPRS-ResourceIndexList-r16 SEQUENCE (SIZE (1..nrMaxResourcesPerSet-r16)) OF  DL-SelectedPRS-ResourceIndex-r16  OPTIONAL --Need ON  }  DL-SelectedPRS-ResourceIndex-r16 ::= SEQUENCE {  nr-DL-SelectedPRS-ResourceIdIndex-r16 INTEGER (0..nrMaxNumDL-PRS-ResourcesPerSet-1-r16),  ...  } |
| Ericsson | Judging from the complexity of this description it is clear that it is much better to list out the instance of the IE NR-DL-PRS-AssistanceData-r16 above the positioning methods, either in the common part or as a separate ProvideAD IE only for NR-DL-PRS  This also means that an error message associsated to the DL-PRS AD and UEB AD can be handled separately, which makes it more clear |
| Apple | Agree with Ericsson |
| vivo | Same opinon with 5.1 |
| CATT | Proposal 23 is not what we discussed last meeting.  We suggest that:   1. When there are multi-NR positioning methods, put all configed DL-PRS data in one container(*NR-DL-PRS-AssistanceData*) which can be put in one of the assigned positioning methods.   Further more, it would be better if the *NR-DL-PRS-AssistanceData* can be in in parellel to *NR-DL-TDOA-ProvideAssistanceData-r16*, *NR-DL-AoD-ProvideAssistanceData-r16*, and *NR-Multi-RTT-ProvideAssistanceData-r16.*   1. Set the selected TRP, selected resource Set, selected resource ID into the nr-SelectedDL-PRS-IndexList-r16 for each involved positioning methods. |
| Intel | Agree the proposal. |
|  |  |

## 6.2 Need Codes in IE *NR-DL-AoD-ProvideAssistanceData*

Same issue as described in section 5.2 above for DL-TDOA; same solution applies here as well.

**Proposal 24 (Ref [4]):** Change the conditional presence of the IE *NR-PositionCalculationAssistanceData* to optional present for UE-based mode DL-AoD.

NOTE: See Annex 4 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.11-2 | |
| Company | Comments |
| Huawei/HiSilicon | Support. |
| Apple | OK |
| vivo | OK |
| CATT | Support |
| Intel | Ok. |
|  |  |
|  |  |

## 6.3 *NR-DL-AoD-SignalMeasurementInformation* Issues

### 6.3.1 NR-TimingMeasQuality

#### 6.3.1.1 Problem

The IE *NR-DL-AoD-MeasElement* in IE *NR-DL-AoD-SignalMeasurementInformation* currently includes the field *nr‑TimingMeasQuality*. However, there are no timing measurements provided for DL-AoD positioning.

#### 6.3.1.2 Description

The *NR-DL-AoD-MeasElement* in IE *NR-DL-AoD-SignalMeasurementInformation* currently includes the field *nr‑TimingMeasQuality* as follows:

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

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

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

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

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

...

}

However, the IE *NR-TimingMeasQuality* is not applicable to DL-PRS RSRP measurements.

#### 6.3.1.3 Proposal

**Proposal 25 (Ref [4],[1]):** Remove the IE *NR-TimingMeasQuality* in IE *NR‑DL‑AoD‑SignalMeasurementInformation.*

NOTE: See Annex 4 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.11-3 | |
| Company | Comments |
| Huawei/HiSilicon | Support |
| Ericsson | Agree – RAN1 should define an RSRP meas quality |
| Apple | Support |
| vivo | OK |
| CATT | Don’t support. There is no timging related measurement report in DL-AoD, why will the *TimingMeasQuality* be reported? |
| Intel | Ok. It is not included in RAN1 table. |
|  |  |

### 6.3.2 TRP Identity for the *NR-DL-AoD-MeasElement*

Same issue as described in section 5.3.3 above for DL-TDOA; same solution applies here as well.

**Proposal 26 (Ref [4]):** Change the presence of the *TRP-ID* in IE *NR-DL-AoD-MeasElement* to mandatory present.

NOTE: See Annex 4 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.11-4 | |
| Company | Comments |
| Huawei/HiSilicon | Support. |
| Ericsson | Agree, but again, the TRP-ID discussion needs to be setted first |
| Apple | Support |
| vivo | OK |
| CATT | Support |
| Intel | Same view as Ericsson. |
|  |  |

### 6.3.3 Additional RSRP Measurements

Same issue as described in section 5.3.4 above for DL-TDOA; same solution applies here as well.

**Proposal 27 (Ref [4]):** Change the presence of the *NR-DL-AoD-AdditionalMeasurements* in IE *NR-DL-AoD-MeasElement* to optional present.

NOTE: See Annex 4 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.11-5 | |
| Company | Comments |
| Huawei/HiSilicon | Support. |
| Ericsson | Agree |
| Apple | Support |
| vivo | OK |
| CATT | Support |
| Intel | Ok. |
|  |  |

## 6.4 DL-AoD Capability Information

### 6.4.1 Periodic Reporting Capability

Same issue as described in section 5.5.1 above for DL-TDOA; same solution applies here as well.

**Proposal 28 (Ref [4]):** Replace the "ENUMERATED { supported }" for the field *periodicalReporting* in IE *NR-DL-AoD-ProvideCapabilities* with field "*PositioningModes*".

NOTE: See Annex 4 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.11-6 | |
| 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. |
| Ericsson | Agree – inline with legacy |
| Apple | Support |
| vivo | OK |
| CATT | Support |
| Intel | Ok. |
|  |  |

## 6.5 DL-AoD Target Device Error Causes

### 6.5.1 Measurements Not Possible

Same issue as described in section 5.6.1 above for DL-TDOA; same solution applies here as well.

**Proposal 29 (Ref [4]):** Remove the field *nr-PRS-RSRPMeasurementNotPossible* in IE *NR-DL-AoD-TargetDeviceErrorCauses*.

NOTE: See Annex 4 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.11-7 | |
| Company | Comments |
| Ericsson | Common DL-PRS errors should be handled |
| vivo | OK |
| CATT | Support |
| Intel | Ok. |
|  |  |
|  |  |
|  |  |

## 6.6 Other "NR DL-AoD Positioning(clause 6.5.11)" Issues

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| Company | Issue |
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|  |  |
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|  |  |
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# 7. Multi-RTT Positioning(clause 6.5.12)

## 7.1 Assistance Data sharing

Same issue as described in section 5.1 above for DL-TDOA; same solution applies here as well.

**Proposal 30 (Ref [4]):** Add field description to IE *NR-Multi-RTT-ProvideAssistanceData* as follows:

- In case of DL-PRS assistance for multiple NR positioning methods the field *nr-DL-PRS-AssistanceData* need to be present in either *NR-DL-TDOA-ProvideAssistanceData* or *NR-Multi-RTT-ProvideAssistanceData* or *NR-DL-AoD-ProvideAssistanceData.*

- 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-Multi-RTT-ProvideAssistanceData* message, or if the IE *NR-DL-PRS-AssistanceData* is provided in IE *NR-DL-AoD-ProvideAssistanceData* or *NR-DL-TDOA-ProvideAssistanceData*.

NOTE: See Annex 5 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.12-1 | |
| Company | Comments |
| Huawei/HiSilicon | We suggest to have a common PRS configuration in *NR-DL-PRS-AssistanceData* promoted outside positioning methods and in parellel to *NR-DL-TDOA-ProvideAssistanceData-r16*, *NR-DL-AoD-ProvideAssistanceData-r16*, and *NR-Multi-RTT-ProvideAssistanceData-r16*, as it is likely we are going to have common PRS processing capabilities.  The field *nr-SelectedDL-PRS-IndexList* can still be conditional present, if not all DL-PRS Resources provided in *nr-DL-PRS-AssistanceData* are applicable for this *NR-DL-TDOA-ProvideAssistanceData* message, and there is no need to say shared assistance data.  For *nr-SelectedDL-PRS-IndexList*, we do not think it needs to have 2-stage perFreq + TRP indication, and the field *nr-SelectedDL-PRS-FrequencyLayerIndex-r16* and the field *nr-SelectedTRP-Index-r16* are useless. For the selection of TRP/DL PRS resource set/DL PRS resources, we simply needs to provide the TRP-ID, selected resource set IDs, and selected resource IDs.  For example (changes are based on R2-2003350):  NR-SelectedDL-PRS-IndexList-r16 ::= SEQUENCE (SIZE (1..256)) OF  NR-SelectedTRP-r16  NR-SelectedTRP-r16 ::= SEQUENCE {  trp-ID-r16 TRP-ID-r16,  dl-SelectedPRS-ResourceSetIndexList-r16 SEQUENCE (SIZE (1..nrMaxSetsPerTrp-r16)) OF  DL-SelectedPRS-ResourceSetIndex-r16  OPTIONAL, --Need ON  ...  }  DL-SelectedPRS-ResourceSetIndex-r16 ::= SEQUENCE {  nr-DL-SelectedPRS-ResourceSetIndex-r16 INTEGER (0..nrMaxSetsPerTrp-r16-1),  dl-SelectedPRS-ResourceIndexList-r16 SEQUENCE (SIZE (1..nrMaxResourcesPerSet-r16)) OF  DL-SelectedPRS-ResourceIndex-r16  OPTIONAL --Need ON  }  DL-SelectedPRS-ResourceIndex-r16 ::= SEQUENCE {  nr-DL-SelectedPRS-ResourceIdIndex-r16 INTEGER (0..nrMaxNumDL-PRS-ResourcesPerSet-1-r16),  ...  } |
| Ericsson | Judging from the complexity of this description it is clear that it is much better to list out the instance of the IE NR-DL-PRS-AssistanceData-r16 above the positioning methods, either in the common part or as a separate ProvideAD IE only for NR-DL-PRS  This also means that an error message associsated to the DL-PRS AD and UEB AD can be handled separately, which makes it more clear |
| Apple | Agree with Ericsson |
| CATT | Proposal 30 is not what we discussed last meeting.  We suggest that:   1. When there are multi-NR positioning methods, put all configed DL-PRS data in one container(*NR-DL-PRS-AssistanceData*) which can be put in one of the assigned positioning methods.   Further more, it would be better if the *NR-DL-PRS-AssistanceData* can be in in parellel to *NR-DL-TDOA-ProvideAssistanceData-r16*, *NR-DL-AoD-ProvideAssistanceData-r16*, and *NR-Multi-RTT-ProvideAssistanceData-r16.*   1. Set the selected TRP, selected resource Set, selected resource ID into the nr-SelectedDL-PRS-IndexList-r16 for each involved positioning methods. |
| Intel | Agree the proposal. |
|  |  |
|  |  |

## 7.2 *NR-Multi-RTT-SignalMeasurementInformation* Issues

### 7.2.1 TRP Identity for the *NR-Multi-RTT-MeasElement*

Same issue as described in section 5.3.3 above for DL-TDOA; same solution applies here as well.

**Proposal 31 (Ref [4]):** Change the presence of the *TRP-ID* in IE *NR-Multi-RTT-MeasElement* to mandatory present.

NOTE: See Annex 5 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.12-2 | |
| Company | Comments |
| Huawei/HiSilicon | Support. |
| Ericsson | Agree, but conditioned on that we have satisfactory settled the TRP-ID discussion |
| Apple | Support |
| vivo | OK |
| CATT | Support |
| Intel | Same view as Ericsson. |
|  |  |

### 7.2.2 Additional Multi-RTT Measurements

Same issue as described in section 5.3.4 above for DL-TDOA; same solution applies here as well.

**Proposal 32 (Ref [4]):** Change the presence of the *NR-Multi-RTT-AdditionalMeasurements* in IE *NR-Multi-RTT-MeasElement* to optional present.

NOTE: See Annex 5 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.12-3 | |
| Company | Comments |
| Huawei/HiSilicon | Support. |
| Ericsson | OK |
| Apple | Support |
| vivo | OK |
| CATT | Support |
| Intel | Ok |
|  |  |

## 7.3 *NR-Multi-RTT-RequestLocationInformation* Issues

### 7.3.1 Requested Measurements

Same issue as described in section 5.4.1 above for DL-TDOA; same solution applies here as well.

**Proposal 33 (Ref [4]):** Change the *nr-RequestedMeasurements* in IE *NR-Multi-RTT-RequestLocationInformation* from BIT STRING to ENUMERATED { requested }.

NOTE: See Annex 5 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.12-4 | |
| Company | Comments |
| Huawei/HiSilicon | It is our understanding it is intentionaly reserved by the rapporteur for future extension. |
| Ericsson | Disagree -  The specification style adopted in the past for other positioning methods is to use a bit string, even is there can only be one bit in this release, see for example TBS and Bluetooth where only one bit in the bit string can be set this far. Therefore, it is better to maintain the coding style of the past and continue using a bit string. |
| Apple | No strong view |
| vivo | OK |
| Intel | Here is to reserve the bits for future extension. But Ok to follow LPP Rapporteur’s view. |
|  |  |
|  |  |

### 7.3.2 Number of Requested RSRP Measurements

Same issue as described in section 5.4.2 above for DL-TDOA; same solution applies here as well.

**Proposal 34 (Ref [4]):** Remove the *maxDL-PRS-RSRP-MeasurementsPerTRP* field from IE *NR-Multi-RTT-ReportConfig*.

NOTE: See Annex 5 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.12-5 | |
| Company | Comments |
| Huawei/HiSilicon | Support. |
| Ericsson | Ok |
| Apple | OK |
| vivo | OK |
| Intel | Ok. |
|  |  |
|  |  |

## 7.4 Multi-RTT Capability Information Issues

### 7.4.1 DL-PRS RSRP measurement capability

Same issue as described in section 5.5.2 above for DL-TDOA; same solution applies here as well.

**Proposal 35 (Ref [4]):** Change the *nr-Multi-RTT-MeasSupported* in IE *NR-Multi-RTT-ProvideCapabilities* from BIT STRING to ENUMERATED { supported } for DL-PRS RSRP.

NOTE: See Annex 5 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.12-6 | |
| Company | Comments |
| Huawei/HiSilicon | It is our understanding it is intentionaly reserved by the rapporteur for future extension. |
| Ericsson | Disagree -  The specification style adopted in the past for other positioning methods is to use a bit string, even is there can only be one bit in this release, see for example TBS and Bluetooth where only one bit in the bit string can be set this far. Therefore, it is better to maintain the coding style of the past and continue using a bit string. |
| Apple | No strong view |
| vivo | OK |
| CATT | It should be reserved for the future extension. So prefer no change here. |
| Intel | Here is to reserve the bits for future extension. But Ok to follow LPP Rapporteur’s view. |
|  |  |

## 7.5 Multi-RTT Target Device Error Causes

### 7.5.1 Measurements Not Possible

Same issue as described in section 5.6.1 above for DL-TDOA; same solution applies here as well.

**Proposal 36 (Ref [4]):** Remove the fields *nr-PRS-RSRPMeasurementNotPossible* and *nr‑UERxTxMeasurementNotPossible* in IE *NR-Multi-RTT-TargetDeviceErrorCauses*.

NOTE: See Annex 5 for example implementation.

|  |  |
| --- | --- |
| Issue 6.5.12-7 | |
| Company | Comments |
| Ericsson | See comment about the need for a common DL-PRS erro handling |
| vivo | OK |
| CATT | Support |
| Intel | Ok. |
|  |  |
|  |  |
|  |  |

## 7.6 Other "Multi-RTT Positioning(clause 6.5.12)" Issues

|  |  |
| --- | --- |
| Company | Issue |
| Apple | In the ASN.1 fo UE Rx-Tx measurement  NR-Multi-RTT-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-UE-RxTxTimeDiff-r16 INTEGER (0..ffs) OPTIONAL,  -- FFS on the value range to be decided in RAN4  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 (FFS) OPTIONAL,  -- FFS, value range to be decided in RAN4.  nr-Multi-RTT-AdditionalMeasurements-r16  NR-Multi-RTT-AdditionalMeasurements-r16 OPTIONAL,  ...  }  In LTE, UE measurement of Rx-TX time difference is always positive due to time advance. But in NR, this is no lnger the case. According to RAN4 defintion in 38,215, this value can be a negative value when TX of SRS happens after th RX of PRS. So, it is not ok to use INTEGET (0…ffs) which suggest this is always a non-negative value, I suggest tochange this as INTEGER(FFS), as similar to nr-PRS-RSRP-result, and waiting for RAN4 to provide guidance of how to represent this. |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

# 8. Broadcast Elements(clause 7)

## 8.1 posSIB Type 6.1

### 8.1.1 Problem

posSIB Type 6.1 provides the measurement assistance data required for both, UE-assisted and UE-based DL-only positioning. However, it currently also includes position calculation assistance data.

### 8.1.2 Description

The following posSIBs are currently defined:

|  |  |
| --- | --- |
| *posSibType6-1* | *NR-DL-Measurement-AD* |
| *posSibType6-2* | *NR-UEB-TRP-LocationData* |
| *posSibType6-3* | *NR-UEB-TRP-RTD-Info* |

posSIB Type 6-1 includes the *NR-PositionCalculationAssistanceData*, which however, are part of posSIB Type 6-2 and 6-3:

-- ASN1START

NR-DL-Measurement-AD-r16 ::= SEQUENCE {

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

nr-PositionCalculationAssistanceData-r16

NR-PositionCalculationAssistanceData-r16 ...

}

-- ASN1STOP

posSIB Type 6-1 need to include the IE *NR-DL-PRS-AssistanceData* only.

### 8.1.3 Proposal

**Proposal 37 (Ref [4]):** Remove the IE *NR-DL-Measurement-AD*. posSIBTyp6-1 includes the IE *NR-DL-PRS-AssistanceData*.

NOTE: See Annex 5 for example implementation.

|  |  |
| --- | --- |
| Issue 7-1 | |
| Company | Comments |
| Huawei/HiSilicon | Support. |
| Ericsson | Agree  In the same way, the IE NR-PositionCalculationAssistanceData can be removed and instead the two IEs *NR-UEB-TRP-LocationData* and *NR-UEB-TRP-RTD-Info* shall be moved to the 6.4.3 subsection |
| Apple | Agree |
| vivo | OK |
| CATT | This is a nice proposal and agree. |
| Intel | Ok |
|  |  |

## 8.2 Other "Broadcast Elements(clause 7)" Issues

|  |  |
| --- | --- |
| Company | Issue |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

# 9. Other Issues

Any other issues which do not fit into the sections 2-8 above.

|  |  |
| --- | --- |
| Company | Issue |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

# Annex 1a: Text Proposal for the *NR-DL-PRS-AssistanceData* Issues (Ref [4])

– *NR-DL-PRS-AssistanceData*

The IE *NR-DL-PRS-AssistanceData* is used by the location server to provide DL-PRS assistance data.

-- ASN1START

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

nr-DL-PRS-ReferenceTRP-r16 TRP-ID-r16,

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

...

}

NR-DL–PRS-PositioningFrequencyLayer-r16 ::= SEQUENCE {

dl-PRS-SubcarrierSpacing-r16 ENUMERATED {kHz15, kHz30, kHz60, kHz120, ...},

dl-PRS-ResourceBandwidth-r16 INTEGER (1..63),

dl-PRS-StartPRB-r16 INTEGER (0..2176),

dl-PRS-PointA-r16 ARFCN-ValueNR-r15,

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

dl-PRS-CyclicPrefix-r16 ENUMERATED {normal, extended, ...},

...

}

nrMaxFreqLayers-r16 INTEGER ::= 4 -- Max freq layers

nrMaxTRPsPerFreq-r16 INTEGER ::= 64 -- Max TRPs per freq layers

nrMaxResourceIDs-r16 INTEGER ::= 64 -- Max ResourceIDs

-- ASN1STOP

#### *– NR-DL-PRS-Config*

The IE *NR-DL-PRS-Config* defines downlink PRS configuration.

-- ASN1START

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

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

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,

...

}

DL-PRS-MutingOption1-r16 ::= SEQUENCE {

dl-prs-MutingBitRepetitionFactor-r16 ENUMERATED ( n1, n2, n4, n8, ... } OPTIONAL, -- Need OP

nr-option1-muting-r16 NR-MutingPattern-r16,

...

}

DL-PRS-MutingOption2-r16 ::= SEQUENCE {

nr-option2-muting-r16 NR-MutingPattern-r16,

...

}

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

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

dl-PRS-SequenceId-r16 INTEGER {0.. 4095},

dl-PRS-CombSizeN-and-ReOffset-r16 CHOICE {

n2-r16 INTEGER (0..1),

n4-r16 INTEGER (0..3),

n6-r16 INTEGER (0..5),

n12-r16 INTEGER (0..11)

},

dl-PRS-ResourceSlotOffset-r16 INTEGER (0..nrMaxResourceOffsetValue-1-r16),

dl-PRS-ResourceSymbolOffset-r16 INTEGER (0..12),

dl-PRS-QCL-Info-r16 DL-PRS-QCL-Info-r16 OPTIONAL, -- Need ON

...

}

NR-MutingPattern-r16 ::= CHOICE {

po2-r16 BIT STRING (SIZE(2)),

po4-r16 BIT STRING (SIZE(4)),

po6-r16 BIT STRING (SIZE(6)),

po8-r16 BIT STRING (SIZE(8)),

po16-r16 BIT STRING (SIZE(16)),

po32-r16 BIT STRING (SIZE(32)),

...

}

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

ssb-r16 SEQUENCE {

pci-r16 NR-PhysCellId-r16,

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,

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

}

}

NR-DL-PRS-Periodicity-and-ResourceSetSlotOffset-r16 ::= CHOICE {

scs15-r16 CHOICE {

n4-r16 INTEGER (0..3),

n5-r16 INTEGER (0..4),

n8-r16 INTEGER (0..7),

n10-r16 INTEGER (0..9),

n16-r16 INTEGER (0..15),

n20-r16 INTEGER (0..19),

n32-r16 INTEGER (0..31),

n40-r16 INTEGER (0..39),

n64-r16 INTEGER (0..63),

n80-r16 INTEGER (0..79),

n160-r16 INTEGER (0..159),

n320-r16 INTEGER (0..319),

n640-r16 INTEGER (0..639),

n1280-r16 INTEGER (0..1279),

n2560-r16 INTEGER (0..2559),

n5120-r16 INTEGER (0..5119),

n10240-r16 INTEGER (0..10239),

...},

scs30-r16 CHOICE {

n8-r16 INTEGER (0..7),

n10-r16 INTEGER (0..9),

n16-r16 INTEGER (0..15),

n20-r16 INTEGER (0..19),

n32-r16 INTEGER (0..31),

n40-r16 INTEGER (0..39),

n64-r16 INTEGER (0..63),

n80-r16 INTEGER (0..79),

n128-r16 INTEGER (0..127),

n160-r16 INTEGER (0..159),

n320-r16 INTEGER (0..319),

n640-r16 INTEGER (0..639),

n1280-r16 INTEGER (0..1279),

n2560-r16 INTEGER (0..2559),

n5120-r16 INTEGER (0..5119),

n10240-r16 INTEGER (0..10239),

n20480-r16 INTEGER (0..20479),

...},

scs60-r16 CHOICE {

n16-r16 INTEGER (0..15),

n20-r16 INTEGER (0..19),

n32-r16 INTEGER (0..31),

n40-r16 INTEGER (0..39),

n64-r16 INTEGER (0..63),

n80-r16 INTEGER (0..79),

n128-r16 INTEGER (0..127),

n160-r16 INTEGER (0..159),

n256-r16 INTEGER (0..255),

n320-r16 INTEGER (0..319),

n640-r16 INTEGER (0..639),

n1280-r16 INTEGER (0..1279),

n2560-r16 INTEGER (0..2559),

n5120-r16 INTEGER (0..5119),

n10240-r16 INTEGER (0..10239),

n20480-r16 INTEGER (0..20479),

n40960-r16 INTEGER (0..40959),

...},

scs120-r16 CHOICE {

n32-r16 INTEGER (0..31),

n40-r16 INTEGER (0..39),

n64-r16 INTEGER (0..63),

n80-r16 INTEGER (0..79),

n128-r16 INTEGER (0..127),

n160-r16 INTEGER (0..159),

n256-r16 INTEGER (0..255),

n320-r16 INTEGER (0..319),

n512-r16 INTEGER (0..511),

n640-r16 INTEGER (0..639),

n1280-r16 INTEGER (0..1279),

n2560-r16 INTEGER (0..2559),

n5120-r16 INTEGER (0..5119),

n10240-r16 INTEGER (0..10239),

n20480-r16 INTEGER (0..20479),

n40960-r16 INTEGER (0..40959),

n81920-r16 INTEGER (0..81919),

...},

...

}

nrMaxNumDL-PRS-ResourcesPerSet-1-r16 INTEGER ::= 63

nrMaxNumDL-PRS-ResourceSetsPerTRP-1-r16 INTEGER ::= 7

nrMaxResourceOffsetValue-1-r16 INTEGER ::= 511

nrMaxResourcesPerSet-r16 INTEGER ::= 64 -- Maximum resources can be configured -- for one set

nrMaxSetsPerTrp-r16 INTEGER ::= 2 -- Maximum resources set can be

-- configured for one TRP

-- ASN1STOP

– *NR-DL-TDOA-RequestLocationInformation*

The IE *NR-DL-TDOA-RequestLocationInformation* is used by the location server to request NR DL-TDOA location measurements from a target device.

-- ASN1START

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

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

nr-RequestedMeasurements-r16 BIT STRING { prsrsrpReq (0)

} (SIZE(1..8)),

nr-AssistanceAvailability-r16 BOOLEAN,

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

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

...

}

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

maxDL-PRS-RSRP-MeasurementsPerTRP-r16 INTEGER (1..8) OPTIONAL,

maxDL-PRS-RSTD-MeasurementsPerTRPPair-r16 INTEGER (1..4) OPTIONAL,

timingReportingGranularityFactor-r16 INTEGER (FFS) OPTIONAL, -- FFS in RAN4

nr-DL-PRS-RSTDReferenceInfo-r16 DL-PRS-IdInfo-r16 OPTIONAL,

...

}

-- ASN1STOP

#### – *DL-PRS-IdInfo*

The IE *DL-PRS-IdInfo* is used to identify the reference TRP IDs for the RSTD measurements.

-- ASN1START

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

trp-ID-r16 TRP-ID-r16,

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

nr-DL-PRS-ResourceID-List-r16 SEQUENCE (SIZE (1..nrMaxResourceIDs-r16)) OF

NR-DL-PRS-ResourceId-r16 OPTIONAL, -- Need OP

...

}

-- ASN1STOP

| ***DL-PRS-IdInfo* field descriptions** |
| --- |
| ***trp-ID***  This fields specifies the TRP ID of the RSTD reference TRP. At least the *dl-prs-id* in IE *TRP-ID* shall be present. |
| ***nr-DL-PRS-ResourceSetId***  This field specifies the DL-PRS Resource Set ID for the RSTD reference TRP. If this field is absent, all DL-PRS Resource Set IDs beloning to the *trp-ID* are applicable. |
| ***nr-DL-PRS-ResourceID-List***  This field specifies the DL-PRS Resource ID or a list of DL-PRS Resource IDs for the RSTD reference TRP. If this field is absent, all DL-PRS Resource IDs beloning to the *nr-DL-PRS-ResourceSetId* of the *trp-ID* are applicable. |

#### – *NR-DL-PRS-ResourceID*

The IE *NR-DL-PRS-ResourceID* defines the idendity of a DL-PRS Resource of a DL-PRS Resource Set of a TRP.

-- ASN1START

NR-DL-PRS-ResourceID-r16 ::= INTEGER (0..nrMaxNumDL-PRS-ResourcesPerSet-1-r16)

-- ASN1STOP

#### – *NR-DL-PRS-ResourceSetID*

The IE *NR-DL-PRS-ResourceSetID* defines the idendity of a DL-PRS Resource Set of a TRP.

-- ASN1START

NR-DL-PRS-ResourceSetID-r16 ::= INTEGER (0..nrMaxNumDL-PRS-ResourceSetsPerTRP-1-r16)

-- ASN1STOP

#### *– TRP-ID*

The IE *TRP-ID* provides a set of IDs to identify a TRP.

-- ASN1START

TRP-ID-r16 ::= SEQUENCE {

dl-PRS-ID-r16 INTEGER (0..255) OPTIONAL, -- Need ON

nr-PhysCellId-r16 NR-PhysCellId-r16 OPTIONAL, -- Need ON

nr-CellGlobalId-r16 NCGI-r15 OPTIONAL, -- Need ON

nrARFCN-r16 ARFCN-ValueNR-r15 OPTIONAL, -- Need ON

...

}

-- ASN1STOP



#### *– NR-TimeStamp*

The IE *NR-TimeStamp* provides the NR System Frame Number and the slot number for a subcarrier spacing for an indicated TRP.

-- ASN1START

NR-TimeStamp-r16 ::= SEQUENCE {

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

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

nr-Slot-r16 CHOICE {

scs15 INTEGER (0..9),

scs30 INTEGER (0..19),

scs60 INTEGER (0..39),

scs120 INTEGER (0..79)

},

...

}

-- ASN1STOP



# Annex 1b: Text Proposal for the *NR-DL-PRS-AssistanceData* Issues (Ref [1])

------------------Text proposal 1------------------------------

#### 6.y.1.1 NR-DL-AoD Assistance Data

#### – *NR-DL-AoD-ProvideAssistanceData*

The IE *NR-DL-AoD-ProvideAssistanceData* is used by the location server to provide assistance data to enable UE‑assisted Aod. It may also be used to provide NR DL AoD positioning specific error reason.

**The *ProvideAssistanceData* are provided as a list of TRPs, where the first TRP in the list is used as reference TRP**

------------------End of Text proposal 1------------------------------

------------------Text proposal 2------------------------------

#### 6.z.1.1 NR-Multi-RTT Assistance Data

#### – *NR-Multi-RTT-ProvideAssistanceData*

The IE *NR-Multi-RTT-ProvideAssistanceData* is used by the location server to provide assistance data to enable UE‑assisted NR Multi-RTT. It may also be used to provide NR Multi-RTT positioning specific error reason.

**The ProvideAssistanceData are provided as a list of TRPs, where the first TRP in the list is used as reference TRP**

------------------End of Text proposal 2------------------------------

# Annex 1c: NR-DL-PRS-config (Ref. [2])

#### *– NR-DL-PRS-Config*

The IE *NR-DL-PRS-Config* defines downlink PRS configuration.

-- ASN1START

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

nr-DL-PRS-ResourceSetList-r16 SEQUENCE (SIZE (1..nrMaxSetsPerTRP)) NR-DL-PRS-ResourceSet-r16,

nr-DL-PRS-SFN0-Offset-r16 SEQUENCE {

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

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

} OPTIONAL,

...

}

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

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

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

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

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

-- Need OR

dl-PRS-ResourceList-r16 SEQUENCE (SIZE (1..nrMaxResourcesPerSet)) OF NR-DL-PRS-Resource-r16,

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

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

}, OPTIONAL, --Need OR

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

...

}

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

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

dl-PRS-SequenceId-r16 INTEGER {0.. 4095},

dl-PRS-ReOffset-r16 CHOICE {

n2-r16 INTEGER (0..1),

n4-r16 INTEGER (0..3),

n6-r16 INTEGER (0..5),

n12-r16 INTEGER (0..11)

},

dl-PRS-ResourceSlotOffset-r16 INTEGER (0..nrMaxResourceOffsetValue-1),

dl-PRS-ResourceSymbolOffset-r16 INTEGER (0..12),

dl-PRS-QCL-Info-r16 DL-PRS-QCL-Info-r16 OPTIONAL,

...

}

MutingPattern-r16 ::= CHOICE {

po2-r16 BIT STRING (SIZE(2)),

po4-r16 BIT STRING (SIZE(4)),

po6-r16 BIT STRING (SIZE(6)),

po8-r16 BIT STRING (SIZE(8)),

po16-r16 BIT STRING (SIZE(16)),

po32-r16 BIT STRING (SIZE(32)),

...

}

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,

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

}

}

NR-DL-PRS-Periodicity-and-ResourceSetSlotOffset-r16 ::= CHOICE {

scs15-r16 CHOICE {

n4-r16 INTEGER (0..3),

n5-r16 INTEGER (0..4),

n8-r16 INTEGER (0..7),

n10-r16 INTEGER (0..9),

n16-r16 INTEGER (0..15),

n20-r16 INTEGER (0..19),

n32-r16 INTEGER (0..31),

n40-r16 INTEGER (0..39),

n64-r16 INTEGER (0..63),

n80-r16 INTEGER (0..79),

n160-r16 INTEGER (0..159),

n320-r16 INTEGER (0..319),

n640-r16 INTEGER (0..639),

n1280-r16 INTEGER (0..1279),

n2560-r16 INTEGER (0..2559),

n5120-r16 INTEGER (0..5119),

n10240-r16 INTEGER (0..10239),

...},

scs30-r16 CHOICE {

n8-r16 INTEGER (0..7),

n10-r16 INTEGER (0..9),

n16-r16 INTEGER (0..15),

n20-r16 INTEGER (0..19),

n32-r16 INTEGER (0..31),

n40-r16 INTEGER (0..39),

n64-r16 INTEGER (0..63),

n80-r16 INTEGER (0..79),

n128-r16 INTEGER (0..127),

n160-r16 INTEGER (0..159),

n320-r16 INTEGER (0..319),

n640-r16 INTEGER (0..639),

n1280-r16 INTEGER (0..1279),

n2560-r16 INTEGER (0..2559),

n5120-r16 INTEGER (0..5119),

n10240-r16 INTEGER (0..10239),

n20480-r16 INTEGER (0..20479),

...},

scs60-r16 CHOICE {

n16-r16 INTEGER (0..15),

n20-r16 INTEGER (0..19),

n32-r16 INTEGER (0..31),

n40-r16 INTEGER (0..39),

n64-r16 INTEGER (0..63),

n80-r16 INTEGER (0..79),

n128-r16 INTEGER (0..127),

n160-r16 INTEGER (0..159),

n256-r16 INTEGER (0..255),

n320-r16 INTEGER (0..319),

n640-r16 INTEGER (0..639),

n1280-r16 INTEGER (0..1279),

n2560-r16 INTEGER (0..2559),

n5120-r16 INTEGER (0..5119),

n10240-r16 INTEGER (0..10239),

n20480-r16 INTEGER (0..20479),

n40960-r16 INTEGER (0..40959),

...},

scs120-r16 CHOICE {

n32-r16 INTEGER (0..31),

n40-r16 INTEGER (0..39),

n64-r16 INTEGER (0..63),

n80-r16 INTEGER (0..79),

n128-r16 INTEGER (0..127),

n160-r16 INTEGER (0..159),

n256-r16 INTEGER (0..255),

n320-r16 INTEGER (0..319),

n512-r16 INTEGER (0..511),

n640-r16 INTEGER (0..639),

n1280-r16 INTEGER (0..1279),

n2560-r16 INTEGER (0..2559),

n5120-r16 INTEGER (0..5119),

n10240-r16 INTEGER (0..10239),

n20480-r16 INTEGER (0..20479),

n40960-r16 INTEGER (0..40959),

n81920-r16 INTEGER (0..81919),

...},

...

}

NR-DL-PRS-ResourceID-r16 ::= INTEGER (0.. nrMaxNumDL-PRS-ResourcesPerSet-1)

NR-DL-PRS-ResourceSetID-r16 ::= INTEGER (0.. nrMaxNumDL-PRS-ResourceSetsPerTRP-1)

nrMaxNumDL-PRS-ResourcesPerSet-1 INTEGER ::= 63

nrMaxNumDL-PRS-ResourceSetsPerTRP-1 INTEGER ::= 7

nrMaxResourceOffsetValue-1 INTEGER ::= 511

nrMaxResourcesPerSet INTEGER ::= 64 -- Maximum resources can be configured for one set

nrMaxSetsPerTrp INTEGER ::= 2 -- Maximum resources set can be configured for one TRP

-- ASN1STOP

# Annex 2: Text Proposal for the NR‑ECID‑SignalMeasurementInformation Issues (Ref [4])

– *NR-ECID-SignalMeasurementInformation*

The IE *NR-ECID-SignalMeasurementInformation* is used by the target device to provide NR ECID measurements to the location server.

-- ASN1START

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 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,

...

}

MeasQuantityResults-r16 ::= SEQUENCE {

nr-RSRP-r16 INTEGER (0..127) OPTIONAL,

nr-RSRQ-r16 INTEGER (0..127) OPTIONAL

}

ResultsPerSSB-IndexList-r16::= SEQUENCE (SIZE (1..64)) OF ResultsPerSSB-Index-r16

ResultsPerSSB-Index-r16 ::= SEQUENCE {

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

ssb-Results-r16 MeasQuantityResults-r16

}

ResultsPerCSI-RS-IndexList-r16::= SEQUENCE (SIZE (1..64)) OF ResultsPerCSI-RS-Index-r16

ResultsPerCSI-RS-Index-r16 ::= SEQUENCE {

csi-RS-Index-r16 INTEGER (0..95),

csi-RS-Results-r16 MeasQuantityResults-r16

}

-- ASN1STOP

| ***NR-ECID-SignalMeasurementInformation* field descriptions** |
| --- |
| ***primaryCellMeasuredResults***  This field contains the E-CID measurements for the primary cell. |
| ***nr-MeasuredResultsList***  This field contains the E CID measurements for up to 32 neighbour cells. |
| ***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. |
| ***trp-ID***  This field specifies the identity of the measured cell. |
| ***resultsSSB-Cell***  This field specifies the SS reference signal received power (SS-RSRP) and quality (SS-RSRQ) measurement aggregated at cell level, as defined in TS 38.331 [35]. |
| ***resultsCSI-RS-Cell***  This field specifies the CSI-RS reference signal received power (CSI-RSRP) and quality (CSI-RSRQ) measurement aggregated at cell level, as defined in TS 38.331 [35]. |
| ***resultsSSB-Indexes***  This field specifies the SS reference signal received power (SS-RSRP) and quality (SS-RSRQ) measurement per SSB resource, as defined in TS 38.331 [35]. |
| ***resultsCSI-RS-Indexes***  This field specifies the CSI-RS reference signal received power (CSI-RSRP) and quality (CSI-RSRQ) per CSI-RS resource, as defined in TS 38.331 [35]. |

# Annex 3: Text Proposal for the NR DL-TDOA Issues (Ref [4])

– *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.

-- 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-PositionCalculationAssistanceData-r16

NR-PositionCalculationAssistanceData-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 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. |

– *NR-SelectedDL-PRS-IndexList*

The IE *NR-SelectedDL-PRS-IndexList* provides a list of indices to the DL-PRS Resources provided in IE *NR‑DL‑PRS‑AssistanceData.*

-- ASN1START

NR-SelectedDL-PRS-IndexList-r16 ::= SEQUENCE (SIZE (1..nrMaxFreqLayers-r16)) OF

NR-SelectedDL-PRS-PerFreq-r16

NR-SelectedDL-PRS-PerFreq-r16 ::= SEQUENCE {

nr-SelectedDL–PRS-FrequencyLayerIndex-r16 INTEGER (0.. nrMaxFreqLayers-1-r16),

nr-SelectedDL-PRS-IndexListPerFreq-r16 SEQUENCE (SIZE (1..nrMaxTRPsPerFreq-r16)) OF

NR-SelectedDL-PRS-IndexPerTRP-r16

OPTIONAL, --Need OP

...

}

NR-SelectedDL-PRS-IndexPerTRP-r16 ::= SEQUENCE {

nr-SelectedTRP-Index-r16 INTEGER (0..nrMaxTRPsPerFreq-1-r16),

dl-SelectedPRS-ResourceSetIndexList-r16 SEQUENCE (SIZE (1..nrMaxSetsPerTrp-r16)) OF

DL-SelectedPRS-ResourceSetIndex-r16

OPTIONAL, --Need OP

...

}

DL-SelectedPRS-ResourceSetIndex-r16 ::= SEQUENCE {

nr-DL-SelectedPRS-ResourceSetIndex-r16 INTEGER (0..nrMaxSetsPerTrp-1-r16),

dl-SelectedPRS-ResourceIndexList-r16 SEQUENCE (SIZE (1..nrMaxResourcesPerSet-r16)) OF

DL-SelectedPRS-ResourceIndex-r16

OPTIONAL, --Need OP

...

}

DL-SelectedPRS-ResourceIndex-r16 ::= SEQUENCE {

nr-dl-SelectedPRS-ResourceIdIndex-r16 INTEGER (0.. maxNumDL-PRS-ResourcesPerSet-1-r16),

...

}

nrMaxFreqLayers-r16 INTEGER ::= 4 -- Max freq layers

nrMaxFreqLayers-1-r16 INTEGER ::= 3

nrMaxTRPsPerFreq-r16 INTEGER ::= 64 -- Max TRPs per freq layers

nrMaxTRPsPerFreq-1-r16 INTEGER ::= 63

nrMaxSetsPerTrp-r16 INTEGER ::= 2 -- Maximum resources set can be configured for one TRP

nrMaxSetsPerTrp-1-r16 INTEGER ::= 1

nrMaxResourcesPerSet-r16 INTEGER ::= 64 -- Maximum resources can be configured for one set

-- ASN1STOP

| *NR-SelectedDL-PRS-IndexList* field descriptions |
| --- |
| ***nr-SelectedDL–PRS-FrequencyLayerIndex***  This field provides an index to an element of the field *nr-DL-PRS-AssistanceDataList* in IE *NR‑DL‑PRS‑AssistanceData*. Value 0 corresponds to the first entry of the *nr-DL-PRS-AssistanceDataList*, Value 1 to the second, and so on. |
| ***nr-SelectedDL-PRS-IndexListPerFreq***  This field provides a list of addressed TRPs for the frequency layer indicated by *nr‑SelectedDL‑PRS‑FrequencyLayerIndex*. If this field is absent, all TRPs corresponding to the *nr‑SelectedDL‑PRS‑FrequencyLayerIndex* are addressed. |
| ***nr-SelectedTRP-Index***  This field provides an index to an element of the field *nr-DL-PRS-AssistanceDataPerFreq* in IE *NR‑DL‑PRS‑AssistanceData.* Value 0 corresponds to the first entry of the *nr-DL-PRS-AssistanceDataPerFreq*, Value 1 to the second, and so on. |
| ***dl-SelectedPRS-ResourceSetIndexList***  This field provides a list of addressed DL-PRS Resource Sets for the TRP indicated by *nr-SelectedTRP-Index*. If this field is absent, all DL-PRS Resource Sets of the TRP corresponding to the *nr-SelectedTRP-Index* are addressed. |
| ***nr-DL-SelectedPRS-ResourceSetIndex***  This field provides an index to an element of the field *nr-DL-PRS-ResourceSetList* in IE *NR-DL-PRS-Config* provided in IE *NR‑DL‑PRS‑AssistanceData.* Value 0 corresponds to the first entry of the *nr-DL-PRS-ResourceSetList,* value 1 to the second. |
| ***dl-SelectedPRS-ResourceIndexList***  This field provides a list of addressed DL-PRS Resources for the DL-PRS Resource Set indicated by *nr‑DL‑SelectedPRS-ResourceSetIndex*. If this field is absent, all DL-PRS Resources of the DL-PRS Resource Set corresponding to the *nr-DL-SelectedPRS-ResourceSetIndex* are addressed. |
| ***nr-dl-SelectedPRS-ResourceIdIndex***  This field provides an index to an element of the field *dl-PRS-ResourceList* in IE *NR-DL-PRS-Config* provided in IE *NR‑DL‑PRS‑AssistanceData.* Value 0 corresponds to the first entry of the *dl-PRS-ResourceList*, Value 1 to the second, and so on. |

– *NR-DL-TDOA-SignalMeasurementInformation*

The IE *NR-DL-TDOA-SignalMeasurementInformation* is used by the target device to provide NR-DL TDOA measurements to the location server.

-- ASN1START

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

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

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

nr-RSTD-RefQuality-r16 NR-TimingMeasQuality-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,

...

}

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

NR-DL-TDOA-AdditionalMeasurementElement-r16

NR-AdditionalPathList-r16 ::= SEQUENCE (SIZE(1..2)) OF NR-AdditionalPath-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-RSTDMeasQuality-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,

...

}

nrMaxTRPs-1-r16 INTEGER ::= 255 -- Max TRPs per UE

-- ASN1STOP

#### – *NR-DL-TDOA-RequestLocationInformation*

The IE *NR-DL-TDOA-RequestLocationInformation* is used by the location server to request NR DL-TDOA location measurements from a target device.

-- ASN1START

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

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

nr-DL-PRS-RSRP-Requested-r16 ENUMERATED { requested } OPTIONAL,

nr-AssistanceAvailability-r16 BOOLEAN,

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

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

...

}

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

maxDL-PRS-RSTD-MeasurementsPerTRPPair-r16 INTEGER (1..4) OPTIONAL,

timingReportingGranularityFactor-r16 INTEGER (FFS) OPTIONAL,

-- FFS in RAN4

...

}

-- ASN1STOP

#### – *NR-DL-TDOA-ProvideCapabilities*

The IE *NR-DL-TDOA-ProvideCapabilities* is used by the target device to indicate its capability to support NR DL-TDOA and to provide its NR DL-TDOA positioning capabilities to the location server.

-- ASN1START

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 PositioningModes,

...

}

-- ASN1STOP

#### – *NR-DL-TDOA-TargetDeviceErrorCauses*

The IE *NR-DL-TDOA-TargetDeviceErrorCauses* is used by the target device to provide NR-DL-TDOA error reasons to the location server.

-- ASN1START

DL-TDOA-TargetDeviceErrorCauses-r16 ::= SEQUENCE {

cause-r16 ENUMERATED { undefined,

assistance-data-missing,

unableToMeasureAnyTRP,

attemptedButUnableToMeasureSomeNeighbourTRPs,

thereWereNotEnoughSignalsReceivedForUeBasedDL-TDOA,

locationCalculationAssistanceDataMissing,

...

},

...

}

-- ASN1STOP

# Annex 4: Text Proposal for the NR DL-AoD Issues (Ref [4])

– *NR-DL-AoD-ProvideAssistanceData*

The IE *NR-DL-AoD-ProvideAssistanceData* is used by the location server to provide assistance data to enable UE‑assisted and UE-based NR DL-Aod. It may also be used to provide NR DL-AoD positioning specific error reason.

-- ASN1START

NR-DL-AoD-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-PositionCalculationAssistanceData-r16

NR-PositionCalculationAssistanceData-r16

OPTIONAL, -- Cond UEB

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

...

}

-- ASN1STOP

| **Conditional presence** | **Explanation** |
| --- | --- |
| *UEB* | The field is optionally present for UE based DL-AoD; 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-AoD-ProvideAssistanceData* message, or if the IE *NR-DL-PRS-AssistanceData* is provided in IE *NR‑Multi‑RTT‑ProvideAssistanceData* or *NR-DL-TDOA-ProvideAssistanceData*. |

| *NR-DL-AoD-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-TDOA-ProvideAssistanceData*. |
| ***nr-SelectedDL-PRS-IndexList***  This field specifies the DL-PRS Resources which are applicable for this *NR-DL-AoD-ProvideAssistanceData* message. |
| ***nr-PositionCalculationAssistanceData***  This field provides TRP location information for the TRPs provided in *nr-DL-PRS-AssistanceData* or *nr‑SelectedDL‑PRS-IndexList* to enable UE-based DL-AoD. |
| ***nr-DL-AoD-Error***  This field provides DL-AoD error reasons. |

#### – *NR-DL-AoD-SignalMeasurementInformation*

The IE *NR-DL-AoD-SignalMeasurementInformation* is used by the target device to provide NR DL-AoD measurements to the location server.

-- 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-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 (FFS) OPTIONAL,

-- Need RAN4 inputs on value range

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

...

}

nrMaxTRPs-r16 INTEGER ::= 256 -- Max TRPs

-- ASN1STOP

#### – *NR-DL-AoD-ProvideCapabilities*

The IE *NR-DL-AoD-ProvideCapabilities* is used by the target device to indicate its capability to support NR DL-AoD and to provide its NR DL-AoD positioning capabilities to the location server.

-- ASN1START

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

nr-DL-TDOA-Mode-r16 PositioningModes,

periodicalReporting-r16 PositioningModes,

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

...

}

-- ASN1STOP

#### – *NR-DL-AoD-TargetDeviceErrorCauses*

The IE *NR-DL-AoD-TargetDeviceErrorCauses* is used by the target device to provide NR-DL-AoD error reasons to the location server.

-- ASN1START

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

cause-r16 ENUMERATED { undefined,

assistance-data-missing,

unableToMeasureAnyTRP,

attemptedButUnableToMeasureSomeNeighbourTRPs,

thereWereNotEnoughSignalsReceivedForUeBasedDL-AoD,

locationCalculationAssistanceDataMissing,

...

},

...

}

-- ASN1STOP

# Annex 5: Text Proposal for the NR Multi-RTT Issues (Ref [4])

#### – *NR-Multi-RTT-ProvideAssistanceData*

The IE *NR-Multi-RTT-ProvideAssistanceData* is used by the location server to provide assistance data to enable UE‑assisted NR Multi-RTT. It may also be used to provide NR Multi-RTT positioning specific error reason.

-- ASN1START

NR-Multi-RTT-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-Multi-RTT-Error-r16 NR-Multi-RTT-Error-r16 OPTIONAL, -- Need ON

...

}

-- ASN1STOP

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

| *NR-Multi-RTT-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-DL-TDOA-ProvideAssistanceData* or *NR-DL-AoD-ProvideAssistanceData*. |
| ***nr-SelectedDL-PRS-IndexList***  This field specifies the DL-PRS Resources which are applicable for this *NR-Multi-RTT-ProvideAssistanceData* message. |
| ***nr-Multi-RTT-Error***  This field provides Multi-RTT error reasons. |

#### – *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.

-- ASN1START

NR-Multi-RTT-SignalMeasurementInformation-r16 ::= SEQUENCE {

nr-Multi-RTT-MeasList-r16 NR-Multi-RTT-MeasList-r16,

...

}

NR-Multi-RTT-MeasList-r16 ::= SEQUENCE (SIZE(1.. nrMaxTRPs-r16)) OF NR-Multi-RTT-MeasElement-r16

NR-Multi-RTT-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-UE-RxTxTimeDiff-r16 INTEGER (0..ffs) OPTIONAL,

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

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 (FFS) OPTIONAL,

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

nr-Multi-RTT-AdditionalMeasurements-r16

NR-Multi-RTT-AdditionalMeasurements-r16 OPTIONAL,

...

}

NR-AdditionalPathList-r16 ::= SEQUENCE (SIZE(1..2)) OF NR-AdditionalPath-r16

NR-Multi-RTT-AdditionalMeasurements-r16 ::= SEQUENCE (SIZE (1..3)) OF

NR-Multi-RTT-AdditionalMeasurementElement-r16

NR-Multi-RTT-AdditionalMeasurementElement-r16 ::= SEQUENCE {

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

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

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

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

nr-UE-RxTxTimeDiffAdditional-r16 INTEGER (0..ffs) OPTIONAL,

-- FFS on the value range

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

...

}

nrMaxTRPs-r16 INTEGER ::= 256 -- Max TRPs

-- ASN1STOP

– *NR-Multi-RTT-RequestLocationInformation*

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

-- ASN1START

NR-Multi-RTT-RequestLocationInformation-r16 ::= SEQUENCE {

nr-DL-PRS-RSRP-Requested-r16 ENUMERATED { requested } OPTIONAL, -- Need ON

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-ProvideCapabilities*

The IE *NR-Multi-RTT-ProvideCapabilities* is used by the target device to indicate its capability to support NR Multi-RTT and to provide its Multi-RTT positioning capabilities to the location server.

-- ASN1START

NR-Multi-RTT-ProvideCapabilities-r16 ::= SEQUENCE {

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

nr-UL-SRS-MeasCapability-r16 NR-UL-SRS-MeasCapability-r16,

dl-PRS-RSRP-MeasSupported-r16 ENUMERATED { supported } OPTIONAL,

additionalPathsReport-r16 ENUMERATED { supported } OPTIONAL,

periodicalReporting-r16 ENUMERATED { supported } OPTIONAL,

...

}

-- ASN1STOP

#### – *NR-Multi-RTT-TargetDeviceErrorCauses*

The IE *NR-Multi-RTT-TargetDeviceErrorCauses* is used by the target device to provide NR Multi-RTT error reasons to the location server.

-- ASN1START

NR-Multi-RTT-TargetDeviceErrorCauses-r16 ::= SEQUENCE {

cause-r16 ENUMERATED { undefined,

dl-assistance-data-missing,

unableToMeasureAnyTRP,

ul-srs-configuration-missing,

unableToTransmit-ul-prs,

...

},

...

}

-- ASN1STOP

# Annex 6: Text Proposal for posSIB Type 6.1 (Ref [4])

Table 7.2-1: Mapping of posSibType to assistanceDataElement

|  |  |  |
| --- | --- | --- |
|  | *posSibType* [12] | *assistanceDataElement* |
| *[…]* | | |
| OTDOA Assistance Data (clause 7.4.2) | *posSibType3-1* | *OTDOA-UE-Assisted* |
| NR DL-TDOA/DL-AoD Assistance Data (clause 6.4.3, 7.4.2) | *posSibType6-1* | *NR-DL-PRS-AssistanceData* |
| *posSibType6-2* | *NR-UEB-TRP-LocationData* |
| *posSibType6-3* | *NR-UEB-TRP-RTD-Info* |