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

Online, June 01 – 12, 2020

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

**Source:** Ericsson

**Title:** Email discussion report: [Post109bis-e][947][POS] TRP-ID structure (Ericsson)

**Document for:**  Discussion and Decision

# 1. Introduction

This document summarizes the following email discussion:

* [Post109bis-e][947][POS] TRP-ID structure (Ericsson)

      Scope: Discuss the proposals for restructuring the TRP-ID and determine which fields are needed for which case.  The table in R2-2003997 can be used as starting point.

      Intended outcome: Summary for next meeting

      Deadline:  Long

To allow a discussion of the summary as well, companies are asked to provide comments no later than Tuesday May 19th, 10.00 UTC.

Section 2 provides discussion templates per IE (in some cases pairs of IEs), where companies are asked to provide technical motivations if additional TRP identifiers are considered needed. The baseline is the analysis in [3] and the company comments in [1].

## References

[1] R2-2003997, "Email discussion report: [AT109bis-e][610][POS] LPP proposals (Ericsson).

[2] R2-20xxxxx, "RAN2 Chairman’s Notes", RAN2#109bis-e.

[3] R2-2003318, "Handling on TRP-ID", Intel Corporation

# 2. Discussion

It is argued in [2] and [3] that the IE *TRP-ID* in RAN2 need to be better defined to avoid confusion with RAN3, its use needs to be clarified and in what IEs it is needed and how the identifiers associated to a TRP shall be represented.

According to [2], it is enough with the PRS ID to uniquely identify a TRP within an LPP session between LMF and a UE. Furthermore, [3] provides a summary of TRP-ID issues. Ultimately, the following Table of required TRP-ID elements for various IEs is derived in [4]:

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| --- | --- |
| IE name | Required fields |
| *NR-Multi-RTT-MeasElement* | dl-PRS-ID |
| *NR-DL-AoD-MeasElement* | dl-PRS-ID |
| *NR-DL-TDOA-MeasElement* | dl-PRS-ID |
| *NR-MeasuredResultsElement* | pci, CGI and ARFCN |
| *NR-TimeStamp* | None |
| *DL-PRS-IdInfo* | dl-PRS-ID |
| *NR-DL-PRS-AssistanceDataPerTRP* | dl-PRS-ID and ARFCN |
| *NR-SSB-Config* | PCI and ARFCN |
| *ReferenceTRP-RTD-Info* | dl-PRS-ID |
| *RTD-InfoElement* | dl-PRS-ID |
| *NR-DL-PRS-BeamInfo* | dl-PRS-ID |
| *TRP-LocationInfoElement* | dl-PRS-ID |

The above Table summarizes the IEs which currently make use of the IE *TRP-ID,* and which fields of the IE *TRP-ID* is/are required for the functionality in the corresponding parent IE.

In addition, the summary Rapporteur’s comment [1] is that a Cell-ID may be required in *NR-TimeStamp* to indicate the cell/TRP from which the SFN has been derived.

In order to avoid unnecessary identifiers, we start this email discussion from a baseline of a minimalistic set of identifiers based on [3] (Table above), as suggested during the online discussion at RAN2#109bis-e. The simplest approach for a minimalistic set if to redefine TRP-ID to represent the INTEGER (0..255) identifying a TRP among the TRPs a target device can handle as per RAN1 agreement:

|  |  |  |
| --- | --- | --- |
| *– TRP-ID*  The IE *TRP-ID* provides the ID to identify the TRP among the TRPs the target device can handle.  -- ASN1START  TRP-ID-r16 ::= INTEGER (0..255)  -- ASN1STOP       | ***TRP-ID* field descriptions** | | --- | | ***TRP-ID***  This field is used along with a DL PRS Resource Set ID and a DL PRS Resources ID to uniquely identify a DL PRS Resource. This ID can be associated with multiple DL PRS Resource Sets associated with a single TRP.  Each TRP can only be associated with one such ID. | |

This means that identifiers used in LTE might be omitted, but can be added based on a technical motivation. In the following subsections, the individual IEs and the necessary additional identifers are discussed

## 2.1 NR-Multi-RTT-MeasElement

The *NR-Multi-RTT-MeasElement* IE is part of the IE *NR-Multi-RTT-SignalMeasurementInformation* and is defined as below:

-- ASN1START

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

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

...

}

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

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

trp-ID-r16 TRP-ID-r16,

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,

...

}

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 INTEGER ::= 256 -- Max TRPs

-- ASN1STOP

| ***NR-Multi-RTT-SignalMeasurementInformation* field descriptions** |
| --- |
| ***nr-PRS-RSRP-Result***  This field specifies the reference signal received power (RSRP) measurement, as defined in TS 38.331 [35]. |
| ***nr-UE-RxTxTimeDiff***  This field specifies the UE Rx–Tx time difference measurement, as defined in FFS. |
| ***nr-AdditionalPathList***  This field specifies one or more additional detected path timing values for the TRP or resource, relative to the path timing used for determining the *nr-UE-RxTxTimeDiff* value or the *nr-UE-RxTxTimeDiffAdditional* value. If this field was requested but is not included, it means the UE did not detect any additional path timing values. |

Companies are asked to identify additional TRP identifiers that are considered needed as to provide a solid technical motivation.

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| Table 2.1 Need for additional TRP identifiers in *NR-Multi-RTT-MeasElement-r16* | |
| Company | Comments |
| Huawei/HiSilicon | *dl-PRS-ID*, *nr-PhysCellId*, *nr-CellGlobalId*  Considering broadcast and positioning SIB may be different for different cell, Cell ID should be included, and optional.  No need for ARFCN, as *dl-PRS-PointA* is already provided in *NR-DL–PRS-PositioningFrequencyLayer* |
| Qulcomm | *dl-PRS-ID*, *nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId*  I understand the *nr-ARFCN* can disambiguate the *nr-PhysCellId* in some cases. I.e., this is the same as in Rel-15 LPP where PCI/ARFCN can be provided as pair. If this is not applicable to NR (and we made a mistake in Rel-15), then I agree with Huawei and *nr-ARFCN* is not needed (note, I understand this *nr-ARFCN* is not supposed to be the *dl-PRS-PointA*).  As mentioned in the comment above (RAN1 agreement), the *dl-PRS-ID* identifies a DL-PRS Resource of a TRP, but not necessarily the TRP. Therefore, the possible identifiers of a TRP (*nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId)* need to be provided in some cases to uniquely identify a TRP and associated measurements. E.g., when the assistance data are not provided from the same source or the same LPP session.  In general, we cannot see anything wrong with the current LPP (apart from the somewhat misleading name of the *TRP-ID* IE). All fields are optional present in this IE and can be provided when needed/appropriate. |
| OPPO | *dl-PRS-ID +* Either *nr-PhysCellId/nr-ARFCN* Or *nr-CellGlobalId*  PRS ID only is not enough since it is unique within a TRP but not across TRPs. So to uniquely identify a TRP, either the combination of *nr-PhysCellId/nr-ARFCN* or *nr-CellGlobalId* can work, by assuming no local PCI confusion at a same local area for a same frequency. May be the latter one, i.e., *nr-CellGlobalId*, is safer. This applies to both UL and DL.  So we fail to see the need to include both the combination of *nr-PhysCellId/nr-ARFCN* and *nr-CellGlobalId* in UL report here for multi-RTT. |
| Ericsson | We read the RAN1 agreement differently. The TRP ID is like the country code of a telephone number that together with an area code and a local number identifies the number identity. Same here, where the DL PRS resource is identified by a TRP-ID, a DL-PRS resource set ID and a DL PRS resource ID.  Therefore, to name the “country code” a “local number identifier” would be strange, and to name the identify of the TRP a DL-PRS ID would also be confusing.  It is important to consider the context here.  A UE requesting DL-PRS assistance data is including the nr-CellGlobalId to the LMF and in return obtains a DL-PRS resources in a hierarchy based on TRPs per frequency layers. A UE retrieving assistance data via system information broadcast from a cell also obtains the nr-CellGlobalId of that cell. Therefore, there is already nr-CellGlobalId + TRP ID provided to the UE to ensure that the UE can handle information from different sources for UEB.  Therefore, it is enough to provide a TRP ID 0..255 to the UE. When the UE provides measurements to the LMF, the corresponding measurement is tied to a TRP with a TRP ID, and since the UE can be configured with up to 4\*64=256 TRPs, the TRP ID 0..255 is enough to identify the measurement as part of UEA.  With a globally unique cell identifier in the unicast AD request and in the broadcast SIB1, and a list of TRPs, each with a TRP ID, how can there be a need for something in addition to that? We do not see any technical motivation for additional identifiers. |
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## 2.2 NR-DL-AoD-MeasElement

The *NR-DL-AoD-MeasElement* IE is part of the IE *NR-DL-AoD-SignalMeasurementInformation* and is defined as below:

-- 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)) 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-TimingMeasQuality-r16 NR-TimingMeasQuality-r16,

nr-DL-Aod-AdditionalMeasurements-r16 NR-DL-AoD-AdditionalMeasurements-r16,

...

}

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 INTEGER ::= 256 -- Max TRPs

-- ASN1STOP

Companies are asked to identify additional TRP identifiers that are considered needed as to provide a solid technical motivation.

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| Table 2.2 Need for additional TRP identifiers in *NR-DL-AoD-MeasElement-r16* | |
| Company | Comments |
| Huawei/HiSilicon | *dl-PRS-ID*, *nr-PhysCellId*, *nr-CellGlobalId*  Considering broadcast and positioning SIB may be different for different cell, Cell ID should be included, and optional.  No need for ARFCN, as *dl-PRS-PointA* is already provided in *NR-DL–PRS-PositioningFrequencyLayer* |
| Qualcomm | *dl-PRS-ID*, *nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId*  I understand the *nr-ARFCN* can disambiguate the *nr-PhysCellId* in some cases. I.e., this is the same as in Rel-15 LPP where PCI/ARFCN can be provided as pair. If this is not applicable to NR (and we made a mistake in Rel-15), then I agree with Huawei and *nr-ARFCN* is not needed (note, I understand this *nr-ARFCN* is not supposed to be the *dl-PRS-PointA*).  As mentioned in the comment above (RAN1 agreement), the *dl-PRS-ID* identifies a DL-PRS Resource of a TRP, but not necessarily the TRP. Therefore, the possible identifiers of a TRP (*nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId)* need to be provided in some cases to uniquely identify a TRP and associated measurements. E.g., when the assistance data are not provided from the same source or the same LPP session.  In general, we cannot see anything wrong with the current LPP (apart from the somewhat misleading name of the *TRP-ID* IE). All fields are optional present in this IE and can be provided when needed/appropriate. |
| OPPO | *dl-PRS-ID +* Either *nr-PhysCellId/nr-ARFCN* Or *nr-CellGlobalId*  PRS ID only is not enough since it is unique within a TRP but not across TRPs. So to uniquely identify a TRP, either the combination of *nr-PhysCellId/nr-ARFCN* or *nr-CellGlobalId* can work, by assuming no local PCI confusion at a same local area for a same frequency. May be the latter one, i.e., *nr-CellGlobalId*, is safer. This applies to both UL and DL.  So we fail to see the need to include both the combination of *nr-PhysCellId/nr-ARFCN* and *nr-CellGlobalId* in UL report here for DL-AoD. |
| Ericsson | We read the RAN1 agreement differently. The TRP ID is like the country code of a telephone number that together with an area code and a local number identifies the number identity. Same here, where the DL PRS resource is identified by a TRP-ID, a DL-PRS resource set ID and a DL PRS resource ID.  Therefore, to name the “country code” a “local number identifier” would be strange, and to name the identify of the TRP a DL-PRS ID would also be confusing.  It is important to consider the context here.  A UE requesting DL-PRS assistance data is including the nr-CellGlobalId to the LMF and in return obtains a DL-PRS resources in a hierarchy based on TRPs per frequency layers. A UE retrieving assistance data via system information broadcast from a cell also obtains the nr-CellGlobalId of that cell. Therefore, there is already nr-CellGlobalId + TRP ID provided to the UE to ensure that the UE can handle information from different sources for UEB.  Therefore, it is enough to provide a TRP ID 0..255 to the UE. When the UE provides measurements to the LMF, the corresponding measurement is tied to a TRP with a TRP ID, and since the UE can be configured with up to 4\*64=256 TRPs, the TRP ID 0..255 is enough to identify the measurement as part of UEA.  With a globally unique cell identifier in the unicast AD request and in the broadcast SIB1, and a list of TRPs, each with a TRP ID, how can there be a need for something in addition to that? We do not see any technical motivation for additional identifiers. |
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## 2.3 NR-DL-TDOA-MeasElement

The *NR-DL-TDOA-MeasElement* IE is part of the IE *NR-DL-TDOA-SignalMeasurementInformation* and is defined as below:

-- ASN1START

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,

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,

...

}

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

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 INTEGER ::= 256 -- Max TRPs per UE

-- ASN1STOP

Companies are asked to identify additional TRP identifiers that are considered needed as to provide a solid technical motivation.

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| Table 2.3 Need for additional TRP identifiers in *NR-DL-TDOA-MeasElement-r16* | |
| Company | Comments |
| Huawei/HiSilicon | *dl-PRS-ID*, *nr-PhysCellId*, *nr-CellGlobalId*  Considering broadcast and positioning SIB may be different for different cell, Cell ID should be included, and optional.  No need for ARFCN, as *dl-PRS-PointA* is already provided in *NR-DL–PRS-PositioningFrequencyLayer* |
| Qualcomm | *dl-PRS-ID*, *nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId*  I understand the *nr-ARFCN* can disambiguate the *nr-PhysCellId* in some cases. I.e., this is the same as in Rel-15 LPP where PCI/ARFCN can be provided as pair. If this is not applicable to NR (and we made a mistake in Rel-15), then I agree with Huawei and *nr-ARFCN* is not needed (note, I understand this *nr-ARFCN* is not supposed to be the *dl-PRS-PointA*).  As mentioned in the comment above (RAN1 agreement), the *dl-PRS-ID* identifies a DL-PRS Resource of a TRP, but not necessarily the TRP. Therefore, the possible identifiers of a TRP (*nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId)* need to be provided in some cases to uniquely identify a TRP and associated measurements. E.g., when the assistance data are not provided from the same source or the same LPP session.  In general, we cannot see anything wrong with the current LPP (apart from the somewhat misleading name of the *TRP-ID* IE). All fields are optional present in this IE and can be provided when needed/appropriate. |
| OPPO | *dl-PRS-ID +* Either *nr-PhysCellId/nr-ARFCN* Or *nr-CellGlobalId*  PRS ID only is not enough since it is unique within a TRP but not across TRPs. So to uniquely identify a TRP, either the combination of *nr-PhysCellId/nr-ARFCN* or *nr-CellGlobalId* can work, by assuming no local PCI confusion at a same local area for a same frequency. May be the latter one, i.e., *nr-CellGlobalId*, is safer. This applies to both UL and DL.  So we fail to see the need to include both the combination of *nr-PhysCellId/nr-ARFCN* and *nr-CellGlobalId* in UL report here for DL-TDOA. |
| Ericsson | We read the RAN1 agreement differently. The TRP ID is like the country code of a telephone number that together with an area code and a local number identifies the number identity. Same here, where the DL PRS resource is identified by a TRP-ID, a DL-PRS resource set ID and a DL PRS resource ID.  Therefore, to name the “country code” a “local number identifier” would be strange, and to name the identify of the TRP a DL-PRS ID would also be confusing.  It is important to consider the context here.  A UE requesting DL-PRS assistance data is including the nr-CellGlobalId to the LMF and in return obtains a DL-PRS resources in a hierarchy based on TRPs per frequency layers. A UE retrieving assistance data via system information broadcast from a cell also obtains the nr-CellGlobalId of that cell. Therefore, there is already nr-CellGlobalId + TRP ID provided to the UE to ensure that the UE can handle information from different sources for UEB.  Therefore, it is enough to provide a TRP ID 0..255 to the UE. When the UE provides measurements to the LMF, the corresponding measurement is tied to a TRP with a TRP ID, and since the UE can be configured with up to 4\*64=256 TRPs, the TRP ID 0..255 is enough to identify the measurement as part of UEA.  With a globally unique cell identifier in the unicast AD request and in the broadcast SIB1, and a list of TRPs, each with a TRP ID, how can there be a need for something in addition to that? We do not see any technical motivation for additional identifiers. |
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## 2.4 NR-MeasuredResultsElement

The *NR-MeasuredResultsElement* IE is part of the IE *NR-ECID-SignalMeasurementInformation* and is defined as below:

-- 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 BIT STRING (SIZE (10)),

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

nr-PhysCellId-r16 NR-PhysCellId-r16,

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

nrARFCNRef-r16 ARFCN-ValueNR-r15,

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

}

-- ASN1STOP

| ***NR-ECID-SignalMeasurementInformation* field descriptions** |
| --- |
| ***systemFrameNumber***  This field specifies the system frame number of the measured cell during which the measurements have been performed. The target device shall include this field if it was able to determine the SFN of the cell at the time of measurement. |
| ***nr-PhysCellId***  This field specifies the physical cell identity of the measured cell. |
| ***nr-CellGlobalId***  This field specifies the NCGI of the measured cell. The target device shall provide this field if it was able to determine the NCGI of the measured cell at the time of measurement . |
| ***nrARFCNRef***  This field specifies the NRARFCN of the measured NR carrier frequency. |
| ***resultsSSB-Cell***  This attribute 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 attribute 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]. |
| ***ssb-Results***  This attribute specifies the SS reference signal received power (SS-RSRP) and quality (SS-RSRQ) measurement per SSB resource, as defined in TS 38.331 [35]. |
| ***csi-RS-Results***  This attribute 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]. |
| ***primaryCellMeasuredResults***  This field contains measurements for the primary cell when the target device reports measurements for both primary cell and neighbour cells. This field shall be omitted when the target device reports measurements for the primary cell only, in which case the measurements for the primary cell is reported in the *measuredResultsList*. |

Companies are asked to identify additional TRP identifiers that are considered needed as to provide a solid technical motivation.

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| Table 2.4 Need for additional TRP identifiers in *NR-MeasuredResultsElement-r16* | |
| Company | Comments |
| Huawei/HiSilicon | For ARFCN, first we do not think that we need “Ref”. Second the ARFCN should either be SSB frequency if RRM is based on SSB or pointA of CSI-RS if RRM is based on CSI-RS. UE may not be able to identify the carrier ARFCN of a neighbouring cell through RRM. |
| Qualcomm | *nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId* are needed. If they are provided individually, the *trp-ID-r16* is not needed.  I understand the *nr-ARFCN* can disambiguate the *nr-PhysCellId* in some cases. I.e., this is the same as in Rel-15 LPP where PCI/ARFCN can be provided as pair. If this is not applicable to NR (and we made a mistake in Rel-15), then *nr-ARFCN* can be removed.  In general, we cannot see anything wrong with the current LPP (apart from the somewhat misleading name of the *TRP-ID* IE). All fields are optional present in the IE and can be provided when needed/appropriate.  However, if desired, the DL-PRS ID could be moved to the *NR-DL-PRS-Config* IE. |
| OPPO | *dl-PRS-ID +* Either *nr-PhysCellId/nr-ARFCN* Or *nr-CellGlobalId*  PRS ID only is not enough since it is unique within a TRP but not across TRPs. So to uniquely identify a TRP, either the combination of *nr-PhysCellId/nr-ARFCN* or *nr-CellGlobalId* can work, by assuming no local PCI confusion at a same local area for a same frequency. May be the latter one, i.e., *nr-CellGlobalId*, is safer. This applies to both UL and DL.  So we fail to see the need to include both the combination of *nr-PhysCellId/nr-ARFCN* and *nr-CellGlobalId* in UL report here for NR ECID. |
| Ericsson | If the timestamp does not include any reference to which cell it has been adopted from, then it should be in the reference TRP information, and not in every element in NR-MeasuredResultsList-r16. |
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## 2.5 NR-TimeStamp

The *NR-TimeStamp* IE is part of several IEs and is defined as below:

-- ASN1START

NR-TimeStamp-r16 ::= SEQUENCE {

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

nr-PhysCellId-r16 NR-PhysCellId-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. |

Companies are asked to identify additional TRP identifiers that are considered needed as to provide a solid technical motivation.

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| Table 2.5 Need for additional TRP identifiers in *NR-TimeStamp-r16* | |
| Company | Comments |
| Huawei/HiSilicon | No need to include TRP ID or PCI, as it was agreed in RAN1 and captured in RAN1 specification, that the assistance data reference is used to identify the time stamp timing.  Agreement (RAN1#99):  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.  TS 38.214  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*. |
| Qualcomm | The proposed *NR-PhysCellId-r16* in the ASN.1 above is included in IE *TRP-ID-r16*, so no change is needed.  The *NR-TimeStamp-r16* can also provide the time stamp for the location estimate (UE-based); e.g., IE *NR-DL-TDOA-LocationInformation,* for which the RAN1 agreement cited by Huawei above seems not applicable (i.e., the *TRP-ID* is optional present). |
| OPPO | We are not sure about the necessity of PCI/Arfcn/CGI information here in timestamp.  If take DL TDOA as an example:   1. For the time stamp included in *NR-DL-AoD-MeasElement-r16,* we assume the agreement cited by Huawei is applicable, so no need for additional information at all (not even PCI); 2. For the time stamp included in *NR-DL-TDOA-LocationInformation*, if Qualcomm comment is correct, and thus cell information is needed, we wonder if PCI is enough, considering the possible PCI confusion issue. As commented above, So to uniquely identify a TRP, either the combination of *nr-PhysCellId/nr-ARFCN* or *nr-CellGlobalId* can work, by assuming no local PCI confusion at a same local area for a same frequency. May be the latter one, i.e., *nr-CellGlobalId*, is safer. This applies to both UL and DL. |
| Ericsson | In response to the QC comment about this already being present in a complex IE:  The clear majority of companies from the RAN2#109bis email discussion were in favor of splitting the TRP ID of the baseline into separate fields, so TRP ID (or another name) in this context is 0..255 and not including PCI.  We agree with QC on the necessity to ensure that SFN is well-defined in all cases. |
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## 2.6 DL-PRS-IdInfo

The IE *DL-PRS-IdInfo* provides the IDs of the reference and neighbour TRPs' DL-PRS Resources.

-- ASN1START

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

trp-ID-r16 TRP-ID-r16,

nr-DL-PRS-ResourceID-List-r16 (SIZE (1..nrMaxResourceIDs)) OF NR-DL-PRS-ResourceId-r16 OPTIONAL,

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

}

-- ASN1STOP

Companies are asked to identify additional TRP identifiers that are considered needed as to provide a solid technical motivation.

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| Table 2.6 Need for additional TRP identifiers in *DL-PRS-IdInfo-r16* | |
| Company | Comments |
| Huawei/HiSilicon | *dl-PRS-ID*, *nr-PhysCellId*, *nr-CellGlobalId*  Considering broadcast and positioning SIB may be different for different cell, Cell ID should be included, and optional.  No need for ARFCN, as *dl-PRS-PointA* is already provided in *NR-DL–PRS-PositioningFrequencyLayer* |
| Qualcomm | *dl-PRS-ID , nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId* are needed.  As mentioned in the comment above (RAN1 agreement), the *dl-PRS-ID* identifies a DL-PRS Resource of a TRP, but not necessarily the TRP. Therefore, the possible identifiers of a TRP (*nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId)* need to be provided in some cases to uniquely identify a TRP and associated measurement. E.g., when the assistance data are not provided from the same source or the same LPP session.  In general, we cannot see anything wrong with the current LPP (apart from the somewhat misleading name of the *TRP-ID* IE). All fields are optional present in the IE and can be provided when needed/appropriate. |
| OPPO | *dl-PRS-ID +* Either *nr-PhysCellId/nr-ARFCN* Or *nr-CellGlobalId*  PRS ID only is not enough since it is unique within a TRP but not across TRPs. So to uniquely identify a TRP, either the combination of *nr-PhysCellId/nr-ARFCN* or *nr-CellGlobalId* can work, by assuming no local PCI confusion at a same local area for a same frequency. May be the latter one, i.e., *nr-CellGlobalId*, is safer. This applies to both UL and DL.  So we fail to see the need to include both the combination of *nr-PhysCellId/nr-ARFCN* and *nr-CellGlobalId* in DL PRS info here. |
| Ericsson | As explained above, there is a *nr-CellGlobalId* presented together with the DL-PRS in the broadcast, and a *nr-CellGlobalId* in the AD request in case of unicast, so an additional cell ID is not needed. |
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## 2.7 NR-DL-PRS-AssistanceDataPerTRP

The *NR-DL-PRS-AssistanceDataPerTRP* IE is part of the IE *NR-DL-PRS-AssistanceData* and is defined as below:

-- ASN1START

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

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

nr-DL-PRS-AssistanceDataList-r16 SEQUENCE (SIZE (1..nrMaxFreqLayers)) 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 (SIZE (1..nrMaxTRPsPerFreq)) OF NR-DL-PRS-AssistanceDataPerTRP-r16,

nr-DL–PRS-PositioningFrequencyLayer-r16 NR-DL–PRS-PositioningFrequencyLayer-r16 OPTIONAL, --Need ON

...

}

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,

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

...

}

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 INTEGER ::= 4 -- Max freq layers

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

nrMaxResourceIDs INTEGER ::= 64 -- Max ResourceIDs

-- ASN1STOP

Companies are asked to identify additional TRP identifiers that are considered needed as to provide a solid technical motivation.

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| Table 2.7 Need for additional TRP identifiers in *NR-DL-PRS-AssistanceDataPerTRP-r16* | |
| Company | Comments |
| Huawei/HiSilicon | *dl-PRS-ID*, *nr-PhysCellId*, *nr-CellGlobalId*  Considering broadcast and positioning SIB may be different for different cell, Cell ID should be included, and optional.  No need for ARFCN, as *dl-PRS-PointA* is already provided in *NR-DL–PRS-PositioningFrequencyLayer* |
| Qualcomm | *dl-PRS-ID*, *nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId*  I understand the *nr-ARFCN* can disambiguate the *nr-PhysCellId* in some cases. I.e., this is the same as in Rel-15 LPP where PCI/ARFCN can be provided as pair. If this is not applicable to NR (and we made a mistake in Rel-15), then I agree with Huawei and *nr-ARFCN* is not needed (note, I understand this *nr-ARFCN* is not supposed to be the *dl-PRS-PointA*).  As mentioned in the comment above (RAN1 agreement), the *dl-PRS-ID* identifies a DL-PRS Resource of a TRP, but not necessarily the TRP. Therefore, the possible identifiers of a TRP (*nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId)* need to be provided in some cases to uniquely identify a TRP and associated measurement. E.g., when the assistance data are not provided from the same source or the same LPP session.  In general, we cannot see anything wrong with the current LPP (apart from the somewhat misleading name of the *TRP-ID* IE). All fields are optional present in the IE and can be provided when needed/appropriate. |
| OPPO | *dl-PRS-ID +* Either *nr-PhysCellId/nr-ARFCN* Or *nr-CellGlobalId*  PRS ID only is not enough since it is unique within a TRP but not across TRPs. So to uniquely identify a TRP, either the combination of *nr-PhysCellId/nr-ARFCN* or *nr-CellGlobalId* can work, by assuming no local PCI confusion at a same local area for a same frequency. May be the latter one, i.e., *nr-CellGlobalId*, is safer. This applies to both UL and DL.  So we fail to see the need to include both the combination of *nr-PhysCellId/nr-ARFCN* and *nr-CellGlobalId* in DL PRS info here. |
| Ericsson | As explained above, there is a *nr-CellGlobalId* presented together with the DL-PRS in the broadcast, and a *nr-CellGlobalId* in the AD request in case of unicast, so an additional cell ID is not needed. |
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## 2.8 NR-SSB-Config

The *IE NR-SSB-Config* is part of the IE *NR-DL-PRS-AssistanceData* and is defined as:

-- ASN1START

NR-SSB-Config-r16 ::= SEQUENCE {

trp-ID-r16 TRP-ID-r16,

nr-PhysCellId-r16 NR-PhysCellId-r16,

nrARFCNRef-r16 ARFCN-ValueNR-r15,

ss-PBCH-BlockPower-r16 INTEGER (-60..50),

halfFrameIndex-r16 INTEGER (0..1),

SSB-periodicity-r16 ENUMERATED { ms5, ms10, ms20, ms40, ms80, ms160, ...},

ssb-PositionsInBurst-r16 CHOICE {

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

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

longBitmap-r16 BIT STRING (SIZE (64))

} OPTIONAL, --Need OR

ssbSubcarrierSpacing-r16 ENUMERATED {kHz15, kHz30, kHz60, kHz120, kHz240, ...},

sfn-SSB-Offset-r16 INTEGER (0..15),

smtc-r16 SEQUENCE {

periodicityAndOffset-r16 CHOICE {

sf5 INTEGER (0..4),

sf10 INTEGER (0..9),

sf20 INTEGER (0..19),

sf40 INTEGER (0..39),

sf80 INTEGER (0..79),

sf160 INTEGER (0..159)

},

duration-r16 ENUMERATED { sf1, sf2, sf3, sf4, sf5, ... }

}

}

-- ASN1STOP

Companies are asked to identify additional TRP identifiers that are considered needed as to provide a solid technical motivation.

|  |  |
| --- | --- |
| Table 2.8 Need for additional TRP identifiers in *NR-SSB-Config-r16* | |
| Company | Comments |
| Huawei/HiSilicon | No need to include TRP-ID or PRS-ID for SSB configuration.  OK have PCI and ARFCN, but *nrARFCNRef-r16* should be *nrARFCN-r16*. |
| Qaulcomm | No need for DL-PRS-ID. But since all fields in IE *TRP-ID-r16* are optional present, I assume a NW is smart enough to provide the required fields in each case.  Alternativlely, as mentioned above, the DL-PRS ID could be moved to the *NR-DL-PRS-Config* IE. |
| OPPO | *dl-PRS-ID + nr-PhysCellId/nr-ARFCN* + *nr-CellGlobalId*  PRS ID only is not enough since it is unique within a TRP but not across TRPs. So to uniquely identify a TRP, either the combination of *nr-PhysCellId/nr-ARFCN* or *nr-CellGlobalId* can work, by assuming no local PCI confusion at a same local area for a same frequency. May be the latter one, i.e., *nr-CellGlobalId*, is safer. This applies to both UL and DL.  However, on top of that, for SSB configuration, the information of PCI and Arfcn helps the UE to locate the SSB, i.e., not from the uniquely identifying the SSB perspective, but from helping the UE to locate the SSB perspective, the additional information is helpful. So for this reason, the additional information of PCI and Arfcn can be used, even in addition to CGI information. |
| Ericsson | We agree, *nrARFCNRef-r16* should be *nrARFCN-r16.*  The TRP-ID shall be removed, it is not needed. |
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## 2.9 ReferenceTRP-RTD-Info and RTD-InfoElement

The IEs *ReferenceTRP-RTD-Info* and *RTD-InfoElement* is part of the IE *NR-RTD-Info* and is defined by

-- ASN1START

NR-RTD-Info-r16 ::= SEQUENCE {

referenceTRP-RTD-Info-r16 ReferenceTRP-RTD-Info-r16,

rtd-InfoList-r16 RTD-InfoList-r16,

...

}

ReferenceTRP-RTD-Info-r16 ::= SEQUENCE {

ref-trp-id-r16 TRP-ID-r16,

refTime-r16 CHOICE {

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

utc-r16 UTCTime,

...

},

rtd-RefQuality-r16 NR-TimingMeasQuality-r16 OPTIONAL, -- Need ON

...

}

RTD-InfoList-r16 ::= SEQUENCE (SIZE (1..4)) OF RTD-InfoListPerFreqLayer-r16

RTD-InfoListPerFreqLayer-r16 ::= SEQUENCE (SIZE(1..63)) OF RTD-InfoElement-r16

RTD-InfoElement-r16 ::= SEQUENCE {

trp-id-r16 TRP-ID-r16,

subframeOffset-r16 INTEGER (0..1966079),

rtd-Quality-r16 NR-TimingMeasQuality-r16,

...

}

-- ASN1STOP

Companies are asked to identify additional TRP identifiers that are considered needed as to provide a solid technical motivation.

|  |  |
| --- | --- |
| Table 2.9 Need for additional TRP identifiers in *ReferenceTRP-RTD-Info-r16* and *RTD-InfoElement-r16* | |
| Company | Comments |
| Huawei/HiSilicon | We think only *dl-PRS-ID* is needed. |
| Qualcomm | *dl-PRS-ID*, *nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId*  As mentioned in the comment above (RAN1 agreement), the *dl-PRS-ID* identifies a DL-PRS Resource of a TRP, but not necessarily the TRP. Therefore, the possible identifiers of a TRP (*nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId)* need to be provided in some cases to uniquely identify a TRP and associated measurement. E.g., when the assistance data are not provided from the same source or the same LPP session.  Also, e.g. RTD and TRP location info can be provided in different posSIBs, and a UE may get the posSIBs from different cells. A UE need to be able to uniquely associate the assistance data to the correct TRP, even when provided from different sources (e.g., different cells/posSIBs, different LPP messages of the same or different LPP session, MO-LR, etc.).  In general, we cannot see anything wrong with the current LPP (apart from the somewhat misleading name of the *TRP-ID* IE). All fields are optional present in the *TRP-ID* IE and can be provided when needed/appropriate. |
| OPPO | *dl-PRS-ID +* Either *nr-PhysCellId/nr-ARFCN* Or *nr-CellGlobalId*  PRS ID only is not enough since it is unique within a TRP but not across TRPs. So to uniquely identify a TRP, either the combination of *nr-PhysCellId/nr-ARFCN* or *nr-CellGlobalId* can work, by assuming no local PCI confusion at a same local area for a same frequency. May be the latter one, i.e., *nr-CellGlobalId*, is safer. This applies to both UL and DL.  So we fail to see the need to include both the combination of *nr-PhysCellId/nr-ARFCN* and *nr-CellGlobalId* in RTD info here. |
| Ericsson | It is important to consider the context here.  A UE requesting DL-PRS assistance data is including the nr-CellGlobalId to the LMF and in return obtains a DL-PRS resources in a hierarchy based on TRPs per frequency layers. A UE retrieving assistance data via system information broadcast from a cell also obtains the nr-CellGlobalId of that cell. Therefore, there is already nr-CellGlobalId + TRP ID provided to the UE to ensure that the UE can handle information from different sources for UEB.  Therefore, it is enough to provide a TRP ID 0..255 to the UE. |
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## 2.10 NR-TRP-LocationInfo and NR-DL-PRS-BeamInfo

The IEs *NR-TRP-LocationInfo and, NR-DL-PRS-BeamInfo* are defined as below:

-- ASN1START

NR-TRP-LocationInfo-r16 ::= SEQUENCE (SIZE (1..4)) OF NR-TRP-LocationInfoPerFreqLayer-r16

NR-TRP-LocationInfoPerFreqLayer-r16 ::= SEQUENCE {

referencePoint-r16 ReferencePoint-r16 OPTIONAL, -- Cond NotSameAsPrev

trp-LocationInfoList-r16 SEQUENCE (SIZE (1..64)) OF TRP-LocationInfoElement-r16,

...

}

TRP-LocationInfoElement-r16 ::= SEQUENCE {

trp-id-r16 TRP-ID-r16,

trp-Location-r16 RelativeLocation-r16 OPTIONAL, -- Need OP

trp-DL-PRS-ResourceSets-r16 SEQUENCE (SIZE(1..2)) OF

DL-PRS-ResourceSets-TRP-Element-r16 OPTIONAL, -- Need OP

...

}

DL-PRS-ResourceSets-TRP-Element-r16 ::= SEQUENCE {

dl-PRS-ResourceSetARP-r16 RelativeLocation-r16 OPTIONAL, -- Need OP

dl-PRS-Resource-ARP-List-r16 SEQUENCE (SIZE(1..64)) OF

DL-PRS-Resource-ARP-Element-r16 OPTIONAL, -- Need OP

...

}

DL-PRS-Resource-ARP-Element-r16 ::= SEQUENCE {

dl-PRS-Resource-ARP-location-r16 RelativeLocation-r16 OPTIONAL, -- Need OP

...

}

-- ASN1STOP

| **Conditional presence** | **Explanation** |
| --- | --- |
| *NotSameAsPrev* | The field is mandatory present in the first entry of the *NR-TRP-LocationInfoPerFreqLayer* list; otherwise it is optionally present, need OP. |

| ***NR-TRP-LocationInfo* field descriptions** |
| --- |
| ***referencePoint***  This field specifies the reference point used to define the TRP location in the *trp-LocationInfoList*. If this field is absent, the reference point is the same as in the previous entry of the *NR-TRP-LocationInfoPerFreqLayer* list. |
| ***trp-LocationInfoList***  This field provides the antenna reference point locations of the DL-PRS Resources for the TRPs and comprises the following sub-fields:  - ***trp-id***: This field provides an identity of the TRP.  - ***trp-Location***: This field provides the location of the TRP relative to the *referencePoint* location. If this field is absent the TRP location coincides with the *referencePoint* location.  - ***trp-DL-PRS-ResourceSets***: This field provides the antenna reference point location(s) of the DL-PRS Resource Set(s) associated with this TRP. If this field is absent, the antenna reference point location(s) of the DL-PRS Resource Set(s) coincides with the *trp-Location* location. This field comprises the following sub-fields:  - ***dl-PRS-ResourceSetARP***: This field provides the antenna reference point location of the DL-PRS Resource Set relative to the *trp-Location* location. If this field is absent, the antenna reference point location of this DL-PRS Resource Set coincides with the *trp-Location* location.  - ***dl-PRS-Resource-ARP-List***: This field provides the antenna reference point location(s) of the DL-PRS Resource(s) associated with this resource set of the TRP. If this field is absent, the antenna reference point location(s) of the DL-PRS Resources coincides with the *dl-PRS-ResourceSetARP* location. This field comprises the following sub-fields:  - ***dl-PRS-Resource-ARP-location***: This field provides the antenna reference point location of the DL-PRS Resource associated with the DL-PRS Resource Set of the TRP relative to the *dl-PRS-ResourceSetARP* location. If this field is absent, the antenna reference point location of this DL-PRS Resource coincides with the *dl-PRS-ResourceSetARP* location. |

-- ASN1START

NR-DL-PRS-BeamInfo-r16 ::= SEQUENCE (SIZE (1..4)) OF NR-DL-PRS-BeamInfoPerFreqLayer-r16

NR-DL-PRS-BeamInfoPerFreqLayer-r16 ::= SEQUENCE (SIZE (1..64)) OF NR-DL-PRS-BeamInfo-r16

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

trp-id-r16 TRP-ID-r16,

lcs-gcs-translation-parameter-r16 LCS-GCS-Translation-Parameter-r16 OPTIONAL, -- Need OP

dl-prs-BeamInfoSet-r16 DL-PRS-BeamInfoSet-r16,

...

}

DL-PRS-BeamInfoSet-r16 ::= SEQUENCE (SIZE(1..2)) OF DL-PRS-BeamInfoResourceSet-r16

DL-PRS-BeamInfoResourceSet-r16 ::= SEQUENCE (SIZE(1..64)) OF DL-PRS-BeamInfoElement-r16

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

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

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

...

}

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

alpha-r16 INTEGER (0..3599),

beta-r16 INTEGER (0..3599),

gamma-r16 INTEGER (0..3599),

...

}

-- ASN1STOP

| ***NR-DL-PRS-Beam-Info* field descriptions** |
| --- |
| ***trp-id***  This field provides an identity of the TRP. |
| ***lcs-gcs-translation-parameter***  This field provides the angles α (bearing angle), β (downtilt angle) and γ (slant angle) for the translation of a Local Coordinate System (LCS) to a Global Coordinate System (GCS) as defined in TR 38.901 [44]. If this field is absent, the *dl-PRS-Azimuth* and *dl-PRS-Elevation* are provided in a GCS. |
| ***dl-prs-BeamInfoSet***  This field provides the DL-PRS beam information for each DL-PRS Resource of the DL-PRS Resource Set associated with this TRP. |
| ***dl-PRS-Azimuth***  This field specifies the azimuth angle of the boresight direction in which the DL-PRS Resources associated with this DL-PRS Resource ID in the DL-PRS Resource Set are transmitted.  For a Global Coordinate System (GCS), the azimuth angle is measured counter-clockwise from geographical North.  For a Local Coordinate System (LCS), the azimuth angle is measured measured counter-clockwise from the x-axis of the LCS.  Scale factor 0.1 degrees; range 0 to 359.9 degrees. |
| ***dl-PRS-Elevation***  This field specifies the elevation angle of the boresight direction in which the DL-PRS Resources associated with this DL-PRS Resource ID in the DL-PRS Resource Set are transmitted.  For a Global Coordinate System (GCS), the elevation angle is measured relative to zenith and positive to the horizontal direction (elevation 0 deg. points to zenith, 90 deg to the horizon).  For a Local Coordinate System (LCS), the elevation angle is measured relative to the z-axis of the LCS (elevation 0 deg. points to the z-axis, 90 deg to the x-y plane).  Scale factor 0.1 degrees; range 0 to 180 degrees. |
| ***alpha***  This field specifies the bearing angle α for the translation of the LCS to a GCS as defined in TR 38.901 [44].  Scale factor 0.1 degrees; range 0 to 359.9 degrees. |
| ***beta***  This field specifies the downtilts angle β for the translation of the LCS to a GCS as defined in TR 38.901 [44].  Scale factor 0.1 degrees; range 0 to 359.9 degrees. |
| ***gamma***  This field specifies the slant angle γ for the translation of the LCS to a GCS as defined in TR 38.901 [44].  Scale factor 0.1 degrees; range 0 to 359.9 degrees. |

Companies are asked to identify additional TRP identifiers that are considered needed as to provide a solid technical motivation.

|  |  |
| --- | --- |
| Table 2.10 Need for additional TRP identifiers in *NR-TRP-LocationInfo-r16 and NR-DL-PRS-BeamInfo-r16* | |
| Company | Comments |
| Huawei/HiSilicon | We think only *dl-PRS-ID* is needed. |
| Qualcomm | *dl-PRS-ID*, *nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId*  As mentioned in the comment above (RAN1 agreement), the *dl-PRS-ID* identifies a DL-PRS Resource of a TRP, but not necessarily the TRP. Therefore, the possible identifiers of a TRP (*nr-PhysCellId/nr-ARFCN*, *nr-CellGlobalId)* need to be provided in some cases to uniquely identify a TRP and associated measurement. E.g., when the assistance data are not provided from the same source or the same LPP session.  Also, e.g. RTD and TRP location info can be provided in different posSIBs, and a UE may get the posSIBs from different cells. A UE need to be able to uniquely associate the assistance data to the correct TRP, even when provided from different sources (e.g., different cells/posSIBs, different LPP messages of the same or different LPP session, MO-LR, etc.).  In general, we cannot see anything wrong with the current LPP (apart from the somewhat misleading name of the *TRP-ID* IE). All fields are optional present in the *TRP-ID* IE and can be provided when needed/appropriate. |
| OPPO | *dl-PRS-ID +* Either *nr-PhysCellId/nr-ARFCN* Or *nr-CellGlobalId*  PRS ID only is not enough since it is unique within a TRP but not across TRPs. So to uniquely identify a TRP, either the combination of *nr-PhysCellId/nr-ARFCN* or *nr-CellGlobalId* can work, by assuming no local PCI confusion at a same local area for a same frequency. May be the latter one, i.e., *nr-CellGlobalId*, is safer. This applies to both UL and DL.  So we fail to see the need to include both the combination of *nr-PhysCellId/nr-ARFCN* and *nr-CellGlobalId* in TRP location and beam info here. |
| Ericsson | It is important to consider the context here.  A UE requesting DL-PRS assistance data is including the nr-CellGlobalId to the LMF and in return obtains a DL-PRS resources in a hierarchy based on TRPs per frequency layers. A UE retrieving assistance data via system information broadcast from a cell also obtains the nr-CellGlobalId of that cell. Therefore, there is already nr-CellGlobalId + TRP ID provided to the UE to ensure that the UE can handle information from different sources for UEB.  Therefore, it is enough to provide a TRP ID 0..255 to the UE. |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |
|  |  |

# 3. Summary

The ambition of the email discussion is to agree on a text proposal based on the technical discussion.

# 4. Conclusion

# Annex 1, Text proposal to 3GPP TS 37.355 for TRP-ID

*[…]*

#### 6.4.3.1 Common NR assistance data Information Elements

*[…]*

*– TRP-ID*

The IE *TRP-ID* provides the ID to identify the TRP among the TRPs the target device can handle. This field is used along with a DL PRS Resource Set ID and a DL PRS Resources ID to uniquely identify a DL PRS Resource. This ID can be associated with multiple DL PRS Resource Sets associated with a single TRP.

Each TRP can only be associated with one such ID.

-- ASN1START

TRP-ID-r16 ::= INTEGER (0..255)

-- ASN1STOP







*– NR-SSB-Config*

The IE *NR-SSB-Config* defines SSB configuration.

-- ASN1START

NR-SSB-Config-r16 ::= SEQUENCE {

trp-ID-r16 TRP-ID-r16,

nr-PhysCellId-r16 NR-PhysCellId-r16,

nrARFCNRef-r16 ARFCN-ValueNR-r15,

ss-PBCH-BlockPower-r16 INTEGER (-60..50),

halfFrameIndex-r16 INTEGER (0..1),

SSB-periodicity-r16 ENUMERATED { ms5, ms10, ms20, ms40, ms80, ms160, ...},

ssb-PositionsInBurst-r16 CHOICE {

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

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

longBitmap-r16 BIT STRING (SIZE (64))

} OPTIONAL, --Need OR

ssbSubcarrierSpacing-r16 ENUMERATED {kHz15, kHz30, kHz60, kHz120, kHz240, ...},

sfn-SSB-Offset-r16 INTEGER (0..15),

smtc-r16 SEQUENCE {

periodicityAndOffset-r16 CHOICE {

sf5 INTEGER (0..4),

sf10 INTEGER (0..9),

sf20 INTEGER (0..19),

sf40 INTEGER (0..39),

sf80 INTEGER (0..79),

sf160 INTEGER (0..159)

},

duration-r16 ENUMERATED { sf1, sf2, sf3, sf4, sf5, ... }

}

}

-- ASN1STOP

| ***NR-SSB-Config* field descriptions** |
| --- |
| ***ssb-PositionsInBurst***  Indicates the time domain positions of the transmitted SS-blocks in a half frame with SS/PBCH blocks as defined in TS 38.213 [39], clause 4.1. The first/ leftmost bit corresponds to SS/PBCH block index 0, the second bit corresponds to SS/PBCH block index 1, and so on. Value 0 in the bitmap indicates that the corresponding SS/PBCH block is not transmitted while value 1 indicates that the corresponding SS/PBCH block is transmitted. |
| ***ss-PBCH-BlockPower***  Average EPRE of the resources elements that carry secondary synchronization signals in dBm that the NW used for SSB transmission, see TS 38.213 [13], clause 7. |
| ***ssb-periodicityServingCell***  The SSB periodicity in ms for the rate matching purpose. If the field is absent, the UE applies the value ms5. (see TS 38.213 [39], clause 4.1). |
| ***ssbSubcarrierSpacing***  Subcarrier spacing of SSB. Only the values 15 kHz or 30 kHz (FR1), and 120 kHz or 240 kHz (FR2) are applicable. |
| ***smtc***  The SSB periodicity/offset/duration configuration. |
| ***ssb-Index***  For a DL PRS resource, SSB index indicated for QCL Type D and QCL Type C is same. |

*[…]*

*–* *NR-TRP-LocationInfo*

The IE *NR-TRP-LocationInfo* is used by the location server to provide the coordinates of the antenna reference points for a set of TRPs. For each TRP, the ARP location can be provided for each associated PRS Resource ID per PRS Resource Set.

-- ASN1START

NR-TRP-LocationInfo-r16 ::= SEQUENCE (SIZE (1..4)) OF NR-TRP-LocationInfoPerFreqLayer-r16

NR-TRP-LocationInfoPerFreqLayer-r16 ::= SEQUENCE {

referencePoint-r16 ReferencePoint-r16 OPTIONAL, -- Cond NotSameAsPrev

trp-LocationInfoList-r16 SEQUENCE (SIZE (1..64)) OF TRP-LocationInfoElement-r16,

...

}

TRP-LocationInfoElement-r16 ::= SEQUENCE {

trp-id-r16 TRP-ID-r16,

trp-Location-r16 RelativeLocation-r16 OPTIONAL, -- Need OP

trp-DL-PRS-ResourceSets-r16 SEQUENCE (SIZE(1..2)) OF

DL-PRS-ResourceSets-TRP-Element-r16 OPTIONAL, -- Need OP

...

}

DL-PRS-ResourceSets-TRP-Element-r16 ::= SEQUENCE {

dl-PRS-ResourceSetARP-r16 RelativeLocation-r16 OPTIONAL, -- Need OP

dl-PRS-Resource-ARP-List-r16 SEQUENCE (SIZE(1..64)) OF

DL-PRS-Resource-ARP-Element-r16 OPTIONAL, -- Need OP

...

}

DL-PRS-Resource-ARP-Element-r16 ::= SEQUENCE {

dl-PRS-Resource-ARP-location-r16 RelativeLocation-r16 OPTIONAL, -- Need OP

...

}

-- ASN1STOP

| **Conditional presence** | **Explanation** |
| --- | --- |
| *NotSameAsPrev* | The field is mandatory present in the first entry of the *NR-TRP-LocationInfoPerFreqLayer* list; otherwise it is optionally present, need OP. |

| ***NR-TRP-LocationInfo* field descriptions** |
| --- |
| ***referencePoint***  This field specifies the reference point used to define the TRP location in the *trp-LocationInfoList*. If this field is absent, the reference point is the same as in the previous entry of the *NR-TRP-LocationInfoPerFreqLayer* list. |
| ***trp-LocationInfoList***  This field provides the antenna reference point locations of the DL-PRS Resources for the TRPs and comprises the following sub-fields:  - ***trp-id***: This field provides an identity of the TRP.  - ***trp-Location***: This field provides the location of the TRP relative to the *referencePoint* location. If this field is absent the TRP location coincides with the *referencePoint* location.  - ***trp-DL-PRS-ResourceSets***: This field provides the antenna reference point location(s) of the DL-PRS Resource Set(s) associated with this TRP. If this field is absent, the antenna reference point location(s) of the DL-PRS Resource Set(s) coincides with the *trp-Location* location. This field comprises the following sub-fields:  - ***dl-PRS-ResourceSetARP***: This field provides the antenna reference point location of the DL-PRS Resource Set relative to the *trp-Location* location. If this field is absent, the antenna reference point location of this DL-PRS Resource Set coincides with the *trp-Location* location.  - ***dl-PRS-Resource-ARP-List***: This field provides the antenna reference point location(s) of the DL-PRS Resource(s) associated with this resource set of the TRP. If this field is absent, the antenna reference point location(s) of the DL-PRS Resources coincides with the *dl-PRS-ResourceSetARP* location. This field comprises the following sub-fields:  - ***dl-PRS-Resource-ARP-location***: This field provides the antenna reference point location of the DL-PRS Resource associated with the DL-PRS Resource Set of the TRP relative to the *dl-PRS-ResourceSetARP* location. If this field is absent, the antenna reference point location of this DL-PRS Resource coincides with the *dl-PRS-ResourceSetARP* location. |

– *ReferencePoint*

The IE *ReferencePoint* provides a well defined location relative to which other locations may be defined.

-- ASN1START

ReferencePoint-r16 ::= SEQUENCE {

referencePointGeographicLocation-r16 CHOICE {

location3D-r16 EllipsoidPointWithAltitudeAndUncertaintyEllipsoid,

ha-location3D-r16 HighAccuracyEllipsoidPointWithAltitudeAndUncertaintyEllipsoid-r15,

...

},

...

}

-- ASN1STOP

| ***ReferencePoint* field descriptions** |
| --- |
| ***referencePointGeographicLocation***  This field provides the geodetic location of the reference point. |

– *RelativeLocation*

The IE *RelativeLocation* provides a location relative to some known reference location.

-- ASN1START

RelativeLocation-r16 ::= SEQUENCE {

milli-arc-second-units-r16 ENUMERATED { mas0-03, mas0-3, mas3, mas30, ...},

height-units-r16 ENUMERATED {mm, cm, m, ...},

delta-latitude-r16 Delta-Latitude-r16,

delta-longitude-r16 Delta-Longitude-r16,

delta-height-r16 Delta-Height-r16,

locationUNC-r16 LocationUncertainty-r16 OPTIONAL, -- Need OP

...

}

Delta-Latitude-r16 ::= SEQUENCE {

delta-Latitude-r16 INTEGER (-1024..1023),

coarse-delta-Latitude-r16 INTEGER (0..4095) OPTIONAL, -- Need OP

...

}

Delta-Longitude-r16 ::= SEQUENCE {

delta-Longitude-r16 INTEGER (-1024..1023),

coarse-delta-Longitude-r16 INTEGER (0..4095) OPTIONAL, -- Need OP

...

}

Delta-Height-r16 ::= SEQUENCE {

delta-Height-r16 INTEGER (-1024..1023),

coarse-delta-Height-r16 INTEGER (0..4095) OPTIONAL, -- Need OP

...

}

LocationUncertainty-r16 ::= SEQUENCE {

horizontalUncertainty-r15 INTEGER (0..255),

horizontalConfidence-r15 INTEGER (0..100),

verticalUncertainty-r15 INTEGER (0..255),

verticalConfidence-r15 INTEGER (0..100)

}

-- ASN1STOP

| ***RelativeLocation* field descriptions** |
| --- |
| ***milli-arc-second-units***  This field provides the units and scale factor for the *delta-latitude* and *delta-longitude* fields. Enumerated values *mas0-03*, *mas0-3*, *mas3*, and *mas30*, correspond to 0.03, 0.3, 3, and 30 milliarcseconds, respectively. |
| ***height-units***  This field provides the units and scale factor for the *delta-height* field. Enumerated values *mm*, *cm*, and *m* correspond to 10-3 metre, 10-2 meter, and 1 meters, respectively. |
| ***delta-latitude***  This field specifies the delta value in latitude of the desired location, defined as "desired location" minus "reference point location" and comprises the following sub-fields:  - ***delta-Latitude*** specifies the delta value in latitude in the unit provided in *milli-arc-second-units* field.  - ***coarse-delta-Latitude*** specifies the delta value in latitude in 1024 times the size of the unit provided in *milli-arc‑second‑units* field and with the same sign as in the *delta-Latitude* field. If this field is absent, the value for *coarse-delta-Latitude*is zero.  I.e., the full *delta-latitude* is given by:  (*delta-Latitude* × *milli-arc-second-units*)±(*coarse-delta-Latitude* × 1024 × *milli-arc-second-units*) [milli-arc-seconds] |
| ***delta-longitude***  This field specifies the delta value in longitude of the desired location, defined as "desired location" minus "reference point location" and comprises the following sub-fields:  - ***delta-Longitude*** specifies the delta value in longitude in the unit provided in *milli-arc-second-units* field.  - ***coarse-delta-Longitude*** specifies the delta value in longitude in 1024 times the size of the unit provided in *milli-arc‑second‑units* field and with the same sign as in the *delta-Longitude* field. If this field is absent, the value for *coarse-delta-Longitude*is zero.  I.e., the full *delta-longitude* is given by:  (*delta-Longitude* × *milli-arc-second-units*)±(*coarse-delta-Latitude* × 1024 × *milli-arc-second-units*) [milli-arc-seconds] |
| ***delta-height***  This field specifies the delta value in ellipsoidal height of the desired location, defined as "desired location" minus "reference point location" and comprises the following sub-fields:  - ***delta-Height*** specifies the delta value in ellipsoidal height in the unit provided in *height-units* field.  - ***coarse-delta-Height*** specifies the delta value in ellipsoidal height in 1024 times the size of the unit provided in *height-units* field and with the same sign as in the *delta-Height* field. If this field is absent, the value for *coarse-delta-Height*is zero.  I.e., the full *delta-height* is given by:  (*delta-Height* × *height-units*) *±* (*coarse-delta-Height* × 1024 × *height-units*) [meters] |
| ***locationUNC***  This field specifies the uncertainty of the location coordinates and comprises the following sub-fields:  - ***horizontalUncertainty*** indicates the horizontal uncertainty of the ARP latitude/longitude. The ′*horizontalUncertainty*′ corresponds to the encoded high accuracy uncertainty as defined in TS 23.032 [15] and ′*horizontalConfidence*′ corresponds to confidence as defined in TS 23.032 [15].  - ***verticalUncertainty*** indicates the vertical uncertainty of the ARP altitude. The '*verticalUncertainty*' corresponds to the encoded high accuracy uncertainty as defined in TS 23.032 [15] and '*verticalConfidence*' corresponds to confidence as defined in TS 23.032 [15].  If this field is absent, the uncertainty is the same as for the associated reference point location. |

– *NR-DL-PRS-BeamInfo*

The IE *NR-DL-PRS-BeamInfo* is used by the location server to provide spatial direction information of the DL-PRS Resources.

-- ASN1START

NR-DL-PRS-BeamInfo-r16 ::= SEQUENCE (SIZE (1..4)) OF NR-DL-PRS-BeamInfoPerFreqLayer-r16

NR-DL-PRS-BeamInfoPerFreqLayer-r16 ::= SEQUENCE (SIZE (1..64)) OF NR-DL-PRS-BeamInfo-r16

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

trp-id-r16 TRP-ID-r16,

lcs-gcs-translation-parameter-r16 LCS-GCS-Translation-Parameter-r16 OPTIONAL, -- Need OP

dl-prs-BeamInfoSet-r16 DL-PRS-BeamInfoSet-r16,

...

}

DL-PRS-BeamInfoSet-r16 ::= SEQUENCE (SIZE(1..2)) OF DL-PRS-BeamInfoResourceSet-r16

DL-PRS-BeamInfoResourceSet-r16 ::= SEQUENCE (SIZE(1..64)) OF DL-PRS-BeamInfoElement-r16

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

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

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

...

}

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

alpha-r16 INTEGER (0..3599),

beta-r16 INTEGER (0..3599),

gamma-r16 INTEGER (0..3599),

...

}

-- ASN1STOP

| ***NR-DL-PRS-Beam-Info* field descriptions** |
| --- |
| ***trp-id***  This field provides an identity of the TRP. |
| ***lcs-gcs-translation-parameter***  This field provides the angles α (bearing angle), β (downtilt angle) and γ (slant angle) for the translation of a Local Coordinate System (LCS) to a Global Coordinate System (GCS) as defined in TR 38.901 [44]. If this field is absent, the *dl-PRS-Azimuth* and *dl-PRS-Elevation* are provided in a GCS. |
| ***dl-prs-BeamInfoSet***  This field provides the DL-PRS beam information for each DL-PRS Resource of the DL-PRS Resource Set associated with this TRP. |
| ***dl-PRS-Azimuth***  This field specifies the azimuth angle of the boresight direction in which the DL-PRS Resources associated with this DL-PRS Resource ID in the DL-PRS Resource Set are transmitted.  For a Global Coordinate System (GCS), the azimuth angle is measured counter-clockwise from geographical North.  For a Local Coordinate System (LCS), the azimuth angle is measured measured counter-clockwise from the x-axis of the LCS.  Scale factor 0.1 degrees; range 0 to 359.9 degrees. |
| ***dl-PRS-Elevation***  This field specifies the elevation angle of the boresight direction in which the DL-PRS Resources associated with this DL-PRS Resource ID in the DL-PRS Resource Set are transmitted.  For a Global Coordinate System (GCS), the elevation angle is measured relative to zenith and positive to the horizontal direction (elevation 0 deg. points to zenith, 90 deg to the horizon).  For a Local Coordinate System (LCS), the elevation angle is measured relative to the z-axis of the LCS (elevation 0 deg. points to the z-axis, 90 deg to the x-y plane).  Scale factor 0.1 degrees; range 0 to 180 degrees. |
| ***alpha***  This field specifies the bearing angle α for the translation of the LCS to a GCS as defined in TR 38.901 [44].  Scale factor 0.1 degrees; range 0 to 359.9 degrees. |
| ***beta***  This field specifies the downtilts angle β for the translation of the LCS to a GCS as defined in TR 38.901 [44].  Scale factor 0.1 degrees; range 0 to 359.9 degrees. |
| ***gamma***  This field specifies the slant angle γ for the translation of the LCS to a GCS as defined in TR 38.901 [44].  Scale factor 0.1 degrees; range 0 to 359.9 degrees. |

– *NR-RTD-Info*

The IE *NR-RTD-Info* is used by the location server to provide time synchronization information between a reference TRP and a list of neighbour TRPs.

-- ASN1START

NR-RTD-Info-r16 ::= SEQUENCE {

referenceTRP-RTD-Info-r16 ReferenceTRP-RTD-Info-r16,

rtd-InfoList-r16 RTD-InfoList-r16,

...

}

ReferenceTRP-RTD-Info-r16 ::= SEQUENCE {

ref-trp-id-r16 TRP-ID-r16,

refTime-r16 CHOICE {

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

utc-r16 UTCTime,

...

},

rtd-RefQuality-r16 NR-TimingMeasQuality-r16 OPTIONAL, -- Need ON

...

}

RTD-InfoList-r16 ::= SEQUENCE (SIZE (1..4)) OF RTD-InfoListPerFreqLayer-r16

RTD-InfoListPerFreqLayer-r16 ::= SEQUENCE (SIZE(1..63)) OF RTD-InfoElement-r16

RTD-InfoElement-r16 ::= SEQUENCE {

trp-id-r16 TRP-ID-r16,

subframeOffset-r16 INTEGER (0..1966079),

rtd-Quality-r16 NR-TimingMeasQuality-r16,

...

}

-- ASN1STOP

| ***NR-RTD-Info* field descriptions** |
| --- |
| ***referenceTRP-RTD-Info***  This field defines the reference TRP for the RTD and comprises the following sub-fields:  - ***ref-trp-id***: This field specifies the identity of the reference TRP.  - ***refTime***: This field specifies the reference time at which the *rtd-InfoList* is valid. The *systemFrameNumber* choice refers to the SFN of the reference TRP.  - ***rtd-RefQuality***: This field specifies the quality of the timing of reference TRP, used to determine the RTD values provided in *rtd-InfoList*. |
| ***trp-id-r16***  This fields provides the identity of the TRP for which the *RTD-InfoElement* is applicable. |
| ***subframeOffset***  This field specifies the subframe boundary offset at the TRP antenna location between the reference TRP and this neighbour TRP in time units  where Hz and  (TS 38.211 [41]).  The offset is counted from the beginning of a subframe #0 of the reference TRP to the beginning of the closest subsequent subframe of this neighbour TRP.  Scale factor 1 Tc. |
| ***rtd-Quality***  This field specifies the quality of the RTD. |

– *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-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 (SIZE (1..nrMaxTRPsPerFreq)) OF NR-DL-PRS-AssistanceDataPerTRP-r16,

nr-DL–PRS-PositioningFrequencyLayer-r16 NR-DL–PRS-PositioningFrequencyLayer-r16 OPTIONAL, --Need ON

...

}

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,

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

...

}

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 INTEGER ::= 4 -- Max freq layers

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

nrMaxResourceIDs INTEGER ::= 64 -- Max ResourceIDs

-- ASN1STOP

| ***NR-DL-PRS-AssistanceData* field descriptions** |
| --- |
| ***nr-DL-PRS-Config***  This field specifies the PRS configuration of the TRP. |
| ***nr-DL-PRS-ReferenceInfo***  This field indicates the IDs of the reference TRP. |
| ***nr-DL-PRS-ResourceID-List***  The list of nr-DL PRS resource ID. Only a single nr-DL-PRS-ResourceId is included if the field is used in measurement reporting. |

#### – *DL-PRS-IdInfo*

The IE *DL-PRS-IdInfo* provides the IDs of the reference and neighbour TRPs' DL-PRS Resources.

-- ASN1START

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

trp-ID-r16 TRP-ID-r16,

nr-DL-PRS-ResourceID-List-r16 (SIZE (1..nrMaxResourceIDs)) OF NR-DL-PRS-ResourceId-r16 OPTIONAL,

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

}

-- ASN1STOP

*[…]*

*[…]*

6.4.3.2 Common NR report Information Elements

*– NR-TimingMeasQuality*

The IE *NR-TimingMeasQuality* defines the target device′s best estimate of the quality of measurements.

-- ASN1START

NR-TimingMeasQuality-r16 ::= SEQUENCE {

timingMeasQualityValue-r16 INTEGER (0..31),

timingMeasQualityResolution-r16 ENUMERATED {mdot1, m1, m10, m30, ...},

...

}

-- ASN1STOP

| ***NR-TimingMeasQuality* field descriptions** |
| --- |
| ***timingMeasQualityValue***  This parameter provides the best estimate of the uncertainty of the measurement. |
| ***timingMeasQualityResolution***  This parameter provides the resolution levels used in the Value field. |

*– NR-TimeStamp*

The IE *NR-TimeStamp* defines the UE measurement associated time stamp.

-- ASN1START

NR-TimeStamp-r16 ::= SEQUENCE {

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

nr-PhysCellId-r16 NR-PhysCellId-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. |

*[…]*

6.5.9.2 NR-ECID Location Information Elements

– *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 BIT STRING (SIZE (10)),

nr-PhysCellId-r16 NR-PhysCellId-r16,

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

nrARFCNRef-r16 ARFCN-ValueNR-r15,

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

}

-- ASN1STOP

| ***NR-ECID-SignalMeasurementInformation* field descriptions** |
| --- |
| ***systemFrameNumber***  This field specifies the system frame number of the measured cell during which the measurements have been performed. The target device shall include this field if it was able to determine the SFN of the cell at the time of measurement. |
| ***nr-PhysCellId***  This field specifies the physical cell identity of the measured cell. |
| ***nr-CellGlobalId***  This field specifies the NCGI of the measured cell. The target device shall provide this field if it was able to determine the NCGI of the measured cell at the time of measurement . |
| ***nrARFCNRef***  This field specifies the NRARFCN of the measured NR carrier frequency. |
| ***resultsSSB-Cell***  This attribute 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 attribute 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]. |
| ***ssb-Results***  This attribute specifies the SS reference signal received power (SS-RSRP) and quality (SS-RSRQ) measurement per SSB resource, as defined in TS 38.331 [35]. |
| ***csi-RS-Results***  This attribute 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]. |
| ***primaryCellMeasuredResults***  This field contains measurements for the primary cell when the target device reports measurements for both primary cell and neighbour cells. This field shall be omitted when the target device reports measurements for the primary cell only, in which case the measurements for the primary cell is reported in the *measuredResultsList*. |

*[…]*

#### 6.5.10.4 NR-DL-TDOA Location Information Elements

#### – *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. The measurements are provided as a list of TRPs, where the first TRP in the list is used as reference TRP in case RSTD measurements are reported. The first TRP in the list may or may not be the reference TRP indicated in the *NR-DL-PRS-AssistanceData*. Furthermore, the target device selects a reference resource per TRP, and compiles the measurements per TRP based on the selected reference resource.

-- ASN1START

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,

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,

...

}

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

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 INTEGER ::= 256 -- Max TRPs per UE

-- ASN1STOP

| *NR-DL-TDOA-SignalMeasurementInformation* field descriptions |
| --- |
| ***nr-PRS-RSRP-Result***  This field specifies the reference signal received power (RSRP) measurement, as defined in TS 38.331 [35]. |
| ***nr-AdditionalPathList***  This field specifies one or more additional detected path timing values for the TRP or resource, relative to the path timing used for determining the *nr-RSTD* value. If this field was requested but is not included, it means the UE did not detect any additional path timing values. |
| ***nr-RSTD***  This field specifies the relative timing difference between this neighbour TRP and the PRS reference TRP, as defined in FFS. Mapping of the measured quantity is defined as in FSS. |
| ***nr-TimingMeasQuality***  This field specifies the target device′s best estimate of the quality of the measurement. |

#### *– NR-DL-TDOA-LocationInformation*

The IE *NR-DL-TDOA-LocationInformation* is included by the target device when location information derived using NR-DL-TDOA is provided to the location server.

-- ASN1START

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

measurementReferenceTime-r16 CHOICE {

systemFrameNumber-r16 NR-TimeStamp-r16,

utc-time-r16 UTCTime,

...

} OPTIONAL,

...

}

-- ASN1STOP

| *NR-DL-TDOA-LocationInformation* field descriptions |
| --- |
| ***measurementReferenceTime***  This field specifies the time for which the location estimate is valid. |

*[…]*

#### 6.5.11.4 NR-DL-AoD Location Information Elements

#### – *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. The measurements are provided as a list of TRPs, where the first TRP in the list is used as reference TRP.

-- 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)) 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-TimingMeasQuality-r16 NR-TimingMeasQuality-r16,

nr-DL-Aod-AdditionalMeasurements-r16 NR-DL-AoD-AdditionalMeasurements-r16,

...

}

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 INTEGER ::= 256 -- Max TRPs

-- ASN1STOP

| *NR-DL-AoD-SignalMeasurementInformation* field descriptions |
| --- |
| ***nr-PRS-RSRP-Result***  This field specifies the reference signal received power (RSRP) measurement, as defined in TS 38.331 [35]. |

#### – *NR-DL-AoD-LocationInformation*

The IE *NR-DL-AoD-LocationInformation* is included by the target device when location information derived using NR-DL-AoD is provided to the location server.

-- ASN1START

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

measurementReferenceTime-r16 CHOICE {

sfn-time-r16 NR-TimeStamp-r16,

utc-time-r16 UTCTime,

...

} OPTIONAL,

...

}

-- ASN1STOP

| *NR-DL-AoD-LocationInformation* field descriptions |
| --- |
| ***measurementReferenceTime***  This field specifies the time for which the location estimate is valid. |

*[…]*

6.5.12.4 NR-Multi-RTT Location Information Elements

– *NR-Multi-RTT-SignalMeasurementInformation*

The IE *NR-Multi-RTT-SignalMeasurementInformation* is used by the target device to provide NR Multi-RTT measurements to the location server. The measurements are provided as a list of TRPs, where the first TRP in the list is used as reference TRP.

-- ASN1START

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

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

...

}

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

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

trp-ID-r16 TRP-ID-r16,

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,

...

}

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 INTEGER ::= 256 -- Max TRPs

-- ASN1STOP

| ***NR-Multi-RTT-SignalMeasurementInformation* field descriptions** |
| --- |
| ***nr-PRS-RSRP-Result***  This field specifies the reference signal received power (RSRP) measurement, as defined in TS 38.331 [35]. |
| ***nr-UE-RxTxTimeDiff***  This field specifies the UE Rx–Tx time difference measurement, as defined in FFS. |
| ***nr-AdditionalPathList***  This field specifies one or more additional detected path timing values for the TRP or resource, relative to the path timing used for determining the *nr-UE-RxTxTimeDiff* value or the *nr-UE-RxTxTimeDiffAdditional* value. If this field was requested but is not included, it means the UE did not detect any additional path timing values. |

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