**3GPP TSG RAN WG2 Meeting #110-e R2-2005315**

**Electronic meeting, June 01 - 12, 2020**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *CR--Form--v12.0* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **37.355** | **CR** | **0261** | **rev** | **-** | **Current version:** | **16.0.0** |  |
|  | | | | | | | | |
| *For* [***HELP***](http://www.3gpp.org/3G_Specs/CRs.htm#_blank)*on using this form: comprehensive instructions can be found at* [*http://www.3gpp.org/Change-Requests*](http://www.3gpp.org/Change-Requests)*.* | | | | | | | | |
|  | | | | | | | | |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ***Proposed change affects:*** | UICC apps |  | ME | **X** | Radio Access Network | **X** | Core Network |  |

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | | | | | |
| ***Title:*** | Introduction of Release-16 UE positioning capabilities | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Intel Corporation, NTT DoCoMo | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_pos-Core | | | | |  | ***Date:*** | | | 2020-06-01 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | B |  | | | | | ***Release:*** | | | Rel-16 |
|  | *Use one of the following categories:* ***F*** *(correction)* ***A*** *(mirror corresponding to a change in an earlier release)* ***B*** *(addition of feature),* ***C*** *(functional modification of feature)* ***D*** *(editorial modification)*  Detailed explanations of the above categories can be found in 3GPP [TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm). | | | | | | | | *Use one of the following releases: Rel-8 (Release 8) Rel-9 (Release 9) Rel-10 (Release 10) Rel-11 (Release 11) Rel-12 (Release 12) Rel-13 (Release 13) Rel-14 (Release 14) Rel-15 (Release 15) Rel-16 (Release 16)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | To capture capabilities for NR positioning into stage 3 specification. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | To capature NR positioning UE capabilities. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | Capability part for NR positioning is missing in stage 3. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.3, 6.4.3.3, 6.5 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **X** | Other core specifications | | | | TS/TR... CR TBD ... | | |
| ***affected:*** | |  | **X** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **X** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

## 6.3 Message Body IEs

#### – *RequestCapabilities*

The *RequestCapabilities* message body in a LPP message is used by the location server to request the target device capability information for LPP and the supported individual positioning methods.

-- ASN1START

RequestCapabilities ::= SEQUENCE {

criticalExtensions CHOICE {

c1 CHOICE {

requestCapabilities-r9 RequestCapabilities-r9-IEs,

spare3 NULL, spare2 NULL, spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

RequestCapabilities-r9-IEs ::= SEQUENCE {

commonIEsRequestCapabilities CommonIEsRequestCapabilities OPTIONAL, -- Need ON

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

otdoa-RequestCapabilities OTDOA-RequestCapabilities OPTIONAL, -- Need ON

ecid-RequestCapabilities ECID-RequestCapabilities OPTIONAL, -- Need ON

epdu-RequestCapabilities EPDU-Sequence OPTIONAL, -- Need ON

...,

[[ sensor-RequestCapabilities-r13 Sensor-RequestCapabilities-r13 OPTIONAL, -- Need ON

tbs-RequestCapabilities-r13 TBS-RequestCapabilities-r13 OPTIONAL, -- Need ON

wlan-RequestCapabilities-r13 WLAN-RequestCapabilities-r13 OPTIONAL, -- Need ON

bt-RequestCapabilities-r13 BT-RequestCapabilities-r13 OPTIONAL -- Need ON

]],

[[ nr-ECID-RequestCapabilities-r16 NR-ECID-RequestCapabilities-r16 OPTIONAL, -- Need ON

nr-Multi-RTT-RequestCapabilities-r16

NR-Multi-RTT-RequestCapabilities-r16

OPTIONAL, -- Need ON

nr-DL-AoD-RequestCapabilities-r16

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

nr-DL-TDOA-RequestCapabilities-r16

NR-DL-TDOA-RequestCapabilities-r16 OPTIONAL, -- Need ON

nr-UL-RequestCapabilities-r16 NR-UL-RequestCapabilities-r16 OPTIONAL -- Need ON

]]

}

-- ASN1STOP

#### – *ProvideCapabilities*

The *ProvideCapabilities* message body in a LPP message indicates the LPP capabilities of the target device to the location server.

-- ASN1START

ProvideCapabilities ::= SEQUENCE {

criticalExtensions CHOICE {

c1 CHOICE {

provideCapabilities-r9 ProvideCapabilities-r9-IEs,

spare3 NULL, spare2 NULL, spare1 NULL

},

criticalExtensionsFuture SEQUENCE {}

}

}

ProvideCapabilities-r9-IEs ::= SEQUENCE {

commonIEsProvideCapabilities CommonIEsProvideCapabilities OPTIONAL,

a-gnss-ProvideCapabilities A-GNSS-ProvideCapabilities OPTIONAL,

otdoa-ProvideCapabilities OTDOA-ProvideCapabilities OPTIONAL,

ecid-ProvideCapabilities ECID-ProvideCapabilities OPTIONAL,

epdu-ProvideCapabilities EPDU-Sequence OPTIONAL,

...,

[[ sensor-ProvideCapabilities-r13 Sensor-ProvideCapabilities-r13 OPTIONAL,

tbs-ProvideCapabilities-r13 TBS-ProvideCapabilities-r13 OPTIONAL,

wlan-ProvideCapabilities-r13 WLAN-ProvideCapabilities-r13 OPTIONAL,

bt-ProvideCapabilities-r13 BT-ProvideCapabilities-r13 OPTIONAL

]],

[[ nr-ECID-ProvideCapabilities-r16 NR-ECID-ProvideCapabilities-r16 OPTIONAL,

nr-Multi-RTT-ProvideCapabilities-r16

NR-Multi-RTT-ProvideCapabilities-r16 OPTIONAL,

nr-DL-AoD-ProvideCapabilities-r16

NR-DL-AoD-ProvideCapabilities-r16 OPTIONAL,

nr-DL-TDOA-ProvideCapabilities-r16

NR-DL-TDOA-ProvideCapabilities-r16 OPTIONAL,

nr-UL-ProvideCapabilities-r16 NR-UL-ProvideCapabilities-r16 OPTIONAL

]]

}

-- ASN1STOP

/\*\*\*start change\*\*\*/

#### 6.4.3.3 Common NR capability Information Elements

#### *– NR-DL-AoD-PRS -Capability*

The IE *NR-DL-AoD-PRS-Capability* defines the DL-AoD PRS capability.

-- ASN1START

NR-DL-AoD-PRS-Capability-r16 ::= SEQUENCE {

dl-AoD-PRS-CapabilityBandList-r16 SEQUENCE (SIZE (1..nrMaxBands)) OF DL-AoD-PRS-CapabilityPerBand-r16,

maxNrOfPosLayer-r16 INTEGER (1..4),

maxNrOfTRP-AcrossFreqs-r16 ENUMERATED { n16, n32, n64, n128, n256},

maxNrOf-PRS-ResourcePerTRPAcrossFreqs-r16 ENUMERATED { n4, n8, n16, n32, n64, n128},

...

}

DL-AoD-PRS-CapabilityPerBand-r16 ::= SEQUENCE {

freqBandIndicatorNR-r16 INTEGER (1..1024),

maxNrOfDL-PRS-ResourceSetPerTrpPerFrequencyLayer-r16 INTEGER (1..2),

maxNrOfDL-PRS-ResourcesPerResourceSet-r16 ENUMERATED {n1, n2, n4, n8, n16, n32, n64},

maxNrOfDL-PRS-ResourcesAcrossAllFL-TRP-ResourceSet-r16 ENUMERATED {n64, n128, n192, n256, n512, n1024, n2048},

maxNrOfDL-PRS-ResourcesPerPositioningFrequencylayer-r16 ENUMERATED {n32, n64, n128, n256, n512, n1024}

}

nrMaxBands-r16 INTEGER ::= 1024 -- Maximum number of supported bands.

-- ASN1STOP

| *NR-DL-AoD-PRS-Capability* field descriptions |
| --- |
| ***maxNrOfPosLayer***  Indicates the maximum number of supported positioning layer. |
| ***maxNrOfTRP-AcrossFreqs***  Indicates the maximum number of TRPs across all positioning frequency layers. |
| ***maxNrOf-PRS-ResourcePerTRPAcrossFreqs***  Indicates the maximum number of DL PRS resources per TRP across all frequency layers. |
| ***maxNrOfDL-PRS-ResourceSetPerTrpPerFrequencyLayer***  Indicates the maximum number of DL PRS Resource Sets per TRP per frequency layer supported by UE. |
| ***maxNrOfDL-PRS-ResourcesPerResourceSet***  Indicates the maximum number of DL PRS Resources per DL PRS Resource Set. |
| ***maxNrOfDL-PRS-ResourcesAcrossAllFL-TRP-ResourceSet***  Indicates the maximum number of DL PRS Resources supported by UE across all frequency layers, TRPs and DL PRS Resource Sets. |
| ***DL PRS Resources per positioning frequency layer***  Indicates the maximum number of DL PRS resources per TRP across all frequency layers. |

#### *– NR-DL-AoD-MeasurementCapability*

The IE *NR-DL-AoD-MeasurementCapability* defines the DL-AoD measurement capability.

-- ASN1START

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

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

interFreqPRS-RSPR-Measurement-r16 ENUMERATED {supported} OPTIONAL,

...

}

-- ASN1STOP

| *NR-DL-AoD-MeasurementCapability* field descriptions |
| --- |
| ***maxDL-PRS-RSRP-Measurement***  Indicates the maximum number of DL PRS RSRP measurements on different PRS resources from the same TRP supported by the UE. |
| ***interFreqPRS-RSPR-Measurement***  Indicates whether the UE supports inter-frequency measurement for DL-AoD. |

#### *– NR-Multi-RTT-PRS -Capability*

The IE *NR-Multi-RTT-PRS-Capability* defines the Multi-RTT PRS capability.

-- ASN1START

NR-Multi-RTT-PRS-Capability-r16 ::= SEQUENCE {

Multi-RTT-PRS-CapabilityBandList-r16 SEQUENCE (SIZE (1..nrMaxBands)) OF Multi-RTT-PRS-CapabilityPerBand-r16,

maxNrOfPosLayer-r16 INTEGER (1..4),

maxNrOfTRP-AcrossFreqs-r16 ENUMERATED { n16, n32, n64, n128, n256},

maxNrOf-PRS-ResourcePerTRPAcrossFreqs-r16 ENUMERATED { n4, n8, n16, n32, n64, n128},

...

}

Multi-RTT-PRS-CapabilityPerBand-r16 ::= SEQUENCE {

freqBandIndicatorNR-r16 INTEGER (1..1024),

maxNrOfDL-PRS-ResourceSetPerTrpPerFrequencyLayer-r16 INTEGER (1..2),

maxNrOfDL-PRS-ResourcesPerResourceSet-r16 ENUMERATED {n1, n2, n4, n8, n16, n32, n64},

maxNrOfDL-PRS-ResourcesAcrossAllFL-TRP-ResourceSet-r16 ENUMERATED {n64, n128, n192, n256, n512, n1024, n2048},

maxNrOfDL-PRS-ResourcesPerPositioningFrequencylayer-r16 ENUMERATED {n32, n64, n128, n256, n512, n1024}

}

nrMaxBands-r16 INTEGER ::= 1024 -- Maximum number of supported bands.

-- ASN1STOP

| *NR-Multi-RTT-PRS-Capability* field descriptions |
| --- |
| ***maxNrOfPosLayer***  Indicates the maximum number of supported positioning layer. |
| ***maxNrOfTRP-AcrossFreqs***  Indicates the maximum number of TRPs across all positioning frequency layers. |
| ***maxNrOf-PRS-ResourcePerTRPAcrossFreqs***  Indicates the maximum number of DL PRS resources per TRP across all frequency layers. |
| ***maxNrOfDL-PRS-ResourceSetPerTrpPerFrequencyLayer***  Indicates the maximum number of DL PRS Resource Sets per TRP per frequency layer supported by UE. |
| ***maxNrOfDL-PRS-ResourcesPerResourceSet***  Indicates the maximum number of DL PRS Resources per DL PRS Resource Set. |
| ***maxNrOfDL-PRS-ResourcesAcrossAllFL-TRP-ResourceSet***  Indicates the maximum number of DL PRS Resources supported by UE across all frequency layers, TRPs and DL PRS Resource Sets. |
| ***DL PRS Resources per positioning frequency layer***  Indicates the maximum number of DL PRS resources per TRP across all frequency layers. |

#### *– NR-Multi-RTT-MeasurementCapability*

The IE *NR-Multi-RTT-MeasurementCapability* defines the Multi-RTT measurement capability.

-- ASN1START

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

rx-TX-MeasurementReport-r16 ENUMERATED { supported} OPTIONAL,

interFreqMeasurement-r16 ENUMERATED {supported} OPTIONAL,

...

}

-- ASN1STOP

| *NR-Multi-RTT-MeasurementCapability* field descriptions |
| --- |
| ***rx-TX-MeasurementReport***  Indicates whether the UE supports RX-TX measurement report for Multi-RTT. |
| ***interFreqMeasurement***  Indicates whether the UE supports inter-frequency measurement for Multi-RTT. |

#### *– NR-DL-PRS-ProcessingCapability*

The IE *NR-DL-PRS-ProcessingCapability* defines the common UE downlink PRS Processing capability.

-- ASN1START

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

prs-ProcessingCapabilityBandList-r16 SEQUENCE (SIZE (1..nrMaxBands)) OF PRS-ProcessingCapabilityPerBand-r16,

maxSupportedFreqLayers-r16 INTEGER (1..4),

...

}

PRS-ProcessingCapabilityPerBand-r16 ::= SEQUENCE {

freqBandIndicatorNR-r16 INTEGER (1..1024),

supportedBandwidthPRS-r16 CHOICE {

fr1 ENUMERATED {mhz5, mhz10, mhz20, mhz40, mhz50, mhz80, mhz100},

fr2 ENUMERATED {mhz50, mhz100, mhz200, mhz400}

},

durationOfPRS-Processing-r16 SEQUENCE {

durationOfPRS-ProcessingSysmbols-r16 ENUMERATED {nDot125, nDot25, nDot5, n1, n2, n4, n8, n12, n16, n20, n25, n30, n35, n40, n45, n50},

durationOfPRS-ProcessingSymbolsInEveryTms-r16 ENUMERATED {n8, n16, n20, n30, n40, n80, n160,n320, n640, n1280}

},

maxNumOfDL-PRS-ResProcessedPerSlotFR1-r16 ENUMERATED {n1, n2, n4, n8, n16, n32, n64},

maxNumOfDL-PRS-ResProcessedPerSlotFR2-r16 ENUMERATED {n1, n2, n4, n8, n16, n32, n64}

}

nrMaxBands-r16 INTEGER ::= 1024 -- Maximum number of supported bands.

-- ASN1STOP

| *NR-DL-PRS-ProcessingCapability* field descriptions |
| --- |
| ***maxSupportedFreqLayers***  Indicates the maximum number of positioning frequency layers supported by UE. |
| ***supportedBandwidthPRS***  Indicates the maximum number of DL PRS bandwidth in MHz, which is supported and reported by UE. |
| ***durationOfPRS-Processing***  Indicates the duration of DL PRS symbol in units of ms a UE can process every T ms assuming maximum DL PRS bandwidth in MHz, which is supported and reported by UE. |
| ***maxNumOfDL-PRS-ResProcessedPerSlotFR1***  Indicates the maximum number of DL PRS resources that UE can process in a slot under FR1. |
| ***maxNumOfDL-PRS-ResProcessedPerSlotFR1***  Indicates the maximum number of DL PRS resources that UE can process in a slot under FR2. |

#### *– NR-DL-PRS-QCL-ProcessingCapability*

The IE *NR-DL-PRS-QCL-ProcessingCapability* defines the common UE downlink PRS QCL Processing capability.

-- ASN1START

NR-DL-PRS-QCL-ProcessingCapability-r16 ::= SEQUENCE {

prs-QCL-ProcessingCapabilityBandList-r16 SEQUENCE (SIZE (1..nrMaxBands)) OF PRS-QCL-ProcessingCapabilityPerBand-r16,

...

}

PRS-QCL-ProcessingCapabilityPerBand-r16 ::= SEQUENCE {

freqBandIndicatorNR-r16 INTEGER (1..1024),

ssbFromNeighCellAsQCL-r16 ENUMERATED { supported} OPTIONAL,

ssbFromNeighServingCellAsQCL-r16 ENUMERATED { supported} OPTIONAL

}

nrMaxBands-r16 INTEGER ::= 1024 -- Maximum number of supported bands.

-- ASN1STOP

| *NR-DL-PRS-QCL-ProcessingCapability* field descriptions |
| --- |
| ***ssbFromNeighCellAsQCL***  Indicates the support of SSB from neighbor cell as QCL source of a DL PRS. |
| ***sbFromNeighServingCellAsQCL***  Indicates the support of DL PRS from serving/neighbor cell as QCL source of a DL PRS. |

#### *– NR-DL-TDOA-PRS-Capability*

The IE *NR-DL-TDOA-PRS-Capability* defines the DL-TDOA PRS capability.

-- ASN1START

NR-DL-TDOA-PRS-Capability-r16 ::= SEQUENCE {

dl-TODA-PRS-CapabilityBandList-r16 SEQUENCE (SIZE (1..nrMaxBands)) OF DL-TDOA-PRS-CapabilityPerBand-r16,

maxNrOfPosLayer-r16 INTEGER (1..4),

maxNrOfTRP-AcrossFreqs-r16 ENUMERATED { n16, n32, n64, n128, n256},

maxNrOf-PRS-ResourcePerTRPAcrossFreqs-r16 ENUMERATED { n4, n8, n16, n32, n64, n128},

...

}

DL-TDOA-PRS-CapabilityPerBand-r16 ::= SEQUENCE {

freqBandIndicatorNR-r16 INTEGER (1..1024),

maxNrOfDL-PRS-ResourceSetPerTrpPerFrequencyLayer-r16 INTEGER (1..2),

maxNrOfDL-PRS-ResourcesPerResourceSet-r16 ENUMERATED {n1, n2, n4, n8, n16, n32, n64},

maxNrOfDL-PRS-ResourcesAcrossAllFL-TRP-ResourceSet-r16 ENUMERATED {n64, n128, n192, n256, n512, n1024, n2048},

maxNrOfDL-PRS-ResourcesPerPositioningFrequencylayer-r16 ENUMERATED {n32, n64, n128, n256, n512, n1024}

}

nrMaxBands-r16 INTEGER ::= 1024 -- Maximum number of supported bands.

-- ASN1STOP

| *NR-DL-TDOA-PRS-Capability* field descriptions |
| --- |
| ***maxNrOfPosLayer***  Indicates the maximum number of supported positioning layer. |
| ***maxNrOfTRP-AcrossFreqs***  Indicates the maximum number of TRPs across all positioning frequency layers. |
| ***maxNrOf-PRS-ResourcePerTRPAcrossFreqs***  Indicates the maximum number of DL PRS resources per TRP across all frequency layers. |
| ***maxNrOfDL-PRS-ResourceSetPerTrpPerFrequencyLayer***  Indicates the maximum number of DL PRS Resource Sets per TRP per frequency layer supported by UE. |
| ***maxNrOfDL-PRS-ResourcesPerResourceSet***  Indicates the maximum number of DL PRS Resources per DL PRS Resource Set. |
| ***maxNrOfDL-PRS-ResourcesAcrossAllFL-TRP-ResourceSet***  Indicates the maximum number of DL PRS Resources supported by UE across all frequency layers, TRPs and DL PRS Resource Sets. |
| ***DL PRS Resources per positioning frequency layer***  Indicates the maximum number of DL PRS resources per TRP across all frequency layers. |

#### *– NR-DL-TDOA-MeasurementCapability*

The IE *NR-DL-TDOA-MeasurementCapability* defines the DL-TDOA measurement capability.

-- ASN1START

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

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

interFreqPRS-Measurement-r16 ENUMERATED {supported} OPTIONAL,

...

}

-- ASN1STOP

| *NR-DL-TDOA-MeasurementCapability* field descriptions |
| --- |
| ***maxDL-PRS-RSRP-Measurement***  Indicates the maximum number of DL PRS RSRP measurements on different PRS resources from the same TRP supported by the UE. |
| ***interFreqPRS-Measurement***  Indicates whether the UE supports inter-frequency measurement for DL-TDOA. |

#### *– NR-UL-SRS-Capability*

The IE *NR-UL-SRS-Capability* defines the UE uplink SRS capability.

-- ASN1START

NR-UL-SRS-Capability-r16 ::= SEQUENCE {

srs-CapabilityBandList-r16 SEQUENCE (SIZE (1..nrMaxBands)) OF SRS-CapabilityPerBand-r16,

...

}

SRS-CapabilityPerBand-r16 ::= SEQUENCE {

maxNumberSRS-ResourceSetPerBWP-r16 ENUMERATED {n1, n2, n4, n8, n12, n16},

maxNumberPeriodicSRS-ResourcesAllSetsPerBWP-r16 ENUMERATED {n1, n2, n4, n8, n16, n32, n64},

maxNumberAperiodicSRS-PerBWP-r16 ENUMERATED {n1, n2, n4, n8, n16, n32, n64},

maxNumberAperiodicSRS-PerBWP-PerSlot-r16 ENUMERATED (n1, n2, n3, n4, n5, n6, n8, n10, n12, n14),

maxNumberSemiPersistentSRS-PerBWP-r16 ENUMERATED {n1, n2, n4, n8, n16, n32, n64},

maxNumberSemiPersistentSRS-PerBWP-PerSlot-r16 ENUMERATED (n1, n2, n3, n4, n5, n6, n8, n10, n12, n14),

maxNumberPeriodicSRS-PerBWP-r16 ENUMERATED {n1, n2, n4, n8, n16, n32, n64},

maxNumberPeriodicSRS-PerBWP-PerSlot-r16 ENUMERATED (n1, n2, n3, n4, n5, n6, n8, n10, n12, n14)}

nrMaxBands-r16 INTEGER ::= 1024 -- Maximum number of supported bands.

-- ASN1STOP

| *NR-UL-SRS-Capability* field descriptions |
| --- |
| ***maxNumberSRS-ResourceSetPerBWP***  Indicates the max number of SRS Resource Sets for positioning supported by UE per BWP. |
| ***maxNumberPeriodicSRS-ResourcesAllSetsPerBWP***  Indicates the max number of periodic SRS Resources for positioning supported by UE across all SRS Resource Sets per BWP. |
| ***maxNumberAperiodicSRS-PerBWP***  Indicates the max number of aperiodic SRS Resources for positioning per BWP. |
| ***maxNumberAperiodicSRS-PerBWP-PerSlot***  Indicates the number of aperiodic SRS Resources for positioning per BWP per slot. |
| ***maxNumberSemiPersistentSRS-PerBWP***  Indicates the max number of semi-persistent SRS Resources for positioning supported by UE per BWP. |
| ***maxNumberSemiPersistentSRS-PerBWP-PerSlot***  Indicates the max number of semi-persistent SRS Resources for positioning supported by UE per BWP per slot. |
| ***maxNumberPeriodicSRS-PerBWP***  Indicates the max number of periodic SRS Resources for positioning per BWP. |
| ***maxNumberPeriodicSRS-PerBWP-PerSlot***  Indicates the number of aperiodic SRS Resources for positioning per BWP per slot. |

#### *– NR-UL-SRS-SpatialRelationCapability*

The IE *NR-UL-SRS-SpatialRelationCapability* defines the UE uplink SRS spatial relation capability.

-- ASN1START

NR-UL-SRS-SpatialRelationCapability-r16 ::= SEQUENCE {

spatialRelation-SRS-PosBasedOnSSB-Serving-r16 ENUMERATED {supported} OPTIONAL,

spatialRelation-SRS-PosBasedOnCSI-RS-Serving-r16 ENUMERATED {supported} OPTIONAL,

spatialRelation-SRS-PosBasedOnPRS-Serving-r16 ENUMERATED {supported} OPTIONAL,

spatialRelation-SRS-PosBasedOnSRS-r16 ENUMERATED {supported} OPTIONAL,

spatialRelation-SRS-PosBasedOnSSB-Neigh-r16 ENUMERATED {supported} OPTIONAL,

spatialRelation-SRS-PosBasedOnPRS-Neigh-r16 ENUMERATED {supported} OPTIONAL,

maxNumberSpatialRelationsAllServing-r16 NUMERATED {n0, n1, n4, n8, n16},

maxNumberSpatialRelationsPerServing-r16 NUMERATED {n0, n1, n4, n8, n16}

}

-- ASN1STOP

| *NR-UL-SRS-SpatialRelationCapability* field descriptions |
| --- |
| ***spatialRelation-SRS-PosBasedOnSSB-Serving***  Indicates whether the UE supports spatial relation for SRS for positioning based on SSB from the serving cell; |
| ***spatialRelation-SRS-PosBasedOnCSI-RS-Serving***  Indicates whether the UE supports spatial relation for SRS for positioning based on CSI-RS from the serving cell; |
| ***spatialRelation-SRS-PosBasedOnPRS-Serving***  Indicates whether the UE supports spatial relation for SRS for positioning based on PRS from the serving cell; |
| ***spatialRelation-SRS-PosBasedOnSRS***  Indicates whether the UE supports spatial relation for SRS for positioning based on SRS; |
| ***spatialRelation-SRS-PosBasedOnSSB-Neigh***  Indicates whether the UE supports spatial relation for SRS for positioning based on SSB from the neighbouring cell; |
| ***spatialRelation-SRS-PosBasedOnPRS-Neigh***  Indicates whether the UE supports spatial relation for SRS for positioning based on PRS from the neighbouring cell; |
| ***maxNumberSpatialRelationsAllServing***  Indicates the maximum number of maintained spatial relations for all the SRS resource sets for positioning across all serving cells in addition to the spatial relations maintained spatial relations per serving cell for the PUSCH/PUCCH/SRS transmissions; |
| ***maxNumberSpatialRelationsPerServing***  Indicates the maximum of maintained spatial relations for all the SRS resource sets for positioning per serving cell in addition to the spatial relations maintained spatial relations per serving cell for the PUSCH/PUCCH/SRS transmissions; |

/\*\*\*Next change\*\*\*/

### 6.5.10 NR-DL-TDOA Positioning

This clause defines the information elements for NR downlink TDOA positioning (TS 38.305 [40]).

#### 6.5.10.1 NR-DL-TDOA Assistance Data

#### – *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 downlink 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 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

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *UEB* | The field is mandatory present for the UE based DL-TDOA; otherwise it is not present. |

#### 6.5.10.2 NR-DL-TDOA Assistance Data Request

#### – *NR-DL-TDOA-RequestAssistanceData*

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

-- ASN1START

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

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

nr-AdType-r16 BIT STRING { dl-prs (0),

posCalc (1) } (SIZE (1..8)),

...

}

-- ASN1STOP

| *NR-DL-TDOA-RequestAssistanceData* field descriptions |
| --- |
| ***nr-PhysCellId***  This field specifies the NR physical cell identity of the current primary cell of the target device. |
| ***nr-AdType***  This field indicates the requested assistance data. dl-prs means requested assistance data is *nr-DL-PRS-AssistanceData*, posCalc means requested assistance data is *nr-PositionCalculationAssistanceData* for UE based positioning. |

#### 6.5.10.3 NR-DL-TDOA Location Information

#### – *NR-DL-TDOA-ProvideLocationInformation*

The IE *NR-DL-TDOA-ProvideLocationInformation* is used by the target device to provide NR-DL-TDOA location measurements to the location server. It may also be used to provide NR-DL-TDOA positioning specific error reason.

-- ASN1START

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

nr-DL-TDOA-SignalMeasurementInformation-r16

DL-TDOA-SignalMeasurementInformation-r16 OPTIONAL,

nr-dl-tdoa-LocationInformation-r16 NR-DL-TDOA-LocationInformation-r16 OPTIONAL, -- Cond UEB

nr-DL-TDOA-Error-r16 DL-TDOA-Error-r16 OPTIONAL,

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *UEB* | The field is mandatory present for the UE based DL-TDOA; otherwise it is not present. |

#### 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 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), -- 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 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. |

#### 6.5.10.5 NR-DL-TDOA Location Information Request

#### – *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

}

-- ASN1STOP

| *NR-DL-TDOA-RequestLocationInformation* field descriptions |
| --- |
| ***nr-AssistanceAvailability***  This field indicates whether the target device may request additional PRS assistance data from the server. TRUE means allowed and FALSE means not allowed. |
| ***nr-RequestedMeasurements***  This field specifies the NR DL-TDOA measurements requested. This is represented by a bit string, with a one‑value at the bit position means the particular measurement is requested; a zero‑value means not requested. |
| ***nr-DL-PRS-RstdMeasurementInfoRequest***  This field indicates whether the target device is requested to report DL PRS Resource ID(s) or DL PRS Resource Set ID(s) used for determining the timing of each TRP in RSTD measurements. |
| ***maxDL-PRS-RSRP-MeasurementsPerTRP***  This field specifies the maximum number of DL PRS RSRP measurements on different DL PRS resources from the same TRP. |
| ***maxDL-PRS-RSTD-MeasurementsPerTRPPair***  This field specifies the maximum number of. DL PRS RSTD measurements per pair of TRPs. The maximum number is defined across all positioning frequency layers. |
| ***timingReportingGranularityFactor***  This field specifies the reporting granularity for the UE timing measurements (DL RSTD, the UE Rx-Tx time difference). |

#### 6.5.10.6 NR-DL-TDOA Capability Information

#### – *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-PRS-Capability-r16 NR-DL-TDOA-PRS-Capability-r16,

nr-DL-TDOA-MeasurementCapability-r16 NR-DL-TDOA-MeasurementCapability-r16,

nr-DL-PRS-QCL-ProcessingCapability-r16 NR-DL-PRS-QCL-ProcessingCapability-r16,

nr-DL-PRS-ProcessingCapability-r16 NR-DL-PRS-ProcessingCapability-r16,

additionalPathsReport-r16 ENUMERATED { supported } OPTIONAL,

periodicalReporting-r16 ENUMERATED { supported } OPTIONAL,

...

}

-- ASN1STOP

| *NR-DL-TDOA-ProvideCapabilities* field descriptions |
| --- |
| ***nr-DL-TDOA-Mode***  This field specifies the DL-TDOA mode(s) supported by the target device. |

#### 6.5.10.7 NR-DL TDOA Capability Information Request

#### – *NR-DL-TDOA-RequestCapabilities*

The IE *NR-DL-TDOA-RequestCapabilities* is used by the location server to request the capability of the target device to support NR DL-TDOA and to request NR DL-TDOA positioning capabilities from a target device.

-- ASN1START

NR-DL-TDOA-RequestCapabilities ::= SEQUENCE {

...

}

-- ASN1STOP

#### 6.5.10.8 NR-DL-TDOA Error Elements

#### – *NR-DL-TDOA-Error*

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

-- ASN1START

NR-DL-TDOA-Error-r16 ::= CHOICE {

locationServerErrorCauses-r16 NR-DL-TDOA-LocationServerErrorCauses-r16,

targetDeviceErrorCauses-r16 NR-DL-TDOA-TargetDeviceErrorCauses-r16,

...

}

-- ASN1STOP

#### – *NR-DL-TDOA-LocationServerErrorCauses*

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

-- ASN1START

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

cause-r16 ENUMERATED { undefined,

assistanceDataNotSupportedByServer,

assistanceDataSupportedButCurrentlyNotAvailableByServer,

notProvidedAssistanceDataNotSupportedByServer, ...

},

...

}

-- 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, ...

},

nr-PRS-RSRPMeasurementNotPossible-r16 NULL OPTIONAL,

nr-RSTDMeasurementNotPossible-r16 NULL OPTIONAL,

...

}

-- ASN1STOP

### 6.5.11 NR-DL-AoD Positioning

This clause defines the information elements for NR downlink AoD positioning (TS 38.305 [40]).

#### 6.5.11.1 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.

-- 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 SEQUENCE (SIZE (1..nrMaxFreqLayers)) OF NR-SelectedDL-PRS-PerFreq-r16 OPTIONAL, -- Need ON

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

#### 6.5.11.2 NR-DL-AoD Assistance Data Request

#### – *NR-DL-AoD-RequestAssistanceData*

The IE *NR-DL-AoD-RequestAssistanceData* is used by the target device to request assistance data from a location server.

-- ASN1START

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

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

nr-AdType-r16 BIT STRING { dl-prs (0), posCalc (1) } (SIZE (1..8)),

...

}

-- ASN1STOP

| *NR-DL-AoD-RequestAssistanceData* field descriptions |
| --- |
| ***nr-PhysCellId***  This field specifies the NR physical cell identity of the current primary cell of the target device. |
| ***nr-AdType***  This field indicates the requested assistance data. dl-prs means requested assistance data is *nr-DL-PRS-AssistanceData*, posCalc means requested assistance data is *nr-PositionCalculationAssistanceData* for UE based positioning. |

#### 6.5.11.3 NR-DL-AoD Location Information

#### – *NR-DL-AoD-ProvideLocationInformation*

The IE *NR-DL-AoD-ProvideLocationInformation* is used by the target device to provide NR DL-AoD location measurements to the location server. It may also be used to provide NR DL-AoD positioning specific error reason.

-- ASN1START

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

nr-DL-AoD-SignalMeasurementInformation-r16

NR-DL-AoD-SignalMeasurementInformation-r16 OPTIONAL,

nr-dl-aod-LocationInformation-r16 NR-DL-AoD-LocationInformation-r16 OPTIONAL, -- Cond UEB

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

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *UEB* | The field is mandatory present for the UE based DL-AoD; otherwise it is not present. |

#### 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 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, -- 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 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. |

#### 6.5.11.5 NR-DL-AoD Location Information Request

#### – *NR-DL-AoD-RequestLocationInformation*

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

-- ASN1START

NR-Dl-AoD-RequestLocationInformation-r16 ::= SEQUENCE {

nr-AssistanceAvailability-r16 BOOLEAN,

nr-DL-AoD-ReportConfig-r16 NR-DL-AoD-ReportConfig-r16,

...

}

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

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

}

-- ASN1STOP

| *NR-DL-AoD-RequestLocationInformation* field descriptions |
| --- |
| ***nr-AssistanceAvailability***  This field indicates whether the target device may request additional PRS assistance data from the server. TRUE means allowed and FALSE means not allowed. |
| ***maxDL-PRS-RSRP-MeasurementsPerTRP***  This field specifies the maximum number of DL PRS RSRP measurements on different DL PRS resources from the same TRP. |

#### 6.5.11.6 NR-DL-AoD Capability Information

#### – *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 ENUMERATED { supported } OPTIONAL,

nr-DL-AoD-PRS-Capability-r16 NR-DL-AoD-PRS-Capability-r16,

nr-DL-AoD-MeasurementCapability-r16 NR-DL-AoD-MeasurementCapability-r16,

nr-DL-PRS-QCL-ProcessingCapability-r16 NR-DL-PRS-QCL-ProcessingCapability-r16,

nr-DL-PRS-ProcessingCapability-r16 NR-DL-PRS-ProcessingCapability-r16,

...

}

-- ASN1STOP

#### 6.5.11.7 NR-DL AoD Capability Information Request

#### – *NR-DL-AoD-RequestCapabilities*

The IE *NR-DL-AoD-RequestCapabilities* is used by the location server to request the capability of the target device to support NR DL-AoD and to request NR DL-AoD positioning capabilities from a target device.

-- ASN1START

NR-DL-AoD-RequestCapabilities ::= SEQUENCE {

...

}

-- ASN1STOP

#### 6.5.11.8 NR-DL-AoD Error Elements

#### – *NR-DL-AoD-Error*

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

-- ASN1START

NR-DL-AoD-Error-r16 ::= CHOICE {

locationServerErrorCauses-r16 NR-DL-AoD-LocationServerErrorCauses-r16,

targetDeviceErrorCauses-r16 NR-DL-AoD-TargetDeviceErrorCauses-r16,

...

}

-- ASN1STOP

#### – *NR-DL-AoD-LocationServerErrorCauses*

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

-- ASN1START

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

cause-r16 ENUMERATED { undefined,

assistanceDataNotSupportedByServer,

assistanceDataSupportedButCurrentlyNotAvailableByServer,

notProvidedAssistanceDataNotSupportedByServer,

...

},

...

}

-- 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,

...

},

nr-PRS-RSRPMeasurementNotPossible-r16 NULL OPTIONAL,

...

}

-- ASN1STOP

### 6.5.12 NR-Multi-RTT Positioning

This clause defines the information elements for downlink NR-Multi-RTT positioning (TS 38.305 [40]).

#### 6.5.12.1 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.

-- 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 SEQUENCE (SIZE (1..nrMaxFreqLayers)) OF NR-SelectedDL-PRS-PerFreq-r16 OPTIONAL, -- Need ON

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

...

}

-- ASN1STOP

#### 6.5.12.2 NR-Multi-RTT Assistance Data Request

#### – *NR-Multi-RTT-RequestAssistanceData*

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

-- ASN1START

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

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

nr-AdType-r16 BIT STRING { dl-prs (0), ul-srs (1) } (SIZE (1..8)),

...

}

-- ASN1STOP

| *NR-Multi-RTT-RequestAssistanceData* field descriptions |
| --- |
| ***nr-PhysCellId***  This field specifies the NR physical cell identity of the current primary cell of the target device. |

#### 6.5.12.3 NR-Multi-RTT Location Information

#### – *NR-Multi-RTT-ProvideLocationInformation*

The IE *NR-Multi-RTT-ProvideLocationInformation* is used by the target device to provide NR Multi-RTT location measurements to the location server. It may also be used to provide NR Multi-RTT positioning specific error reason.

-- ASN1START

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

nr-Multi-RTT-SignalMeasurementInformation-r16 NR-Multi-RTT-SignalMeasurementInformation-r16 OPTIONAL,

nr-Multi-RTT-Error-r16 NR-Multi-RTT-Error-r16 OPTIONAL,

...

}

-- ASN1STOP

#### 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 OPTIONAL,

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

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

nr-UE-RxTxTimeDiff-r16 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. |

#### 6.5.12.5 NR-Multi-RTT Location Information Request

#### – *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-RequestedMeasurements-r16 BIT STRING { prsrsrpReq (0)} (SIZE(1..8)),

nr-AssistanceAvailability-r16 BOOLEAN,

nr-Multi-RTT-ReportConfig-r16 NR-Multi-RTT-ReportConfig-r16,

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

...

}

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

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

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

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

}

-- ASN1STOP

| *NR-Multi-RTT-RequestLocationInformation* field descriptions |
| --- |
| ***nr-AssistanceAvailability***  This field indicates whether the target device may request additional PRS assistance data from the server. TRUE means allowed and FALSE means not allowed. |
| ***maxDL-PRS-RSRP-MeasurementsPerTRP***  This field specifies the maximum number of DL PRS RSRP measurements on different DL PRS resources from the same TRP. |
| ***maxDL-PRS-RxTxTimeDiffMeasPerTRP***  This field specifies the maximum number of UE-Rx-Tx time difference measurements for different DL PRS resources or DL PRS resource sets per TRP. |
| ***timingReportingGranularityFactor***  This field specifies the reporting granularity for the UE timing measurements (DL RSTD, the UE Rx-Tx time difference). |

#### 6.5.12.6 NR-Multi-RTT Capability Information

#### – *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-Multi-RTT-PRS-Capability-r16 NR-Multi-RTT-PRS-Capability-r16,

nr-Multi-RTT-MeasurementCapability-r16 NR-Multi-RTT-MeasurementCapability-r16,

nr-DL-PRS-QCL-ProcessingCapability-r16 NR-DL-PRS-QCL-ProcessingCapability-r16,

nr-DL-PRS-ProcessingCapability-r16 NR-DL-PRS-ProcessingCapability-r16,

nr-UL-SRS-Capability-r16 NR-UL-SRS-Capability-r16,

nr-UL-SRS-SpatialRelationCapability-r16 NR-UL-SRS-SpatialRelationCapability-r16,

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

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

additionalPathsReport-r16 ENUMERATED { supported } OPTIONAL,

periodicalReporting-r16 ENUMERATED { supported } OPTIONAL,

...

}

-- ASN1STOP

#### 6.5.12.7 NR-Multi-RTT Capability Information Request

#### – *NR-Multi-RTT-RequestCapabilities*

The IE *NR-Multi-RTT-RequestCapabilities* is used by the location server to request the capability of the target device to support NR Multi-RTT and to request NR Multi-RTT positioning capabilities from a target device.

-- ASN1START

NR-Multi-RTT-RequestCapabilities ::= SEQUENCE {

...

}

-- ASN1STOP

#### 6.5.12.8 NR-Multi-RTT Error Elements

#### – *NR-Multi-RTT-Error*

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

-- ASN1START

NR-Multi-RTT-Error-r16 ::= CHOICE {

locationServerErrorCauses-r16 NR-Multi-RTT-LocationServerErrorCauses-r16,

targetDeviceErrorCauses-r16 NR-Multi-RTT-TargetDeviceErrorCauses-r16,

...

}

-- ASN1STOP

#### – *NR-Multi-RTT-LocationServerErrorCauses*

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

-- ASN1START

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

cause-r16 ENUMERATED { undefined,

assistanceDataNotSupportedByServer,

assistanceDataSupportedButCurrentlyNotAvailableByServer,

...

},

...

}

-- 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,

attemptedButUnableToMeasureSomeNeighbourTRPs,

ul-srs-configuration-missing,

unableToTransmit-ul-prs,

...

},

nr-PRS-RSRPMeasurementNotPossible-r16 NULL OPTIONAL,

nr-UERxTxMeasurementNotPossible-r16 NULL OPTIONAL,

...

}

-- ASN1STOP

#### *– End of LPP-PDU-Definitions*

-- ASN1START

END

-- ASN1STOP