**3GPP TSG-RAN WG2 Meeting #120 *R2-2213188***

**Toulouse, FR, November 14 – 18, 2022**

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| *CR-Form-v12.2* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **37.355** | **CR** | **0386** | **rev** | **3** | **Current version:** | **17.2.0** |  |
|  | | | | | | | | |
| *For* [***HE******LP***](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)*.* | | | | | | | | |
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| ***Proposed change affects:*** | UICC apps |  | ME | **x** | Radio Access Network |  | Core Network | **x** |

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| ***Title:*** | Various LPP Corrections | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | Qualcomm Incorporated (Rapporteur) | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_pos\_enh-Core | | | | |  | ***Date:*** | | | 2022-12-01 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | F |  | | | | | ***Release:*** | | | Rel-17 |
|  | *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-16 (Release 16) Rel-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | 1. A UE should declare PRS processing capabilities for each of the supported PPW Type (Type-1A, Type-1B, Type-2) in the case the UE supports multiple PPW types in a band. 2. The Note "A single value is reported when both Multi-RTT and DL-TDOA are supported." for the *nr-los-nlos-IndicatorSupport* is missing in *NR-DL-TDOA-ProvideCapabilities* and *NR-Multi-RTT-ProvideCapabilities.* 3. The Note "A single value is reported when both Multi-RTT and DL-TDOA are supported." in the field description for *nr-los-nlos-AssistanceDataSupport* in *NR-DL-TDOA-ProvideCapabilities, NR-DL-AoD-ProvideCapabilities,* and *NR-Multi-RTT-ProvideCapabilities* is not correct, since UE-based mode is not supported for Multi-RTT and the Note is only applicable to DL-TDOA and Multi-RTT. 4. Release 17 introduced RSRPP, which is not reflected as a measurement option in the definition of *nr-DL-PRS-RxBeamIndex*. 5. Release 17 introduced RSRPP, which necessitated the addition of *nr-DL-PRS-FirstPathRSRP-Result-Diff-r17* in *NR-DL-AoD-AdditionalMeasurementElement-r17*. The fields *nr-Dl-PRS-RSRP-ResultDiff-r17* and *nr-Dl-PRS-FirstPathRSRP-ResultDiff-r17* are optional, conditional on the presence of the other. Because the release 16 specification does not define RSRPP, the conditional presence explanations are vague with regard to *NR-DL-AoD-AdditionalMeasurementElement-r16*, where *nr-DL-PRS-RSRP-ResultDiff-r16* is mandatory. 6. *nr-DL-PRS-RxBeamIndex* indication is used for DL-PRS measurements only when additional DL-PRS measurements are also included and all these DL-PRS measurements are associated with a single TRP (up to 8 measurements in Rel-16 or 24 measurements in Rel-17). 7. According to 38.214 v17.3.0, section 5.1.6.5   *"The UE may be configured to measure and report, subject to UE capability, up to 24 DL PRS-RSRP measurements on DL PRS resources associated with the same dl-PRS-ID”. <…>. The UE may be configured to measure and optionally report, subject to UE capability, up to 24 DL PRS RSRPP for the first detected path on DL PRS resources associated with the same dl-PRS-ID"*.  This means both the *nr-DL-AoD-AdditionalMeasurements-r16* and *nr-DL-AoD-AdditionalMeasurementsExt-r17* fields cannot be included by the UE at the same time because the total reported measurements would exceed 24 in Rel-17.   1. RAN1 has made the agreement on the maximum number of SRS and TEG association reports in a measurement instance:   *Agreement in RAN1#109-e:*  *Include the following in the reply LS to RAN4, RAN2, RAN3:*  *In RAN1’s understanding, each measurement instance may allow up to 8 reports (or changes) of the TEG-SRS association information for each TEG ID.*  Therefore, the maximum number of TEG-SRS association information per measurement instance can be up to 8\*8=64. However, *maxTxTEG-Sets-r17* has the value 256.   1. For FG 27-3-3 (R1-2210488), 'DL PRS Processing Capability outside MG', the meaning/interpretation of (N,T) and (N2,T2) is currently missing. 2. For FG 27-3-3 (R1-2210488), the UE shall support either component 2a (*ppw-durationOfPRS-Processing1*) or component 2b (*ppw-durationOfPRS-Processing2*), but not both for each supported type in a band. However, corresponding field description is currently missing. 3. The in Rel-17 introduced Table NOTEs need to be distinguished from the Rel-16 NOTE below the field description Table, which defines the (N,T) definition for the Rel-16 *durationOfPRS-Processing*. 4. *NR-UL-SRS-Capability*: referring to the latest RAN1 features list R1-2207923 the FG 27-15 and 27-15a are defined with regards to positioning SRS transmission in RRC\_INACTIVE state for initial BWP, see table below. In NR RRC the FGs have been specified in separate capabilities, i.e. FG 27-15 in *srs-PosResourcesRRC-Inactive-r17* and FG 27-15a in *srs-SemiPersistent-PosResourcesRRC-Inactive-r17*. However, in LPP both FGs have been merged into the same capability *posSRS-RRC-Inactive-InInitialUL-BWP-r17*. Since FG 27-15 is pre-requisite for FG 27-15a this results in a very confusing condition for the presence of the fields related to FG 27-15a (*maxNumOfSemiPersistentSRSposResources-r17* and *maxNumOfSemiPersistentSRSposResourcesPerSlot-r17*) saying:   “*The UE can include this field only if the UE supports posSRS-RRC-Inactive-InInitialUL-BWP. Otherwise, the UE does not include this field.*”  To avoid the confusing presence condition and considering the fact that FG 27-15 is pre-requisite for other FGs (27-15b, 27-15c, 27-16a, 27-19a) but FG 27-15a is not pre-requisite for other FGs, it is recommended to specifiy FG 27-15a as separate capability as it was done in NR RRC.   |  |  |  |  | | --- | --- | --- | --- | | **FG** | **Description** | **Components** | **Pre-requisite** | | 27-15 | Positioning SRS transmission in RRC\_INACTIVE state for initial UL BWP (->ASN.1: posSRS-RRC-Inactive-InInitialUL-BWP-r17) | 1. Max number of SRS Resource Sets for positioning supported by UE  (->ASN.1: maxNumOfSRSposResourceSets-r17)  2. Max number of P/SPSRS Resources for positioning (->ASN.1: maxNumOfPeriodicAndSemiPeristentSRSposResources-r17)  3. Max number of P/SPSRS Resources for positioning per slot  (->ASN.1: maxNumOfPeriodicAndSemiPeristentSRSposResourcesPerSlot-r17)  4. Max number of periodic SRS Resources for positioning (->ASN.1: maxNumOfPeriodicSRSposResources-r17)  5. Max number of periodic SRS Resources for positioning per slot  (->ASN.1: maxNumOfPeriodicSRSposResourcesPerSlot-r17) |  | | 27-15a | Support of positioning SRS transmission in RRC\_INACTIVE state for initial BWP with semi-persistent SRS  (->ASN.1: posSRS-RRC-Inactive-InInitialUL-BWP-r17) | 1. Max number of semi-persistent SRS Resources for positioning (->ASN.1: maxNumOfSemiPeristentSRSposResources-r17)  2. Max number of semi-persistent SRS Resources for positioning per slot  (->ASN.1:  maxNumOfSemiPersistentSRSposResourcesPerSlot-r17) | 27-15 | | 27-15b | Positioning SRS transmission in RRC\_INACTIVE state configured outside initial UL BWP (->ASN.1: posSRS-RRC-Inactive-OutsideInitialUL-BWP-r17) | 1. Maximum SRS bandwidth supported for each SCS that UE supports within a single CC  2. Max number of SRS Resource Sets for positioning supported by UE  3. Max number of periodic SRS Resources for positioning  4. Max number of periodic SRS Resources for positioning per slot  5. Support of ifferent numerology between the SRS and the initial UL BWP  6. Support of SRS operation without restriction on the BW: BW of the SRS may not include BW of the CORESET#0 and SSB  7. Max number of P/SP SRS Resources for positioning  8. Max number of P/SP SRS Resources for positioning per slot  9. Support a different center frequenecy between the SRS for positioning and the initial UL BWP  10. Switching time between SRS Tx and other Tx in initial UL BWP or Rx in initial DL BWP | 27-15 | | 27-15c | Support of positioning SRS transmission in RRC\_INACTIVE state outside initial BWP with semi-persistent SRS (->ASN.1: posSRS-RRC-Inactive-OutsideInitialUL-BWP-r17) | 1. Max number of semi-persistent SRS Resources for positioning  (->ASN.1: maxNumOfSemiPersistentSRSposResources-r17)  2. Max number of semi-persistent SRS Resources for positioning per slot  (->ASN.1: maxNumOfSemiPersistentSRSposResourcesPerSlot-r17) | 27-15 | | 27-16a | OLPC for positioning SRS in RRC\_INACTIVE state – location server (->ASN.1: olpc-SRS-PosRRC-Inactive-r17) | Same as LPP  OLPC-SRS-Pos-r16 | 27-15 | | 27-19a | Spatial relation for positioning SRS in RRC\_INACTIVE state – location server (->ASN.1: spatialRelationsSRS-PosRRC-Inactive-r17) | Same as LPP  SpatialRelationsSRS-Pos-r16 | 27-15 |  1. *NR-DL-AoD-MeasurementCapability*: With regards to FG 27-2-2 new Rel-17 fields *maxDL-PRS-RSRP-MeasurementFR1-r17*, *maxDL-PRS-RSRP-MeasurementFR2-r17* were introduced to extend the Rel-16 value range to {16, 24}.  |  |  |  |  | | --- | --- | --- | --- | | **FG** | **Description** | **Components** | **Pre-requisite** | | 27-2-2 | DL PRS RSRP reporting for more than 8 measurements for UE-assisted DL-AoD positioning | Support reporting K> 8 DL PRS RSRP measurements per TRP. | 13-5 |   But since the corresponding Rel-16 fields (FG 13-5) are pre-requisite for FG 27-2-2 a confusing condition for the presence of the Rel-17 fields has been defined in the respective field descriptions, e.g. for *maxDL-PRS-RSRP-MeasurementFR1*:  *“The UE can include maxDL-PRS-RSRP-MeasurementFR1 only if the UE supports one of maxDL-PRS-RSRP-MeasurementFR1 and maxDL-PRS-RSRP-MeasurementFR2. Otherwise, the UE does not include this field.”*  To avoid the confusing condition and considering the fact that the Rel-17 fields merely represent an extension of the value range for the existing Rel-16 fields, it is recommended to define the new Rel-17 fields as Rel-17 non-critical extensions of the Rel-16 fields *maxDL-PRS-RSRP-MeasurementFR1-r16*, *maxDL-PRS-RSRP-MeasurementFR2-r16*.   1. The Note in *prs-ProcessingCapabilityOutsideMGinPPW*:   "A UE that supports one of *prs-ProcessingWindowType1*, *prs-ProcessingWindowType1B* or *prs-ProcessingWindowType2* defined in TS 38.331 shall always support *ppw-dl-PRS-BufferType*, *ppw-durationOfPRS-Processing1*, *ppw-durationOfPRS-Processing2*, *ppw-maxNumOfDL-PRS-ResProcessedPerSlot*, and *ppw-maxNumOfDL-BandwidthFR1* or *ppw-maxNumOfDL-BandwidthFR2*” is in conflict with the condition in FG 27-3-3: “A UE that supports FG 27-3-2 must indicate this FG is supported”.  15. Acc. to the latest RAN1 NR features list R1-2210488 (attached in the RAN1 LS R2-2211140), RAN1 updated the description of Component 2 of FG 27-3-2, see below. This requires an update of the capability description for *prs-ProcessingWindowType1A* in LPP.   |  |  |  |  | | --- | --- | --- | --- | | 27. NR\_pos\_enh | 27-3-2 | DL PRS measurement outside MG and in a PRS processing window | 1. Supported PRS processing types subject to the UE determining that DL PRS to be higher priority for PRS measurement outside MG and in a PRS processing window  2. Support of priority handing options of PRS: Option1, Option2 or Option3   * + 1. Option 1: Support of “st1” and “st3” defined in clause 5.1.6.5 of TS 38.214     2. Option 2: Support of “st1”, “st2”, and “st3” defined in clause 5.1.6.5 of TS 38.214     3. Option 3: Support of “st1” only defined in clause 5.1.6.5 of TS 38.214 | | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | 1. It is clarified in the field description for *prs-ProcessingCapabilityOutsideMGinPPW* that the DL-PRS Processing Capability outside MG is provided for each supported PPW Type. 2. The Note "A single value is reported when both Multi-RTT and DL-TDOA are supported." is added to the field description for the *nr-los-nlos-IndicatorSupport* in *NR-DL-TDOA-ProvideCapabilities* and *NR-Multi-RTT-ProvideCapabilities.* 3. The Note "A single value is reported when both Multi-RTT and DL-TDOA are supported." in the field description for *nr-los-nlos-AssistanceDataSupport* in *NR-DL-TDOA-ProvideCapabilities, NR-DL-AoD-ProvideCapabilities,* and *NR-Multi-RTT-ProvideCapabilities* is deleted. 4. In 6.5.11.4, *NR-DL-AoD-SignalMeasurementInformation* field descriptions, add DL-PRS RSRPP measurements to the types of measurements that, exceeding 2, require the *nr-DL-PRS-RxBeamIndex* field to be present. 5. In 6.5.11.4, *NR-DL-AoD-SignalMeasurementInformation*, conditional presence explanations, the fields *nr-DL-PRS-FirstPathRSRP-ResultDiff* and *nr-DL-PRS-RSRP-Result* diff should be appended with -r17 to increase clarity of the conditions. 6. In 6.5.11.4, *NR-DL-AoD-SignalMeasurementInformation*, clarify the field description for *nr-DL-PRS-RxBeamIndex* that it is used for DL-PRS measurements only when additional DL-PRS measurements are also included and all DL-PRS measurements are associated with a single TRP. 7. In 6.5.11.4, *NR-DL-AoD-SignalMeasurementInformation*, add field descriptions for *nr-DL-AoD-AdditionalMeasurements-r16* and clarify that only one of *nr-DL-AoD-AdditionalMeasurements-r16* or *nr-DL-AoD-AdditionalMeasurementsExt-r17* field can be included by the UE in the measurement report. 8. It is clarified in the field description for *nr-SRS-TxTEG-Set* in *NR-Multi-RTT-SignalMeasurementInformation* that the maximum value is 64.   It is clarified in the ASN.1 that the max. applicable value for *maxTxTEG-Sets* is 64.   1. The 'Note 1' in for FG 27-3-3 in R1-2210488 is added to the field description for *prs-ProcessingCapabilityOutsideMGinPPW*:   "Note 1:The (N, T) UE capabilities are interpreted as legacy (N, T) in FG 13-1, and the UE is expected to receive the PRS within the PRS processing window and but the processing of the received PRS may be outside a PRS processing window.  The (N2, T2) UE capabilities are interpreted such that the UE is capable of measuring up to N2 ms PRS within a PPW and is capable of completing the PRS processing within the PPW, e.g., if the time duration from the last symbol of the measured PRS resource(s) inside the PPW, to the end of PPW is not smaller than T2 ms".   1. The 'Note 3' in for FG 27-3-3 in R1-2210488 is added to the field description for *prs-ProcessingCapabilityOutsideMGinPPW*: "Note 3: UE shall support either component 2a or component 2b , but not both for each supported type in a band" 2. The Rel-17 Table Notes 'NOTE' are replaced by 'NOTE 1'. 3. *NR-UL-SRS-Capability*:  * FG 27-15a has been specified as separate capability *posSRS-SP-RRC-Inactive-InInitialUL-BWP-r17*. * In IE *PosSRS-RRC-Inactive-InInitialUL-BWP-r17* the fields *maxNumOfSemiPersistentSRSposResources-r17*, *maxNumOfSemiPersistentSRSposResourcesPerSlot-r17*) have been dummified.  1. *NR-DL-AoD-MeasurementCapability*:  * In ASN.1 the suffices of the Rel-17 fields *maxDL-PRS-RSRP-MeasurementFR1* and *maxDL-PRS-RSRP-MeasurementFR2* have been corrected to “-v1730”. * In the respective field descriptions the confusing condition for the presence of the Rel-17 fields have been removed.  1. Instead of itemizing all fields of 27-3-3, the parent IE is used in the pre-requisite statement. 2. The capability description for *prs-ProcessingWindowType1A* has been updated in accordance with the latest RAN1 NR features list R1-2210488. 3. Misc. editorial corrections   **Impact analysis**  **1.-3.**  **Impacted functionality:**  UE Capability Reporting  **Inter-operability:**  If the network is implemented according to the CR and the UE is not, there are no interoperability problems.  If the UE is implemented according to the CR and the network is not, there are no interoperability problems.  **4.-7. Impacted functionality:**  NR DL-AOD Measurement Reporting  **Inter-operability:**  If the network is implemented according to the CR and the UE is not, an error might occur when the UE neglects to send the *nr-DL-PRS-RxBeamIndex-r17* when sending two or more RSRPP measurements.  If the UE is implemented according to the CR and the network is not, an error might occur if the UE sends an unsolicited *nr-DL-PRS-RxBeamIndex-r17* when sending two or more RSRPP measurements.  **8.**  **Impacted functionality:**  Number of SRS and TEG association reports  **Inter-operability:**  If the network is implemented according to the CR and the UE is not, an error might occur if the UE sends more than 64 SRS-TEG associations.  If the UE is implemented according to the CR and the network is not, there are no interoperability problems.  **9. – 11.**  **Impacted functionality:**  DL PRS Processing Capability outside MG  **Inter-operability:**  If the network is imvplemented according to the CR and UE is not, the network may have a different interpretation for the *ppw-durationOfPRS-Processing1* and *ppw-durationOfPRS-Processing2* than the UE.  If the UE is implemented according to the CR and network is not, the network may have a different interpretation for the *ppw-durationOfPRS-Processing1* and *ppw-durationOfPRS-Processing2* than the UE.  **12.**  **Impacted functionality:**  LPP capability signalling  If the UE is implemented according to this CR while the network is not, the network will not comprehend the capability signalling of *maxNumOfSemiPersistentSRSposResources-r17* and *maxNumOfSemiPersistentSRSposResourcesPerSlot-r17* in *posSRS-SP-RRC-Inactive-InInitialUL-BWP-r17* and will not configure the UE with semi-persistent SRS in initial UL BWP for positioning in RRC\_INACTIVE.  If the network is implemented according to this CR while the UE is not, the network will ignore the capability signalling of *maxNumOfSemiPersistentSRSposResources-r17* and *maxNumOfSemiPersistentSRSposResourcesPerSlot-r17* in *posSRS-RRC-Inactive-InInitialUL-BWP-r17* and will not configure the UE with semi-persistent SRS in initial UL BWP for positioning in RRC\_INACTIVE.  **13.-15.**  **Impacted functionality:**  LPP capability signalling  **Inter-operability:**  There are no interoperability issues. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | 1.-3. The description is not aligned with RAN1 feature list.  4.-7. Specification is ambiguous about the usage of n*r-DL-PRS-RxBeamIndex* and *nr-DL-AoD-AdditionalMeasurements-r16* fields.  Without clarification to the conditional presence definitions, the definitions are in conflict with the -r16 message.  8. Applicable number for *nr-SRS-TxTEG-Set* is unclear/not aligned with RAN1 agreement.  9. The meaning of (N,T) and (N2,T2) remains undefined.   1. A UE may declare cababilities for both, *ppw-durationOfPRS-Processing1* and *ppw-durationOfPRS-Processing2,* which however, would not be according to RAN1 feature list. 2. It remains unclear to which NOTE the Rel-16 NOTE for *durationOfPRS-Processing* refers to. 3. The specification of the FGs 27-15, 27-15a, 27-15b, 27-15c, 27-16a, 27-19a remains misaligned with the RAN1 features list. 4. Inconsistencies in the specification of LPP capabilities remain. 5. Wrong pre-requisite statement remains. 6. The capability description for *prs-ProcessingWindowType1A* remains misaligned with the latest RAN1 NR features list R1-2210488 | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 6.4.3, 6.5.10.6, 6.5.11.4, 6.5.11.6, 6.5.11.6a, 6.5.12.4, 6.5.12.6, 6.6 | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | |  | **x** | Other core specifications | | | | TS/TR ... CR ... | | |
| ***affected:*** | |  | **x** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | |  | | | | | | | | |

### 6.4.3 Common NR Positioning Information Elements

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

The IE *NR-DL-PRS-ProcessingCapability* defines the common DL-PRS Processing capability. In the case of capabilities for multiple NR positioning methods are provided, the IE *NR-DL-PRS-ProcessingCapability* applies across the NR positioning methods and the target device shall indicate the same values for the capabilities in IEs *NR-DL-TDOA-ProvideCapabilities*, *NR-DL-AoD-ProvideCapabilities*, and *NR-Multi-RTT-ProvideCapabilities*.

The *PRS-ProcessingCapabilityPerBand* is defined for a single positioning frequency layer on a certain band (i.e., a target device supporting multiple positioning frequency layers is expected to process one frequency layer at a time).

-- ASN1START

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

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

PRS-ProcessingCapabilityPerBand-r16,

maxSupportedFreqLayers-r16 INTEGER (1..4),

simulLTE-NR-PRS-r16 ENUMERATED { supported } OPTIONAL,

...,

[[

dummy ENUMERATED { m1, m2, ... } OPTIONAL

]]

}

PRS-ProcessingCapabilityPerBand-r16 ::= SEQUENCE {

freqBandIndicatorNR-r16 FreqBandIndicatorNR-r16,

supportedBandwidthPRS-r16 CHOICE {

fr1 ENUMERATED {mhz5, mhz10, mhz20, mhz40,

mhz50, mhz80, mhz100},

fr2 ENUMERATED {mhz50, mhz100, mhz200, mhz400},

...

},

dl-PRS-BufferType-r16 ENUMERATED {type1, type2, ...},

durationOfPRS-Processing-r16 SEQUENCE {

durationOfPRS-ProcessingSymbols-r16 ENUMERATED {nDot125, nDot25, nDot5, n1,

n2, n4, n6, n8, n12, n16, n20, n25,

n30, n32, n35, n40, n45, n50},

durationOfPRS-ProcessingSymbolsInEveryTms-r16

ENUMERATED {n8, n16, n20, n30, n40, n80,

n160,n320, n640, n1280},

...

},

maxNumOfDL-PRS-ResProcessedPerSlot-r16 SEQUENCE {

scs15-r16 ENUMERATED {n1, n2, n4, n8, n16, n24, n32,

n48, n64} OPTIONAL,

scs30-r16 ENUMERATED {n1, n2, n4, n8, n16, n24, n32,

n48, n64} OPTIONAL,

scs60-r16 ENUMERATED {n1, n2, n4, n8, n16, n24, n32,

n48, n64} OPTIONAL,

scs120-r16 ENUMERATED {n1, n2, n4, n8, n16, n24, n32,

n48, n64} OPTIONAL,

...

},

...,

[[

supportedDL-PRS-ProcessingSamples-RRC-CONNECTED-r17 ENUMERATED { supported } OPTIONAL,

prs-ProcessingWindowType1A-r17 ENUMERATED { option1, option2, option3} OPTIONAL,

prs-ProcessingWindowType1B-r17 ENUMERATED { option1, option2, option3} OPTIONAL,

prs-ProcessingWindowType2-r17 ENUMERATED { option1, option2, option3} OPTIONAL,

prs-ProcessingCapabilityOutsideMGinPPW-r17

SEQUENCE (SIZE(1..3)) OF

PRS-ProcessingCapabilityOutsideMGinPPWperType-r17

OPTIONAL,

dl-PRS-BufferType-RRC-Inactive-r17 ENUMERATED { type1, type2, ... } OPTIONAL,

durationOfPRS-Processing-RRC-Inactive-r17 SEQUENCE {

durationOfPRS-ProcessingSymbols-r17 ENUMERATED {nDot125, nDot25, nDot5, n1,

n2, n4, n6, n8, n12, n16, n20, n25,

n30, n32, n35, n40, n45, n50},

durationOfPRS-ProcessingSymbolsInEveryTms-r17

ENUMERATED {n8, n16, n20, n30, n40, n80,

n160,n320, n640, n1280},

...

} OPTIONAL,

maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive-r17 SEQUENCE {

scs15-r17 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64} OPTIONAL,

scs30-r17 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64} OPTIONAL,

scs60-r17 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64} OPTIONAL,

scs120-r17 ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24,

n32, n48, n64} OPTIONAL,

...

} OPTIONAL,

supportedLowerRxBeamSweepingFactor-FR2-r17 ENUMERATED { n1, n2, n4, n6 } OPTIONAL

]],

[[

supportedDL-PRS-ProcessingSamples-RRC-Inactive-r17 ENUMERATED { supported } OPTIONAL

]]

}

PRS-ProcessingCapabilityOutsideMGinPPWperType-r17 ::= SEQUENCE {

prsProcessingType-r17 ENUMERATED { type1A, type1B, type2 },

ppw-dl-PRS-BufferType-r17 ENUMERATED { type1, type2, ... },

ppw-durationOfPRS-Processing1-r17 SEQUENCE {

ppw-durationOfPRS-ProcessingSymbolsN-r17

ENUMERATED { msDot125, msDot25, msDot5, ms1, ms2, ms4,

ms6, ms8, ms12, ms16, ms20, ms25, ms30, ms32, ms35,

ms40, ms45, ms50 },

ppw-durationOfPRS-ProcessingSymbolsT-r17

ENUMERATED { ms1, ms2, ms4, ms8, ms16, ms20, ms30, ms40, ms80,

ms160, ms320, ms640, ms1280 }

} OPTIONAL,

ppw-durationOfPRS-Processing2-r17 SEQUENCE {

ppw-durationOfPRS-ProcessingSymbolsN2-r17

ENUMERATED { msDot125, msDot25, msDot5, ms1, ms2, ms3, ms4, ms5,

ms6, ms8, ms12 },

ppw-durationOfPRS-ProcessingSymbolsT2-r17

ENUMERATED { ms4, ms5, ms6, ms8 }

} OPTIONAL,

ppw-maxNumOfDL-PRS-ResProcessedPerSlot-r17 SEQUENCE {

scs15-r17 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 }

OPTIONAL,

scs30-r17 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 }

OPTIONAL,

scs60-r17 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 }

OPTIONAL,

scs120-r17 ENUMERATED {n1, n2, n4, n6, n8, n12,

n16, n24, n32, n48, n64 }

OPTIONAL,

...

},

...,

[[

ppw-maxNumOfDL-Bandwidth-r17 CHOICE {

fr1 ENUMERATED {mhz5, mhz10, mhz20, mhz40,

mhz50, mhz80, mhz100},

fr2 ENUMERATED {mhz50, mhz100, mhz200, mhz400}

} OPTIONAL

]]

}

-- ASN1STOP

| *NR-DL-PRS-ProcessingCapability* field descriptions |
| --- |
| ***maxSupportedFreqLayers***  Indicates the maximum number of positioning frequency layers supported by UE. |
| ***simulLTE-NR-PRS***  Indicates whether the UE supports parallel processing of LTE PRS and NR PRS. |
| ***dummy***  This field is not used in the specification. If received it shall be ignored by the receiver. |
| ***supportedBandwidthPRS***  Indicates the maximum number of DL-PRS bandwidth in MHz, which is supported and reported by UE. |
| ***dl-PRS-BufferType***  IndicatesDL-PRS buffering capability. Value *type1* indicates sub-slot/symbol level buffering and value *type2* indicates slot level buffering. |
| ***durationOfPRS-Processing***  Indicates the duration *N* of DL-PRS symbols in units of ms a UE can process every T ms assuming maximum DL-PRS bandwidth provided in *supportedBandwidthPRS* and comprises the following subfields:  - ***durationOfPRS-ProcessingSymbols***: This field specifies the values for *N*. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 4, 8, 12, 16, 20, 25, 30, 35, 40, 45, 50 ms.  - ***durationOfPRS-ProcessingSymbolsInEveryTms***: This field specifies the values for *T*. Enumerated values indicate 8, 16, 20, 30, 40, 80, 160, 320, 640, 1280 ms.  See NOTE. |
| ***maxNumOfDL-PRS-ResProcessedPerSlot***  Indicates the maximum number of DL-PRS resources that UE can process in a slot. SCS: 15 kHz, 30 kHz, 60 kHz are applicable for FR1 bands. SCS: 60 kHz, 120 kHz are applicable for FR2 bands. |
| ***supportedDL-PRS-ProcessingSamples-RRC-CONNECTED***  Indicates the UE capability for support of measurements based on measuring M=1 or M=2 (instances) of a DL-PRS Resource Set. The UE can include this field only if the UE supports *prs-ProcessingCapabilityBandList*. Otherwise, the UE does not include this field.  NOTE 1: This feature is supported for both UE-assisted and UE based positioning. |
| ***prs-ProcessingWindowType1A***  Indicates the supported DL-PRS processing types subject to the UE determining that DL-PRS to be higher priority for DL-PRS measurement outside MG and in a DL-PRS Processing Window.  Type 1A refers to the determination of prioritization between DL-PRS and other DL signals/channels in all OFDM symbols within the PRS Processing Window. The DL signals/channels from all DL CCs (per UE) are affected across LTE and NR. Enumerated value indicates supported priority handing options of DL-PRS:  - *option1*: Support of "st1" and "st3" defined in clause 5.1.6.5 of TS 38.214 [45].  - *option2*: Support of "st1", "st2", and "st3" defined in clause 5.1.6.5 of TS 38.214 [45].  - *option3*: Support of “st1” only defined in clause 5.1.6.5 of TS 38.214 [45].  The UE can include this field only if the UE supports *prs-ProcessingCapabilityBandList*. Otherwise, the UE does not include this field.  NOTE 1: Within a PRS processing window, UE measurement is inside the active DL BWP with PRS having the same numerology as the active DL BWP. |
| ***prs-ProcessingWindowType1B***  Indicates the supported DL-PRS processing types subject to the UE determining that DL-PRS to be higher priority for DL-PRS measurement outside MG and in a DL-PRS Processing Window.  Type 1B refers to the determination of prioritization between DL-PRS and other DL signals/channels in all OFDM symbols within the PRS processing window. The DL signals/channels from a certain band are affected. Enumerated value indicates supported priority handing options of DL-PRS (see *prs-ProcessingWindowType1A*).  The UE can include this field only if the UE supports prs-ProcessingCapabilityBandList. Otherwise, the UE does not include this field.  NOTE 1: Within a PRS processing window, UE measurement is inside the active DL BWP with PRS having the same numerology as the active DL BWP. |
| ***prs-ProcessingWindowType2***  Indicates the supported DL-PRS processing types subject to the UE determining that DL-PRS to be higher priority for DL-PRS measurement outside MG and in a DL-PRS Processing Window.  Type 2 refers to the determination of prioritization between DL-PRS and other DL signals/channels only in DL-PRS symbols within the PRS processing window. Enumerated value indicates supported priority handing options of DL-PRS (see *prs-ProcessingWindowType1A*).  The UE can include this field only if the UE supports *prs-ProcessingCapabilityBandList*. Otherwise, the UE does not include this field.  NOTE 1: Within a PRS processing window, UE measurement is inside the active DL BWP with PRS having the same numerology as the active DL BWP. |
| ***prs-ProcessingCapabilityOutsideMGinPPW***  Indicates the DL-PRS Processing Capability outside MG of each of the supported PPW Type in the case the UE supports multiple PPW Types in a band and comprises the following subfields:  - ***prsProcessingType***: Indicates the DL-PRS Processing Window Type for which the *prs-ProcessingCapabilityOutsideMGinPPW* are provided.  - ***ppw-dl-PRS-BufferType***: Indicates DL-PRS buffering capability. Value '*type1'* indicates sub-slot/symbol level buffering and value '*type2'* indicates slot level buffering.  - ***ppw-durationOfPRS-Processing1***: Indicates the duration of DL-PRS symbols N in units of ms a UE can process every T ms assuming maximum DL-PRS bandwidth provided in *ppw-maxNumOfDL-Bandwidth* and comprises the following subfields:  - ***ppw-durationOfPRS-ProcessingSymbolsN***: This field specifies the values for *N*. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50 ms.  - ***ppw-durationOfPRS-ProcessingSymbolsT***: This field specifies the values for *T*. Enumerated values indicate 1, 2, 4, 8, 16, 20, 30, 40, 80, 160, 320, 640, 1280 ms.  - ***ppw-durationOfPRS-Processing2***: Indicates the duration of DL-PRS symbols N2 in units of ms a UE can process inT2 ms assuming maximum DL-PRS bandwidth provided in *ppw-maxNumOfDL-Bandwidth* and comprises the following subfields:  - ***ppw-durationOfPRS-ProcessingSymbolsN2***: This field specifies the values for *N2*. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 3, 4, 5, 6, 8, 12 ms.  - ***ppw-durationOfPRS-ProcessingSymbolsT2***: This field specifies the values for *T2*. Enumerated values indicate 4, 5, 6, 8 ms.  - ***ppw-maxNumOfDL-PRS-ResProcessedPerSlot:*** Indicates the maximum number of DL-PRS resources that UE can process in a slot. SCS: 15 kHz, 30 kHz, 60 kHz are applicable for FR1 bands. SCS: 60 kHz, 120 kHz are applicable for FR2 bands.  - ***ppw-maxNumOfDL-Bandwidth:*** Indicates the maximum number of DL PRS bandwidth in MHz, which is supported and reported by UE for PRS measurement outside MG within the PPW.  The UE can include this field only if the UE supports one of *prs-ProcessingWindowType1A*, *prs-ProcessingWindowType1B* and *prs-ProcessingWindowType2*. Otherwise, the UE does not include this field.  NOTE 1: A UE that supports one of *prs-ProcessingWindowType1A*, *prs-ProcessingWindowType1B* or *prs-ProcessingWindowType2* shall always include the *prs-ProcessingCapabilityOutsideMGinPPW*.  NOTE 2: The (N, T) UE capability in *ppw-durationOfPRS-Processing1* is interpreted as in NOTE, and the UE is expected to receive the DL-PRS within the PRS processing window but the processing of the received DL-PRS may be outside a DL-PRS processing window.  NOTE 3: The (N2, T2) UE capability in *ppw-durationOfPRS-Processing2* is interpreted such that the UE is capable of measuring up to N2 ms DL-PRS within a PPW and is capable of completing the DL-PRS processing within the PPW, e.g., if the time duration from the last symbol of the measured DL-PRS resource(s) inside the PPW to the end of PPW is not smaller than T2 ms.  NOTE 4: A UE which supports *prs-ProcessingCapabilityOutsideMGinPPW* shall support either *ppw-durationOfPRS-Processing1* or *ppw-durationOfPRS-Processing2*, but not both for each supported type in a band. |
| ***dl-PRS-BufferType-RRC-Inactive***  IndicatesDL-PRS buffering capability in RRC\_INACTIVE state. Value '*type1'* indicates sub-slot/symbol level buffering and value '*type2'* indicates slot level buffering. |
| ***durationOfPRS-Processing-RRC-Inactive***  Indicates the duration *N* of DL-PRS symbols in units of ms a UE can process every *T* ms in RRC\_INACTIVE state assuming maximum DL-PRS bandwidth provided in *supportedBandwidthPRS* and comprises the following subfields:  - ***durationOfPRS-ProcessingSymbols***: This field specifies the values for *N*. Enumerated values indicate 0.125, 0.25, 0.5, 1, 2, 4, 6, 8, 12, 16, 20, 25, 30, 32, 35, 40, 45, 50 ms.  - ***durationOfPRS-ProcessingSymbolsInEveryTms***: This field specifies the values for *T*. Enumerated values indicate 8, 16, 20, 30, 40, 80, 160, 320, 640, 1280 ms.  See NOTE. |
| ***maxNumOfDL-PRS-ResProcessedPerSlot-RRC-Inactive***  Indicates the maximum number of DL-PRS resources a UE can process in a slot in RRC\_INACTIVE state. SCS: 15 kHz, 30 kHz, 60 kHz are applicable for FR1 bands. SCS: 60 kHz, 120 kHz are applicable for FR2 bands. |
| ***supportedLowerRxBeamSweepingFactor-FR2***  Indicates support of the lower Rx beam sweeping factor than 8 for FR2. Enumerated value indicates the number of Rx beam sweeping factors supported. |
| ***supportedDL-PRS-ProcessingSamples-RRC-Inactive***  Indicates the UE capability for support of measurements based on measuring M=1 or M=2 samples (instances) of a DL-PRS Resource Set in RRC\_INACTIVE state. The UE can include this field only if the UE supports *prs-ProcessingRRC-Inactive* defined in TS 38.331 [35]. Otherwise, the UE does not include this field. |

NOTE: When the target device provides the *durationOfPRS-Processing* capability (*N*, *T*) for any time window defined in TS 38. 214 [45] clause 5.1.6.5, the target device should be capable of processing all DL-PRS resources within , if

- where K is defined in the TS 38.214 [45] clause 5.1.6.5, and

- the number of DL-PRS Resources in each slot does not exceed the *maxNumOfDL-PRS-ResProcessedPerSlot*, and

- the configured measurement gap and a maximum ratio of measurement gap length (MGL) / measurement gap repetition period (MGRP) is as specified in TS 38.133 [46].

*– 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-r16)) OF

SRS-CapabilityPerBand-r16,

srs-PosResourceConfigCA-BandList-r16 SEQUENCE (SIZE (1..nrMaxConfiguredBands-r16)) OF

SRS-PosResourcesPerBand-r16 OPTIONAL,

maxNumberSRS-PosPathLossEstimateAllServingCells-r16

ENUMERATED {n1, n4, n8, n16} OPTIONAL,

maxNumberSRS-PosSpatialRelationsAllServingCells-r16

ENUMERATED {n0, n1, n2, n4, n8, n16} OPTIONAL,

...

}

SRS-CapabilityPerBand-r16 ::= SEQUENCE {

freqBandIndicatorNR-r16 FreqBandIndicatorNR-r16,

olpc-SRS-Pos-r16 OLPC-SRS-Pos-r16 OPTIONAL,

spatialRelationsSRS-Pos-r16 SpatialRelationsSRS-Pos-r16 OPTIONAL,

...,

[[

posSRS-RRC-Inactive-InInitialUL-BWP-r17 PosSRS-RRC-Inactive-InInitialUL-BWP-r17 OPTIONAL,

posSRS-RRC-Inactive-OutsideInitialUL-BWP-r17

PosSRS-RRC-Inactive-OutsideInitialUL-BWP-r17

OPTIONAL,

olpc-SRS-PosRRC-Inactive-r17 OLPC-SRS-Pos-r16 OPTIONAL,

spatialRelationsSRS-PosRRC-Inactive-r17 SpatialRelationsSRS-Pos-r16 OPTIONAL

]],

[[

posSRS-SP-RRC-Inactive-InInitialUL-BWP-r17 PosSRS-SP-RRC-Inactive-InInitialUL-BWP-r17

OPTIONAL

]]

}

OLPC-SRS-Pos-r16 ::= SEQUENCE {

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

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

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

maxNumberPathLossEstimatePerServing-r16 ENUMERATED {n1, n4, n8, n16} OPTIONAL,

...

}

SpatialRelationsSRS-Pos-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,

...

}

SRS-PosResourcesPerBand-r16 ::= SEQUENCE {

freqBandIndicatorNR-r16 FreqBandIndicatorNR-r16,

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

maxNumberSRS-PosResourcesPerBWP-r16 ENUMERATED {n1, n2, n4, n8, n16, n32, n64},

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

maxNumberAP-SRS-PosResourcesPerBWP-r16 ENUMERATED {n1, n2, n4, n8, n16, n32, n64}

OPTIONAL,

maxNumberSP-SRS-PosResourcesPerBWP-r16 ENUMERATED {n1, n2, n4, n8, n16, n32, n64}

OPTIONAL,

...

}

PosSRS-RRC-Inactive-InInitialUL-BWP-r17 ::= SEQUENCE {

maxNumOfSRSposResourceSets-r17 ENUMERATED {n1, n2, n4, n8, n12, n16 } OPTIONAL,

maxNumOfPeriodicAndSemiPersistentSRSposResources-r17

ENUMERATED {n1, n2, n4, n8, n16, n32, n64 }

OPTIONAL,

maxNumOfPeriodicAndSemiPersistentSRSposResourcesPerSlot-r17

ENUMERATED {n1, n2, n3, n4, n5, n6, n8, n10, n12, n14}

OPTIONAL,

maxNumOfPeriodicSRSposResources-r17

ENUMERATED {n1, n2, n4, n8, n16, n32, n64 }

OPTIONAL,

maxNumOfPeriodicSRSposResourcesPerSlot-r17

ENUMERATED {n1, n2, n3, n4, n5, n6, n8, n10, n12, n14}

OPTIONAL,

dummy1 ENUMERATED {n1, n2, n4, n8, n16, n32, n64} OPTIONAL,

dummy2 ENUMERATED { n1, n2, n3, n4, n5, n6, n8, n10, n12, n14 }

OPTIONAL,

...

}

PosSRS-RRC-Inactive-OutsideInitialUL-BWP-r17 ::= SEQUENCE {

maxSRSposBandwidthForEachSCS-withinCC-FR1-r17

ENUMERATED { bw5, bw10, bw15, bw20, bw25, bw30, bw35,

bw40, bw45, bw50, bw60, bw70, bw80,

bw90, bw100 } OPTIONAL,

maxSRSposBandwidthForEachSCS-withinCC-FR2-r17

ENUMERATED { bw50, bw100, bw200, bw400 } OPTIONAL,

maxNumOfSRSposResourceSets-r17 ENUMERATED { n1, n2, n4, n8, n12, n16 } OPTIONAL,

maxNumOfPeriodicSRSposResources-r17 ENUMERATED { n1, n2, n4, n8, n16, n32, n64 }

OPTIONAL,

maxNumOfPeriodicSRSposResourcesPerSlot-r17

ENUMERATED { n1, n2, n3, n4, n5, n6, n8, n10, n12, n14 }

OPTIONAL,

differentNumerologyBetweenSRSposAndInitialBWP-r17

ENUMERATED { supported } OPTIONAL,

srsPosWithoutRestrictionOnBWP-r17

ENUMERATED { supported } OPTIONAL,

maxNumOfPeriodicAndSemiPersistentSRSposResources-r17

ENUMERATED {n1, n2, n4, n8, n16, n32, n64} OPTIONAL,

maxNumOfPeriodicAndSemiPersistentSRSposResourcesPerSlot-r17

ENUMERATED { n1, n2, n3, n4, n5, n6, n8, n10,

n12, n14 } OPTIONAL,

differentCenterFreqBetweenSRSposAndInitialBWP-r17

ENUMERATED { supported } OPTIONAL,

maxNumOfSemiPersistentSRSposResources-r17

ENUMERATED { n1, n2, n4, n8, n16, n32, n64 }

OPTIONAL,

maxNumOfSemiPersistentSRSposResourcesPerSlot-r17

ENUMERATED { n1, n2, n3, n4, n5, n6, n8, n10,

n12, n14 } OPTIONAL,

switchingTimeSRS-TX-OtherTX-r17 ENUMERATED { us100, us140, us200, us300, us500 }

OPTIONAL,

...

}

PosSRS-SP-RRC-Inactive-InInitialUL-BWP-r17 ::= SEQUENCE {

maxNumOfSemiPersistentSRSposResources-r17

ENUMERATED {n1, n2, n4, n8, n16, n32, n64} OPTIONAL,

maxNumOfSemiPersistentSRSposResourcesPerSlot-r17

ENUMERATED {n1, n2, n3, n4, n5, n6, n8, n10, n12, n14}

OPTIONAL,

...

}

-- ASN1STOP

|  |
| --- |
| ***NR-UL-SRS-Capability* field descriptions** |
| ***srs-PosResourceConfigCA-BandList***  This field indicates the number of SRS for positioning resources supported by the target device. The target device includes this field for each band for the current configured CA band combination. The capability signalling comprises the following parameters:  - ***freqBandIndicatorNR***indicates the current configured NR band of the target device.  - ***maxNumberSRS-PosResourceSetsPerBWP***indicates the maximum number of SRS Resource Sets for positioning supported by the target device per BWP. Enumerated values *n1*, *n2*, *n4*, *n8*, *n12*, *n16* correspond to 1, 2, 4, 8, 12, 16 SRS Resource Sets for positioning, respectively.  - ***maxNumberSRS-PosResourcesPerBWP***indicates the maximum number of periodic, semi-persistent, and aperiodic SRS Resources for positioning supported by the target device per BWP. Enumerated values *n1, n2, n4, n8, n16, n32, n64* correspond to 1, 2, 4, 8, 16, 32, 64 SRS Resources for positioning, respectively.  - ***maxNumberPeriodicSRS-PosResourcesPerBWP***indicates the maximum number of periodic SRS Resources for positioning supported by the target device per BWP. Enumerated values *n1, n2, n4, n8, n16, n32, n64* correspond to 1, 2, 4, 8, 16, 32, 64 periodic SRS Resources for positioning, respectively.  - ***maxNumberAP-SRS-PosResourcesPerBWP***indicates the maximum number of aperiodic SRS Resources for positioning supported by the target device per BWP. Enumerated values *n1, n2, n4, n8, n16, n32, n64* correspond to 1, 2, 4, 8, 16, 32, 64 aperiodic SRS Resources for positioning, respectively.  - ***maxNumberSP-SRS-PosResourcesPerBWP***indicates the maximum number of semi-persistent SRS Resources for positioning supported by the target device per BWP. Enumerated values *n1, n2, n4, n8, n16, n32, n64* correspond to 1, 2, 4, 8, 16, 32, 64 semi-persistent SRS Resources for positioning, respectively. |
| ***maxNumberSRS-PosPathLossEstimateAllServingCells***  Indicates the maximum number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning across all cells in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions. The UE shall include this field if the UE supports any of *olpc-SRS-PosBasedOnPRS-Serving, olpc-SRS-PosBasedOnSSB-Neigh* and *olpc-SRS-PosBasedOnPRS-Neigh.* Otherwise, the UE does not include this field. |
| ***maxNumberSRS-PosSpatialRelationsAllServingCells***  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. It is only applied for FR2. The UE can include this field only if the UE supports any of *spatialRelation-SRS-PosBasedOnSSB-Serving*, *spatialRelation-SRS-PosBasedOnCSI-RS-Serving*, *spatialRelation-SRS-PosBasedOnPRS-Serving*, *spatialRelation-SRS-PosBasedOnSSB-Neigh* or *spatialRelation-SRS-PosBasedOnPRS-Neigh*. Otherwise, the UE does not include this field. |
| ***olpc-SRS-Pos***  Indicates whether the UE supports open-loop power control for SRS for positioning. The capability signalling comprises the following parameters:  - ***olpc-SRS-PosBasedOnPRS-Serving***indicates whether the UE supports OLPC for SRS for positioning based on PRS from the serving cell in the same band. The UE can include this field only if the UE supports NR-DL-*PRS-ProcessingCapability* and *srs-PosResources* TS38.331 [35] Otherwise, the UE does not include this field.  - ***olpc-SRS-PosBasedOnSSB-Neigh***indicates whether the UE supports OLPC for SRS for positioning based on SSB from the neighbouring cell in the same band. The UE can include this field only if the UE supports *srs-PosResources* TS 38.331 [35]. Otherwise, the UE does not include this field.  - ***olpc-SRS-PosBasedOnPRS-Neigh***indicates whether the UE supports OLPC for SRS for positioning based on PRS from the neighbouring cell in the same band. The UE can include this field only if the UE supports *olpc-SRS-PosBasedOnPRS-Serving*. Otherwise, the UE does not include this field.  Note: A PRS from a PRS-only TP is treated as PRS from a non-serving cell.  - ***maxNumberPathLossEstimatePerServing***indicates the maximum number of pathloss estimates that the UE can simultaneously maintain for all the SRS resource sets for positioning per serving cell in addition to the up to four pathloss estimates that the UE maintains per serving cell for the PUSCH/PUCCH/SRS transmissions. The UE shall include this field if the UE supports any of *olpc-SRS-PosBasedOnPRS-Serving, olpc-SRS-PosBasedOnSSB-Neigh* and *olpc-SRS-PosBasedOnPRS-Neigh.* Otherwise, the UE does not include this field. |
| ***spatialRelationsSRS-Pos***  Indicates whether the UE supports spatial relations for SRS for positioning. It is only applicable for FR2. The capability signalling comprises the following parameters:  - ***spatialRelation-SRS-PosBasedOnSSB-Serving*** indicates whether the UE supports spatial relation for SRS for positioning based on SSB from the serving cell in the same band. The UE can include this field only if the UE supports *srs-PosResources* TS 38.331 [35]. Otherwise, the UE does not include this field.  - ***spatialRelation-SRS-PosBasedOnCSI-RS-Serving*** indicates whether the UE supports spatial relation for SRS for positioning based on CSI-RS from the serving cell in the same band. The UE can include this field only if the UE supports *spatialRelation-SRS-PosBasedOnSSB-Serving*. Otherwise, the UE does not include this field.  - ***spatialRelation-SRS-PosBasedOnPRS-Serving***indicates whether the UE supports spatial relation for SRS for positioning based on PRS from the serving cell in the same band. The UE can include this field only if the UE supports any of DL-PRS Resources for DL-AoD, DL-PRS Resources for DL-TDOA or DL-PRS Resources for Multi-RTT, or *srs-PosResources* TS 38.331 [35]. Otherwise, the UE does not include this field.  - ***spatialRelation-SRS-PosBasedOnSRS***indicates whether the UE supports spatial relation for SRS for positioning based on SRS in the same band. The UE can include this field only if the UE supports *srs-PosResources* TS 38.331 [35]. Otherwise, the UE does not include this field.  - ***spatialRelation-SRS-PosBasedOnSSB-Neig****h* indicates whether the UE supports spatial relation for SRS for positioning based on SSB from the neighbouring cell in the same band. The UE can include this field only if the UE supports *spatialRelation-SRS-PosBasedOnSSB-Serving*. Otherwise, the UE does not include this field.  - ***spatialRelation-SRS-PosBasedOnPRS-Neigh***indicates whether the UE supports spatial relation for SRS for positioning based on PRS from the neighbouring cell in the same band. The UE can include this field only if the UE supports *spatialRelation-SRS-PosBasedOnPRS-Serving*. Otherwise, the UE does not include this field.  Note: A PRS from a PRS-only TP is treated as PRS from a non-serving cell. |
| ***posSRS-RRC-Inactive-InInitialUL-BWP***  Indicates whether the UE supports positioning SRS transmission in RRC\_INACTIVE state for initial UL BWP. The capability signalling comprises the following parameters:  - ***maxNumOfSRSposResourceSets*** indicates the maximum number of SRS Resource Sets for positioning supported by the UE.  - ***maxNumOfPeriodicAndSemiPersistentSRSposResources*** indicates the maximum number of periodic and semi-persistent SRS Resources for positioning supported by the UE.  - ***maxNumOfPeriodicAndSemiPersistentSRSposResourcesPerSlot***indicates the maximum number of periodic and semi-persistent SRS Resources for positioning per slot supported by the UE.  - ***maxNumOfPeriodicSRSposResources***indicates the maximum number of periodic SRS Resources for positioning supported by the UE.  - ***maxNumOfPeriodicSRSposResourcesPerSlot***indicates the maximum number of periodic SRS Resources for positioning per slot supported by the UE.  - ***dummy1, dummy2***are not used in the specification. If received they shall be ignored by the receiver. |
| ***posSRS-RRC-Inactive-OutsideInitialUL-BWP***  Indicates whether the UE supports positioning SRS transmission in RRC\_INACTIVE state outside initial UL BWP. The UE can include this field only if the UE supports *posSRS-RRC-Inactive-InInitialUL-BWP*. Otherwise, the UE does not include this field. The capability signalling comprises the following parameters:  - ***maxSRSposBandwidthForEachSCS-withinCC-FR1*** indicates the maximum SRS bandwidth supported for each SCS that UE supports within a single CC for FR1.  - ***maxSRSposBandwidthForEachSCS-withinCC-FR2*** indicates the maximum SRS bandwidth supported for each SCS that UE supports within a single CC for FR2.  - ***maxNumOfSRSposResourceSets*** indicates the maximum number of SRS Resource Sets for positioning supported by the UE.  - ***maxNumOfPeriodicSRSposResources***indicates the maximum number of periodic SRS Resources for positioning supported by the UE.  - ***maxNumOfPeriodicSRSposResourcesPerSlot***indicates the maximum number of periodic SRS Resources for positioning per slot supported by the UE.  - ***differentNumerologyBetweenSRSposAndInitialBWP***indicates whether different numerology between the SRS and the initial UL BWP is supported by the UE. If the field is absent, the UE only supports same numerology between the SRS and the initial UL BWP.  - ***srsPosWithoutRestrictionOnBWP*** indicates whether SRS operation without restriction on the BW is supported by the UE; BW of the SRS may not include BW of the CORESET#0 and SSB. If the field is absent, the UE supports only SRS BW that includes the BW of the CORESET #0 and SSB.  - ***maxNumOfPeriodicAndSemiPersistentSRSposResources*** indicates the maximum number of periodic and semi-persistent SRS Resources for positioning supported by the UE.  - ***maxNumOfPeriodicAndSemiPersistentSRSposResourcesPerSlot*** indicates the maximum number of periodic and semi-persistent SRS Resources for positioning per slot supported by the UE.  - ***differentCenterFreqBetweenSRSposAndInitialBWP*** indicates whether different center frequency between the SRS for positioning and the initial UL BWP is supported by the UE. If the field is absent, the UE only supports same center frequency between the SRS for positioning and initial UL BWP.  - ***maxNumOfSemiPersistentSRSposResources***indicates the maximum number of semi-persistent SRS Resources for positioning supported by the UE. The UE can include this field only if the UE supports *posSRS-RRC-Inactive-InInitialUL-BWP*. Otherwise, the UE does not include this field.  - ***maxNumOfSemiPersistentSRSposResourcesPerSlot***indicates the maximum number of semi-persistent SRS Resources for positioning per slot supported by the UE. The UE can include this field only if the UE supports *posSRS-RRC-Inactive-InInitialUL-BWP*. Otherwise, the UE does not include this field.  - ***switchingTimeSRS-TX-OtherTX*** indicates the switching time between SRS Tx and other Tx in initial UL BWP or Rx in initial DL BWP. |
| ***olpc-SRS-PosRRC-Inactive***  Indicates whether the UE supports open-loop power control for SRS for positioning in RRC\_INACTIVE state. The UE can include this field only if the UE supports *posSRS-RRC-Inactive-InInitialUL-BWP*. Otherwise, the UE does not include this field. |
| ***spatialRelationsSRS-PosRRC-Inactive***  Indicates whether the UE supports spatial relations for SRS for positioning in RRC\_INACTIVE state on FR2. The UE can include this field only if the UE supports *posSRS-RRC-Inactive-InInitialUL-BWP*. Otherwise, the UE does not include this field. |
| ***posSRS-SP-RRC-Inactive-InInitialUL-BWP***  Indicates whether the UE supports positioning SRS transmission in RRC\_INACTIVE state for initial UL BWP with semi-persistent SRS. The UE can include this field only if the UE supports *posSRS-RRC-Inactive-InInitialUL-BWP*. Otherwise, the UE does not include this field. The capability signalling comprises the following parameters:  - ***maxNumOfSemiPersistentSRSposResources***indicates the maximum number of semi-persistent SRS Resources for positioning supported by the UE.  - ***maxNumOfSemiPersistentSRSposResourcesPerSlot***indicates the maximum number of semi-persistent SRS Resources for positioning per slot supported by the UE. |

#### 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-PRS-ResourcesCapability-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 PositioningModes OPTIONAL,

...,

[[

ten-ms-unit-ResponseTime-r17 PositioningModes OPTIONAL,

nr-PosCalcAssistanceSupport-r17 BIT STRING { trpLocSup (0),

beamInfoSup (1),

rtdInfoSup (2),

trpTEG-InfoSup (3)

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

nr-los-nlos-AssistanceDataSupport-r17 SEQUENCE {

type-r17 LOS-NLOS-IndicatorType2-r17,

granularity-r17 LOS-NLOS-IndicatorGranularity2-r17,

...

} OPTIONAL,

nr-DL-PRS-ExpectedAoD-or-AoA-Sup-r17 BIT STRING { eAoD (0),

eAoA (1)

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

nr-DL-TDOA-On-Demand-DL-PRS-Support-r17 NR-On-Demand-DL-PRS-Support-r17 OPTIONAL,

nr-los-nlos-IndicatorSupport-r17 SEQUENCE {

type-r17 LOS-NLOS-IndicatorType2-r17,

granularity-r17 LOS-NLOS-IndicatorGranularity2-r17,

...

} OPTIONAL,

additionalPathsExtSupport-r17 ENUMERATED { n4, n6, n8 } OPTIONAL,

scheduledLocationRequestSupported-r17 ScheduledLocationTimeSupportPerMode-r17 OPTIONAL,

nr-dl-prs-AssistanceDataValidity-r17 SEQUENCE {

area-validity-r17 INTEGER (1..maxNrOfAreas-r17) OPTIONAL, ...

} OPTIONAL,

multiMeasInSameMeasReport-r17 ENUMERATED { supported } OPTIONAL,

mg-ActivationRequest-r17 ENUMERATED { supported } OPTIONAL

]]

}

-- ASN1STOP

|  |
| --- |
| *NR-DL-TDOA-ProvideCapabilities* field descriptions |
| ***nr-DL-TDOA-Mode***  This field specifies the NR DL-TDOA mode(s) supported by the target device. |
| ***periodicalReporting***  This field, if present, specifies the positioning modes for which the target device supports *periodicalReporting.* This is represented by a bit string, with a one‑value at the bit position means *periodicalReporting* for the positioning mode is supported; a zero‑value means not supported. If this field is absent, the target device does not support *periodicalReporting* in *CommonIEsRequestLocationInformation*. |
| ***ten-ms-unit-ResponseTime***  This field, if present, specifies the positioning modes for which the target device supports the enumerated value '*ten-milli-seconds*' in the IE *ResponseTime* in IE *CommonIEsRequestLocationInformation*. This is represented by a bit string, with a one‑value at the bit position means '*ten-milli-seconds'* response time unit for the positioning mode is supported; a zero‑value means not supported. If this field is absent, the target device does not support '*ten-milli-seconds'* response time unitin *CommonIEsRequestLocationInformation*. |
| ***nr-PosCalcAssistanceSupport***  This field indicates the Position Calculation Assistance Data supported by the target device for UE-based DL-TDOA. This is represented by a bit string, with a one‑value at the bit position means the particular assistance data is supported; a zero‑value means not supported.  - bit 0 indicates whether the field *nr-TRP-LocationInfo* in IE *NR-PositionCalculationAssistance* is supported or not;  - bit 1 indicates whether the field *nr-DL-PRS-BeamInfo* in IE *NR-PositionCalculationAssistance* is supported or not;  - bit 2 indicates whether the field *nr-RTD-Info* in IE *NR-PositionCalculationAssistance* is supported or not;  - bit 3 indicates whether the field *nr-DL-PRS-TRP-TEG-Info* in IE *NR-PositionCalculationAssistance* is supported or not. The UE can indicate this bit only if the UE supports *prs-ProcessingCapabilityBandList* and any of *maxNrOfDL-PRS-ResourceSetPerTrpPerFrequencyLayer*, *maxNrOfTRP-AcrossFreqs*, *maxNrOfPosLayer*, *maxNrOfDL-PRS-ResourcesPerResourceSet* and *maxNrOfDL-PRS-ResourcesPerPositioningFrequencylayer*. Otherwise, the UE does not include this field. |
| ***nr-los-nlos-AssistanceDataSupport***  This field, if present, indicates that the target device supports the *NR-DL-PRS-ExpectedLOS-NLOS-Assistance* in IE *NR-PositionCalculationAssistance*:  - *type* indicates whether the target device supports '*hard*' value or '*hard*' and '*soft*' value in *LOS-NLOS-Indicator* in IE *NR-DL-PRS-ExpectedLOS-NLOS-Assistance*.  - *granularity* indicates whether the target device supports *nr-los-nlos-indicator* in IE *NR-DL-PRS-ExpectedLOS-NLOS-Assistance* '*per-trp*', '*per-resource*', or both.  The UE can include this field only if the UE supports one of *maxDL-PRS-RSRP-MeasurementFR1*, *maxDL-PRS-RSRP-MeasurementFR2*, *dl-RSTD-MeasurementPerPairOfTRP-FR1*, *dl-RSTD-MeasurementPerPairOfTRP-FR*2, *maxNrOfRx-TX-MeasFR1*, *maxNrOfRx-TX-MeasFR2*, *supportOfRSRP-MeasFR1* and *supportOfRSRP-MeasFR2*. Otherwise, the UE does not include this field. |
| ***nr-DL-PRS-ExpectedAoD-or-AoA-Sup***  This field, if present, indicates that the target device supports the *NR-DL-PRS-ExpectedAoD-or-AoA* in *NR-DL-PRS-AssistanceData.* |
| ***nr-DL-TDOA-On-Demand-DL-PRS-Support***  This field, if present, indicates that the target device supports on-demand DL-PRS requests. |
| ***nr-los-nlos-IndicatorSupport***  This field, if present, indicates that the target device supports *nr-los-nlos-Indicator* reporting in IE *NR-DL-TDOA-SignalMeasurementInformation*.  - *type* indicates whether the target device supports '*hard*' value or '*hard*' and '*soft*' value in IE *LOS-NLOS-Indicator.*  - *granularity* indicates whether the target device supports *LOS-NLOS-Indicator* reporting per TRP, per DL-PRS Resource, or both.  NOTE: A single value is reported when both Multi-RTT and DL-TDOA are supported. |
| ***additionalPathsExtSupport***  This field, if present, indicates that the target device supports the *nr-AdditionalPathListExt* reporting in IE *NR-DL-TDOA-SignalMeasurementInformation*. The enumerated value indicates the number of additional paths supported by the target device.  NOTE: The *supportOfDL-PRS-FirstPathRSRP* in IE *NR-DL-TDOA-MeasurementCapability* also applies to the additional paths. |
| ***scheduledLocationRequestSupported***  This field, if present, specifies the positioning modes for which the target device supports scheduled location requests – i.e., supports the IE *ScheduledLocationTime* in IE *CommonIEsRequestLocationInformation* – and the time base(s) supported for the scheduled location time for each positioning mode. If this field is absent, the target device does not support scheduled location requests. |
| ***nr-dl-prs-AssistanceDataValidity***  This field, if present, indicates that the target device supports validity conditions for pre-configured assistance data and comprises the following subfields:  - ***area-validity*** indicates that the target device supports pre-configured assistance data with area validity. The integer number indicates the maximum number of areas the target device supports*.* |
| ***multiMeasInSameMeasReport***  This field, if present, indicates that the target device supports multiple measurement instances in a single measurement report. |
| ***mg-ActivationRequest***  This field, if present, indicates that the target device supports low latency measurement gap activation request for DL-PRS measurements. The UE can include this field only if the UE supports *mg-ActivationRequestPRS-Meas* and *mg-ActivationCommPRS-Meas* defined in TS 38.331 [35]. |

#### 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.

-- ASN1START

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

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

...

}

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

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

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

nr-PhysCellID-r16 NR-PhysCellID-r16 OPTIONAL,

nr-CellGlobalID-r16 NCGI-r15 OPTIONAL,

nr-ARFCN-r16 ARFCN-ValueNR-r15 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-DL-PRS-RSRP-Result-r16 INTEGER (0..126),

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

nr-DL-AoD-AdditionalMeasurements-r16

NR-DL-AoD-AdditionalMeasurements-r16 OPTIONAL,

...,

[[

nr-DL-PRS-FirstPathRSRP-Result-r17

INTEGER (0..126) OPTIONAL,

nr-los-nlos-Indicator-r17 CHOICE {

perTRP-r17 LOS-NLOS-Indicator-r17,

perResource-r17 LOS-NLOS-Indicator-r17

} OPTIONAL,

nr-DL-AoD-AdditionalMeasurementsExt-r17

NR-DL-AoD-AdditionalMeasurementsExt-r17 OPTIONAL

]]

}

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

NR-DL-AoD-AdditionalMeasurementElement-r16

NR-DL-AoD-AdditionalMeasurementsExt-r17 ::= SEQUENCE (SIZE (1..maxAddMeasAoD-r17)) OF

NR-DL-AoD-AdditionalMeasurementElement-r17

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

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

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

nr-DL-PRS-RSRP-ResultDiff-r16 INTEGER (0..30),

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

...

}

NR-DL-AoD-AdditionalMeasurementElement-r17 ::= SEQUENCE {

nr-DL-PRS-ResourceID-r17 NR-DL-PRS-ResourceID-r16 OPTIONAL,

nr-DL-PRS-ResourceSetID-r17 NR-DL-PRS-ResourceSetID-r16 OPTIONAL,

nr-TimeStamp-r17 NR-TimeStamp-r16,

nr-DL-PRS-RSRP-ResultDiff-r17 INTEGER (0..30) OPTIONAL, -- Cond rsrp

nr-DL-PRS-RxBeamIndex-r17 INTEGER (1..8) OPTIONAL,

nr-DL-PRS-FirstPathRSRP-ResultDiff-r17 INTEGER (0..61) OPTIONAL, -- Cond rsrpp

nr-los-nlos-IndicatorPerResource-r17 LOS-NLOS-Indicator-r17 OPTIONAL,

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *rsrp* | The field is mandatory present if the field *nr-DL-PRS-FirstPathRSRP-ResultDiff-r17* is absent; otherwise it is optionally present, need ON. |
| *rsrpp* | The field is mandatory present if the field *nr-DL-PRS-RSRP-ResultDiff-r17* is absent; otherwise it is optionally present, need ON. |

|  |
| --- |
| *NR-DL-AoD-SignalMeasurementInformation* field descriptions |
| ***dl-PRS-ID***  This field is used along with a DL-PRS Resource Set ID and a DL-PRS Resource 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 should only be associated with one such ID. |
| ***nr-PhysCellID***  This field specifies the physical cell identity of the associated TRP, as defined in TS 38.331 [35]. |
| ***nr-CellGlobalID***  This field specifies the NCGI, the globally unique identity of a cell in NR, of the associated TRP, as defined in TS 38.331 [35]. |
| ***nr-ARFCN***  This field specifies the NR-ARFCN of the TRP's CD-SSB (as defined in TS 38.300 [47]) corresponding to *nr-PhysCellID*. |
| ***nr-TimeStamp***  This field specifies the time instance at which the measurement is performed. |
| ***nr-DL-PRS-RSRP-Result***  This field specifies the NR DL-PRS reference signal received power (DL-PRS RSRP) measurement, as defined in TS 38.215 [36]. The mapping of the measured quantity is defined as in TS 38.133 [46]. |
| ***nr-DL-PRS-RxBeamIndex***  This field provides an index of the target device receive beam used for DL-PRS measurements associated with a single TRP in *nr-DL-AoD-MeasList-r16* when additional DL-PRS measurements are also included in either *nr-DL-AoD-AdditionalMeasurements-r16* or *nr-DL-AoD-AdditionalMeasurementsExt-r17*. If the value of the receive beam index for two or more DL-PRS measurements is the same, it indicates that the target device receive beam for the two or more DL-PRS measurements associated with a TRP were made with the same RX beam. The field is mandatory present if at least two DL-PRS RSRP measurements and/or DL-PRS RSRPP measurements from the same DL-PRS Resource Set associated with a TRP have been made with the same RX beam by the target device; otherwise it is not present. |
| ***nr-DL-AoD-AdditionalMeasurements***  This field specifies a list of additional DL-PRS RSRP measurements of different DL-PRS resources for the same TRP. If this field is present, the field *nr-DL-AoD-AdditionalMeasurementsExt* should not be present. |
| ***nr-DL-PRS-FirstPathRSRP-Result***  This field specifies the NR DL-PRS reference signal received path power (DL-PRS RSRPP) of the first detected path in time, as defined in TS 38.215 [36]. The mapping of the measured quantity is defined as in TS 38.133 [46]. |
| ***nr-los-nlos-Indicator***  This field specifies the target device's best estimate of the LOS or NLOS of the RSRP or RSRPP of first path measurement for the TRP or resource.  NOTE: If the requested type or granularity in *nr-los-nlos-IndicatorRequest* is not possible, the target device may provide a different type and granularity for the estimated *LOS-NLOS-Indicator.* |
| ***nr-DL-AoD-AdditionalMeasurementsExt***  This field specifies a list of additional DL-PRS RSRP and/or DL-PRS RSRPP measurements of different DL-PRS resources for the same TRP. If this field is present, the field *nr-DL-AoD-AdditionalMeasurements* should not be present. |
| ***nr-DL-PRS-RSRP-ResultDiff***  This field provides the additional DL-PRS RSRP measurement result relative to *nr-DL-PRS-RSRP-Result*. The DL-PRS RSRP value of this measurement is obtained by adding the value of this field to the value of the *nr-DL-PRS-RSRP-Result* field. The mapping of the field is defined in TS 38.133 [46]. |
| ***nr-DL-PRS-FirstPathRSRP-ResultDiff***  This field specifies the additional NR DL-PRS reference signal received path power (DL-PRS RSRPP) of the first detected path in time relative to *nr-DL-PRS-FirstPathRSRP-Result*. The DL-PRS RSRPP of first path value of this measurement is obtained by adding the value of this field to the value of the *nr-DL-PRS-FirstPathRSRP-Result* field. The mapping of the field is defined in TS 38.133 [46]. |
| ***nr-los-nlos-IndicatorPerResource***  This field specifies the target device's best estimate of the LOS or NLOS of the RSRP or RSRPP of first path measurement for the resource.  This field may only be present if the field *nr-LOS-NLOS-Indicator* choice indicates *perResource*. |

#### 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-AoD-Mode-r16 PositioningModes,

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

periodicalReporting-r16 PositioningModes OPTIONAL,

...,

[[

ten-ms-unit-ResponseTime-r17 PositioningModes OPTIONAL,

nr-PosCalcAssistanceSupport-r17 BIT STRING { trpLocSup (0),

beamInfoSup (1),

rtdInfoSup (2),

beamAntInfoSup (3)

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

nr-los-nlos-AssistanceDataSupport-r17 SEQUENCE {

type-r17 LOS-NLOS-IndicatorType2-r17,

granularity-r17 LOS-NLOS-IndicatorGranularity2-r17,

...

} OPTIONAL,

nr-DL-PRS-ExpectedAoD-or-AoA-Sup-r17 BIT STRING { eAoD (0),

eAoA (1)

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

nr-DL-PRS-BeamInfoSup-r17 ENUMERATED { sameSet, differentSet, sameOrDifferentSet }

OPTIONAL,

dl-PRS-ResourcePrioritySubset-Sup-r17 ENUMERATED { supported } OPTIONAL,

nr-DL-AoD-On-Demand-DL-PRS-Support-r17 NR-On-Demand-DL-PRS-Support-r17 OPTIONAL,

nr-los-nlos-IndicatorSupport-r17 SEQUENCE {

type-r17 LOS-NLOS-IndicatorType2-r17,

granularity-r17 LOS-NLOS-IndicatorGranularity2-r17,

...

} OPTIONAL,

scheduledLocationRequestSupported-r17 ScheduledLocationTimeSupportPerMode-r17

OPTIONAL,

nr-dl-prs-AssistanceDataValidity-r17 SEQUENCE {

area-validity-r17 INTEGER (1..maxNrOfAreas-r17) OPTIONAL,

...

} OPTIONAL,

multiMeasInSameMeasReport-r17 ENUMERATED { supported } OPTIONAL,

mg-ActivationRequest-r17 ENUMERATED { supported } OPTIONAL

]]

}

-- ASN1STOP

|  |
| --- |
| *NR-DL-AoD-ProvideCapabilities* field descriptions |
| ***nr-DL-AoD-Mode***  This field specifies the NR DL-AoD mode(s) supported by the target device. |
| ***periodicalReporting***  This field, if present, specifies the positioning modes for which the target device supports *periodicalReporting.* This is represented by a bit string, with a one‑value at the bit position means *periodicalReporting* for the positioning mode is supported; a zero‑value means not supported. If this field is absent, the target device does not support *periodicalReporting* in *CommonIEsRequestLocationInformation*. |
| ***ten-ms-unit-ResponseTime***  This field, if present, specifies the positioning modes for which the target device supports the enumerated value '*ten-milli-seconds*' in the IE *ResponseTime* in IE *CommonIEsRequestLocationInformation*. This is represented by a bit string, with a one‑value at the bit position means '*ten-milli-seconds'* response time unit for the positioning mode is supported; a zero‑value means not supported. If this field is absent, the target device does not support '*ten-milli-seconds'* response time unitin *CommonIEsRequestLocationInformation*. |
| ***nr-PosCalcAssistanceSupport***  This field indicates the Position Calculation Assistance Data supported by the target device for UE-based DL-AoD. This is represented by a bit string, with a one‑value at the bit position means the particular assistance data is supported; a zero‑value means not supported.  - bit 0 indicates whether the field *nr-TRP-LocationInfo* in IE *NR-PositionCalculationAssistance* is supported or not;  - bit 1 indicates whether the field *nr-DL-PRS-BeamInfo* in IE *NR-PositionCalculationAssistance* is supported or not;  - bit 2 indicates whether the field *nr-RTD-Info* in IE *NR-PositionCalculationAssistance* is supported or not. The UE can indicate this bit only if the UE supports *prs-ProcessingCapabilityBandList* and any of *maxNrOfDL-PRS-ResourceSetPerTrpPerFrequencyLayer*, *maxNrOfTRP-AcrossFreqs*, *maxNrOfPosLayer*, *maxNrOfDL-PRS-ResourcesPerResourceSet* and *maxNrOfDL-PRS-ResourcesPerPositioningFrequencylayer*. Otherwise, the UE does not include this field;  - bit 3 indicates whether the field *nr-TRP-BeamAntennaInfo* in IE *NR-PositionCalculationAssistance* is supported or not. |
| ***nr-los-nlos-AssistanceDataSupport***  This field, if present, indicates that the target device supports the *NR-DL-PRS-ExpectedLOS-NLOS-Assistance* in IE *NR-PositionCalculationAssistance*:  - *type* indicates whether the target device supports '*hard*' value or '*hard*' and '*soft*' value in *LOS-NLOS-Indicator* in IE *NR-DL-PRS-ExpectedLOS-NLOS-Assistance*.  - *granularity* indicates whether the target device supports *nr-los-nlos-indicator* in IE *NR-DL-PRS-ExpectedLOS-NLOS-Assistanc*e 'per-trp', '*per-resource*', or both.  The UE can include this field only if the UE supports one of *maxDL-PRS-RSRP-MeasurementFR1*, *maxDL-PRS-RSRP-MeasurementFR2,dl-RSTD-MeasurementPerPairOfTRP-FR1, dl-RSTD-MeasurementPerPairOfTRP-FR2, maxNrOfRx-TX-MeasFR1, maxNrOfRx-TX-MeasFR2, supportOfRSRP-MeasFR1* and *supportOfRSRP-MeasFR2* . Otherwise, the UE does not include this field. |
| ***nr-DL-PRS-ExpectedAoD-or-AoA-Sup***  This field, if present, indicates that the target device supports the *NR-DL-PRS-ExpectedAoD-or-AoA* in *NR-DL-PRS-AssistanceData.* |
| ***nr-DL-PRS-BeamInfoSup***  This field, if present, indicates that the target device supports the *NR-DL-PRS-BeamInfo* in IE *NR-DL-AoD-ProvideAssistanceData.* |
| ***dl-PRS-ResourcePrioritySubset-Sup***  This field, if present, indicates that the target device supports the *DL-PRS-ResourcePrioritySubset* in IE *NR-DL-PRS-Info.* Enumerated value indicates the supported resource set relationship for the target DL-PRS Resource and the associated subset. |
| ***nr-DL-AoD-On-Demand-DL-PRS-Support***  This field, if present, indicates that the target device supports on-demand DL-PRS requests. |
| ***nr-los-nlos-IndicatorSupport***  This field, if present, indicates that the target device supports *nr-los-nlos-Indicator* reporting in IE *NR-DL-AoD-SignalMeasurementInformation*.  - *type* indicates whether the target device supports '*hard*' value or '*hard*' and '*soft*' value in IE *LOS-NLOS-Indicator.*  - *granularit*y indicates whether the target device supports *LOS-NLOS-Indicator* reporting per TRP, per DL-PRS Resource, or both. |
| ***scheduledLocationRequestSupported***  This field, if present, specifies the positioning modes for which the target device supports scheduled location requests – i.e., supports the IE *ScheduledLocationTime* in IE *CommonIEsRequestLocationInformation* – and the time base(s) supported for the scheduled location time for each positioning mode. If this field is absent, the target device does not support scheduled location requests. |
| ***nr-dl-prs-AssistanceDataValidity***  This field, if present, indicates that the target device supports validity conditions for pre-configured assistance data and comprises the following subfields:  - ***area-validity*** indicates that the target device supports pre-configured assistance data with area validity. The integer number indicates the maximum number of areas the target device supports. |
| ***multiMeasInSameMeasReport***  This field, if present, indicates that the target device supports multiple measurement instances in a single measurement report. |
| ***mg-ActivationRequest***  This field, if present, indicates that the target device supports low latency measurement gap activation request for DL-PRS measurements. The UE can include this field only if the UE supports *mg-ActivationRequestPRS-Meas* and *mg-ActivationCommPRS-Meas* defined in TS 38.331 [35]. |

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

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

The IE *NR-DL-AoD-MeasurementCapability* defines the DL-AoD measurement capability. The UE can include this IE only if the UE supports *NR-DL-PRS-ResourcesCapability* for DL-AoD. Otherwise, the UE does not include this IE;

-- ASN1START

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

maxDL-PRS-RSRP-MeasurementFR1-r16 INTEGER (1..8),

maxDL-PRS-RSRP-MeasurementFR2-r16 INTEGER (1..8),

dl-AoD-MeasCapabilityBandList-r16 SEQUENCE (SIZE (1..nrMaxBands-r16)) OF

DL-AoD-MeasCapabilityPerBand-r16,

...,

[[

maxDL-PRS-RSRP-MeasurementFR1-v1730 ENUMERATED { n16, n24 } OPTIONAL,

maxDL-PRS-RSRP-MeasurementFR2-v1730 ENUMERATED { n16, n24 } OPTIONAL

]]

}

DL-AoD-MeasCapabilityPerBand-r16 ::= SEQUENCE {

freqBandIndicatorNR-r16 FreqBandIndicatorNR-r16,

simul-NR-DL-AoD-DL-TDOA-r16 ENUMERATED { supported} OPTIONAL,

simul-NR-DL-AoD-Multi-RTT-r16 ENUMERATED { supported} OPTIONAL,

...,

[[

maxDL-PRS-FirstPathRSRP-MeasPerTRP-r17 ENUMERATED { n1, n2, n4, n8, n16, n24 } OPTIONAL,

dl-PRS-MeasRRC-Inactive-r17 ENUMERATED { supported } OPTIONAL

]]

}

-- ASN1STOP

|  |
| --- |
| *NR-DL-AoD-MeasurementCapability* field descriptions |
| ***maxDL-PRS-RSRP-MeasurementFR1***  Indicates the maximum number of DL-PRS RSRP measurements on different PRS resources from the same TRP supported by the UE on FR1. If this field with suffix -v1730 is present, the target device should set the field with suffix -r16 to value '8'. |
| ***maxDL-PRS-RSRP-MeasurementFR2***  Indicates the maximum number of DL-PRS RSRP measurements on different PRS resources from the same TRP supported by the UE on FR2. If this field with suffix -v1730 is present, the target device should set the field with suffix -r16 to value '8'. |
| ***simul-NR-DL-AoD-DL-TDOA***  Indicates whether the UE supports simultaneous processing for DL-AoD and DL-TDOA measurements. The UE can include this field only if the UE supports DL-TDOA and DL-AoD. Otherwise, the UE does not include this field. |
| ***simul-NR-DL-AoD-Multi-RTT***  Indicates whether the UE supports simultaneous processing for DL-AoD and UE Multi-RTT measurements. The UE can include this field only if the UE supports Multi-RTT and DL-AoD. Otherwise, the UE does not include this field. |
| ***maxDL-PRS-FirstPathRSRP-MeasPerTRP***  This field, if present, indicates that the target device supports measuring and reporting the PRS RSRPP of the first path. The enumerated value indicates the maximum number of RSRPP of first path per TRP supported. The UE can include this field only if the UE supports one of *maxDL-PRS-RSRP-MeasurementFR1* and *maxDL-PRS-RSRP-MeasurementFR2*. Otherwise, the UE does not include this field.  NOTE 1: The maximum number of first path PRS RSRP per TRP should be less than or equal to the maximum number of PRS RSRP defined in *maxDL-PRS-RSRP-MeasurementFR1* and *maxDL-PRS-RSRP-MeasurementFR2*. |
| ***dl-PRS-MeasRRC-Inactive***  This field, if present, indicates that the target device supports DL-PRS measurement in RRC\_INACTIVE state. The UE can include this field only if the UE supports *maxNrOfDL-PRS-ResourceSetPerTrpPerFrequencyLayer, maxNrOfTRP-AcrossFreqs, maxNrOfPosLayer* and *dl-PRS-BufferType-RRC-Inactive*. Otherwise, the UE does not include this field.  NOTE 1: This capability is applicable to both, UE-assisted and UE-based DL-AoD.  NOTE 2: The capabilities *NR-DL-PRS-ResourcesCapability, simul-NR-DL-AoD-DL-TDOA* are the same in RRC\_INACTIVE state. |

#### 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.

-- ASN1START

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

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

nr-NTA-Offset-r16 ENUMERATED { nTA1, nTA2, nTA3, nTA4, ... } OPTIONAL,

...,

[[

nr-SRS-TxTEG-Set-r17 SEQUENCE (SIZE(1..maxTxTEG-Sets-r17)) OF

NR-SRS-TxTEG-Element-r17 OPTIONAL

-- Cond Case2-3

]],

[[

nr-UE-RxTEG-TimingErrorMargin-r17 TEG-TimingErrorMargin-r17 OPTIONAL,-- Cond TEGCase3

nr-UE-TxTEG-TimingErrorMargin-r17 TEG-TimingErrorMargin-r17 OPTIONAL,-- Cond TEGCase2-3

nr-UE-RxTxTEG-TimingErrorMargin-r17 RxTxTEG-TimingErrorMargin-r17 OPTIONAL -- Cond TEGCase1-2

]]

}

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

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

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

nr-PhysCellID-r16 NR-PhysCellID-r16 OPTIONAL,

nr-CellGlobalID-r16 NCGI-r15 OPTIONAL,

nr-ARFCN-r16 ARFCN-ValueNR-r15 OPTIONAL,

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

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

nr-UE-RxTxTimeDiff-r16 CHOICE {

k0-r16 INTEGER (0..1970049),

k1-r16 INTEGER (0..985025),

k2-r16 INTEGER (0..492513),

k3-r16 INTEGER (0..246257),

k4-r16 INTEGER (0..123129),

k5-r16 INTEGER (0..61565),

...

},

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

nr-TimingQuality-r16 NR-TimingQuality-r16,

nr-DL-PRS-RSRP-Result-r16 INTEGER (0..126) OPTIONAL,

nr-Multi-RTT-AdditionalMeasurements-r16

NR-Multi-RTT-AdditionalMeasurements-r16 OPTIONAL,

...,

[[

nr-UE-RxTx-TEG-Info-r17 NR-UE-RxTx-TEG-Info-r17 OPTIONAL,

nr-DL-PRS-FirstPathRSRP-Result-r17 INTEGER (0..126) OPTIONAL,

nr-los-nlos-Indicator-r17 CHOICE {

perTRP-r17 LOS-NLOS-Indicator-r17,

perResource-r17 LOS-NLOS-Indicator-r17

} OPTIONAL,

nr-AdditionalPathListExt-r17 NR-AdditionalPathListExt-r17 OPTIONAL,

nr-Multi-RTT-AdditionalMeasurementsExt-r17

NR-Multi-RTT-AdditionalMeasurementsExt-r17 OPTIONAL

]]

}

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

NR-Multi-RTT-AdditionalMeasurementElement-r16

NR-Multi-RTT-AdditionalMeasurementsExt-r17 ::= SEQUENCE (SIZE (1..maxAddMeasRTT-r17)) 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-DL-PRS-RSRP-ResultDiff-r16 INTEGER (0..61) OPTIONAL,

nr-UE-RxTxTimeDiffAdditional-r16 CHOICE {

k0-r16 INTEGER (0..8191),

k1-r16 INTEGER (0..4095),

k2-r16 INTEGER (0..2047),

k3-r16 INTEGER (0..1023),

k4-r16 INTEGER (0..511),

k5-r16 INTEGER (0..255),

...

},

nr-TimingQuality-r16 NR-TimingQuality-r16,

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

nr-TimeStamp-r16 NR-TimeStamp-r16,

...,

[[

nr-UE-RxTx-TEG-Info-r17 NR-UE-RxTx-TEG-Info-r17 OPTIONAL,

nr-DL-PRS-FirstPathRSRP-ResultDiff-r17 INTEGER (0..61) OPTIONAL,

nr-los-nlos-IndicatorPerResource-r17 LOS-NLOS-Indicator-r17 OPTIONAL,

nr-AdditionalPathListExt-r17 NR-AdditionalPathListExt-r17 OPTIONAL

]]

}

NR-SRS-TxTEG-Element-r17 ::= SEQUENCE {

nr-TimeStamp-r17 NR-TimeStamp-r16 OPTIONAL, -- Need OP

nr-UE-Tx-TEG-ID-r17 INTEGER (0..maxNumOfTxTEGs-1-r17),

carrierFreq-r17 SEQUENCE {

absoluteFrequencyPointA-r17 ARFCN-ValueNR-r15,

offsetToPointA-r17 INTEGER (0..2199)

} OPTIONAL,

srs-PosResourceList-r17 SEQUENCE (SIZE (1..maxNumOfSRS-PosResources-r17)) OF

INTEGER (0..maxNumOfSRS-PosResources-1-r17),

...

}

NR-UE-RxTx-TEG-Info-r17 ::= CHOICE {

case1-r17 SEQUENCE {

nr-UE-RxTx-TEG-ID-r17 INTEGER (0..maxNumOfRxTxTEGs-1-r17)

},

case2-r17 SEQUENCE {

nr-UE-RxTx-TEG-ID-r17 INTEGER (0..maxNumOfRxTxTEGs-1-r17),

nr-UE-Tx-TEG-Index-r17 INTEGER (1..maxTxTEG-Sets-r17)

},

case3-r17 SEQUENCE {

nr-UE-Rx-TEG-ID-r17 INTEGER (0..maxNumOfRxTEGs-1-r17),

nr-UE-Tx-TEG-Index-r17 INTEGER (1..maxTxTEG-Sets-r17)

},

...

}

-- ASN1STOP

| Conditional presence | Explanation |
| --- | --- |
| *Case2-3* | The field is mandatory present if the IE *NR-UE-RxTx-TEG-Info* is provided for choice's *case2* and *case3*. Otherwise it is not present. |
| *TEGCase3* | The field is optionally present, need OP, if the IE *NR-UE-RxTx-TEG-Info* is provided for choice *case3*. Otherwise it is not present. |
| *TEGCase2-3* | The field is optionally present, need OP, if the IE *NR-UE-RxTx-TEG-Info* is provided for choice's *case2* and *case3*. Otherwise it is not present. |
| *TEGCase1-2* | The field is optionally present, need OP, if the IE *NR-UE-RxTx-TEG-Info* is provided for choice's *case1* and *case2*. Otherwise it is not present. |

|  |
| --- |
| *NR-Multi-RTT-SignalMeasurementInformation* field descriptions |
| ***nr-NTA-Offset***  This field provides the *NTAoffset* used by the target device as specified in TS 38.133 [46], Table 7.1.2-2. Enumerated values nTA1, nTA2, nTA3, and nTA4 correspond to *NTAoffset* of 25600 Tc, 0 Tc, 39936 Tc, and 13792 Tc, respectively. |
| ***nr-SRS-TxTEG-Set***  This field provides the SRS for Positioning Resources associated with a particular UE Tx TEG and comprises the following subfields:  - ***nr-TimeStamp*** specifies the start time for which the *NR-SRS-TxTEG-Element* is valid. If this field is absent, the *nr-TimeStamp* of this instance of the *NR-SRS-TxTEG-Element* of the *nr-SRS-TxTEG-Set* is the same as the *nr-TimeStamp* of the previous instance of the *NR-SRS-TxTEG-Element*. If this field is also absent in the first *NR-SRS-TxTEG-Element* of the *nr-SRS-TxTEG-Set*, all *NR-SRS-TxTEG-Element*'s provided are valid for the measurement period of the *NR-Multi-RTT-SignalMeasurementInformation.*  - ***nr-UE-Tx-TEG-ID*** specifies the ID of this UE Tx TEG.  - ***carrierFreq*** specifies the frequency of the SRS for positioning resources.  - ***srs-PosResourceList*** specifies the SRS for Positioning Resources belonging to this UE Tx TEG.  For each UE Tx TEG, there may be up to 8 changes (different *nr-TimeStamp*) of the TEG-SRS association information provided in *nr-SRS-TxTEG-Set*, i.e., the maximum value for *maxTxTEG-Sets* is 64. |
| ***nr-UE-RxTEG-TimingErrorMargin***  This field specifies the UE Rx TEG timing error margin value for all the UE Rx TEGs within one *NR-Multi-RTT-SignalMeasurementInformation*. If the IE *NR-UE-RxTx-TEG-Info* is present with choice *case3* and this field is absent, the receiver should consider the UE Rx TEG timing error margin value to be the maximum applicable value as defined in TS 38.133 [46]. |
| ***nr-UE-TxTEG-TimingErrorMargin***  This field specifies the UE Tx TEG timing error margin value for all the UE Tx TEGs within one *NR-Multi-RTT-SignalMeasurementInformation*. If the IE *NR-UE-RxTx-TEG-Info* is present with choice *case2* or *case3* and this field is absent, the receiver should consider the UE Tx TEG timing error margin value to be the maximum value available in IE *TEG-TimingErrorMargin*. |
| ***nr-UE-RxTxTEG-TimingErrorMargin***  This field specifies the UE RxTx TEG timing error margin value for all the UE RxTx TEGs within one *NR-Multi-RTT-SignalMeasurementInformation*. If the IE *NR-UE-RxTx-TEG-Info* is present with choice *case1* or *case2* and this field is absent, the receiver should consider the UE RxTx TEG timing error margin value to be the maximum applicable value as defined in TS 38.133 [46]. |
| ***dl-PRS-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 should only be associated with one such ID. |
| ***nr-PhysCellID***  This field specifies the physical cell identity of the associated TRP, as defined in TS 38.331 [35]. |
| ***nr-CellGlobalID***  This field specifies the NCGI, the globally unique identity of a cell in NR, of the associated TRP, as defined in TS 38.331 [35]. |
| ***nr-ARFCN***  This field specifies the NR-ARFCN of the TRP's CD-SSB (as defined in TS 38.300 [47]) corresponding to *nr-PhysCellID*. |
| ***nr-UE-RxTxTimeDiff***  This field specifies the UE Rx–Tx time difference measurement, as defined in TS 38.215 [36]. |
| ***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. If this field was requested but is not included, it means the UE did not detect any additional path timing values. If this field is present, the field *nr-AdditionalPathListExt* shall be absent. |
| ***nr-TimeStamp***  This field specifies the time instance for which the measurement is performed. |
| ***nr-TimingQuality***  This field specifies the target device′s best estimate of the quality of the measurement. |
| ***nr-DL-PRS-RSRP-Result***  This field specifies the NR DL-PRS reference signal received power (DL PRS-RSRP) measurement, as defined in TS 38.215 [36]. The mapping of the quantity is defined as in TS 38.133 [46]. |
| ***nr-UE-RxTx-TEG-Info***  This field provides the ID(s) of the UE TEG associated with the *nr-UE-RxTxTimeDiff* or*nr-UE-RxTxTimeDiffAdditional* measurement. One of the following combinations of TEG IDs can be provided:  - ***case1*** provides the UE RxTx TEG ID;  - ***case2*** provides the UE RxTx TEG ID together with the UE Tx TEG ID. The *nr-UE-Tx-TEG-Index* provides the index to the *nr-SRS-TxTEG-Set* field for the applicable UE Tx TEG ID, where value '1' indicates the first *NR-SRS-TxTEG-Element* in *nr-SRS-TxTEG-Set*, value '2' indicates the second *NR-SRS-TxTEG-Element* in *nr-SRS-TxTEG-Set*, and so on;  - ***case3*** provides the UE Rx TEG ID together with the UE Tx TEG ID. The *nr-UE-Tx-TEG-Index* provides the index to the *nr-SRS-TxTEG-Set* field for the applicable UE Tx TEG ID, where value '1' indicates the first *NR-SRS-TxTEG-Element* in *nr-SRS-TxTEG-Set*, value '2' indicates the second *NR-SRS-TxTEG-Element* in *nr-SRS-TxTEG-Set*, and so on. |
| ***nr-DL-PRS-FirstPathRSRP-Result***  This field specifies the NR DL PRS reference signal received path power (DL PRS-RSRPP) of the first detected path in time, as defined in TS 38.215 [36]. The mapping of the measured quantity is defined as in TS 38.133 [46]. |
| ***nr-los-nlos-Indicator***  This field specifies the target device's best estimate of the LOS or NLOS of the UE Rx-Tx Time Difference, RSRP or RSRPP of first path measurement for the TRP or resource.  NOTE: If the requested type or granularity in *nr-los-nlos-IndicatorRequest* is not possible, the target device may provide a different type and granularity for the estimated *LOS-NLOS-Indicator.* |
| ***nr-AdditionalPathListExt***  This field provides up to 8 additional detected path timing values for the TRP or resource, relative to the path timing used for determining the *nr-UE-RxTxTimeDiff* value. If this field was requested but is not included, it means the UE did not detect any additional path timing values. If this field is present, the field *nr-AdditionalPathList* shall be absent. |
| ***nr-Multi-RTT-AdditionalMeasurementsExt***  This field, in addition to the measurements provided in *NR-Multi-RTT-MeasElement*, provides UE Rx-Tx time difference measurements of up to 4 DL-PRS Resources of a TRP with different UE RxTx or UE Rx TEGs. For a certain DL-PRS Resource, there can be up to 8 measurement results with respect to different UE RxTx or UE Rx TEGs. If this field is present, the field *nr-Multi-RTT-AdditionalMeasurements* should not be present. |
| ***nr-DL-PRS-RSRP-ResultDiff***  This field provides the additional DL-PRS RSRP measurement result relative to *nr-DL-PRS-RSRP-Result.* The DL-PRS RSRP value of this measurement is obtained by adding the value of this field to the value of the *nr-DL-PRS-RSRP-Result*. The mapping of this field is defined as in TS 38.133 [46]. |
| ***nr-UE-RxTxTimeDiffAdditional***  This field provides the additional UE Rx-Tx Difference measurement result relative to *nr-UE-RxTxTimeDiff.* The UE Rx-Tx Difference value of this measurement is obtained by adding the value of this field to the value of the *nr-UE-RxTxTimeDiff* field. The mapping of the field is defined in TS 38.133 [46]. |
| ***nr-DL-PRS-FirstPathRSRP-ResultDiff***  This field specifies the additional NR DL-PRS reference signal received path power (DL PRS-RSRPP) of the first detected path in time relative to *nr-DL-PRS-FirstPathRSRP-Result*. The DL-PRS RSRPP of first path value of this measurement is obtained by adding the value of this field to the value of the *nr-DL-PRS-FirstPathRSRP-Result* field. The mapping of the field is defined in TS 38.133 [46]. |
| ***nr-los-nlos-IndicatorPerResource***  This field specifies the target device's best estimate of the LOS or NLOS of the UE Rx-Tx Time Difference, RSRP or RSRPP of first path measurement for the resource.  This field may only be present if the field *nr-LOS-NLOS-Indicator* choice indicates *perResource*. |

#### 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 NR Multi-RTT positioning capabilities to the location server.

-- ASN1START

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

nr-Multi-RTT-PRS-Capability-r16 NR-DL-PRS-ResourcesCapability-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,

additionalPathsReport-r16 ENUMERATED { supported } OPTIONAL,

periodicalReporting-r16 ENUMERATED { supported } OPTIONAL,

...,

[[

ten-ms-unit-ResponseTime-r17 ENUMERATED { supported } OPTIONAL,

nr-DL-PRS-ExpectedAoD-or-AoA-Sup-r17 BIT STRING { eAoD (0),

eAoA (1)

} (SIZE (1..8)) OPTIONAL, nr-Multi-RTT-On-Demand-DL-PRS-Support-r17

NR-On-Demand-DL-PRS-Support-r17 OPTIONAL,

nr-UE-RxTx-TEG-ID-ReportingSupport-r17 BIT STRING { case1 (0),

case2 (1),

case3 (2)

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

nr-los-nlos-IndicatorSupport-r17 SEQUENCE {

type-r17 LOS-NLOS-IndicatorType2-r17,

granularity-r17 LOS-NLOS-IndicatorGranularity2-r17,

...

} OPTIONAL,

additionalPathsExtSupport-r17 ENUMERATED { n4, n6, n8 } OPTIONAL,

scheduledLocationRequestSupported-r17 ScheduledLocationTimeSupport-r17 OPTIONAL,

nr-dl-prs-AssistanceDataValidity-r17 SEQUENCE {

area-validity-r17 INTEGER (1..maxNrOfAreas-r17) OPTIONAL,

...

} OPTIONAL,

multiMeasInSameMeasReport-r17 ENUMERATED { supported } OPTIONAL,

mg-ActivationRequest-r17 ENUMERATED { supported } OPTIONAL

]]

}

-- ASN1STOP

| *NR-Multi-RTT-ProvideCapabilities* field descriptions |
| --- |
| ***ten-ms-unit-ResponseTime***  This field, if present, indicates that the target device supports the enumerated value '*ten-milli-seconds*' in the IE *ResponseTime* in IE *CommonIEsRequestLocationInformation*. |
| ***nr-DL-PRS-ExpectedAoD-or-AoA-Sup***  This field, if present, indicates that the target device supports the *NR-DL-PRS-ExpectedAoD-or-AoA* in *NR-DL-PRS-AssistanceData.* |
| ***nr-Multi-RTT-On-Demand-DL-PRS-Support***  This field, if present, indicates that the target device supports on-demand DL-PRS requests. |
| ***nr-UE-RxTx-TEG-ID-ReportingSupport***  This field, if present, indicates that the target device supports *nr-UE-RxTx-TEG-Info* reporting in IE *NR-Multi-RTT-SignalMeasurementInformation.* This is represented by a bit string, with a one‑value at the bit position means the particular case is supported; a zero‑value means not supported:  - bit 0indicates that the target device supports the '*case1*' choice in *NR-UE-RxTx-TEG-Info*.  - bit 1 indicates that the target device supports the '*case2*' choice in *NR-UE-RxTx-TEG-Info*.  - bit 2 indicates that the target device supports the '*case3*' choice in *NR-UE-RxTx-TEG-Info*. |
| ***nr-los-nlos-IndicatorSupport***  This field, if present, indicates that the target device supports *nr-los-nlos-Indicator* reporting in IE *NR-Multi-RTT-SignalMeasurementInformation*.  - *type* indicates whether the target device supports '*hard*' value or '*hard*' and '*soft*' value in IE *LOS-NLOS-Indicator.*  - *granularity* indicates whether the target device supports *LOS-NLOS-Indicator* reporting per TRP, per DL-PRS Resource, or both.  NOTE: A single value is reported when both Multi-RTT and DL-TDOA are supported. |
| ***additionalPathsExtSupport***  This field, if present, indicates that the target device supports the *nr-AdditionalPathListExt* reporting in IE *NR-Multi-RTT-SignalMeasurementInformation*. The enumerated value indicates the number of additional paths supported by the target device.  NOTE: The *supportOfDL-PRS-FirstPathRSRP* in IE *NR-Multi-RTT-MeasurementCapability* also applies to the additional paths. |
| ***scheduledLocationRequestSupported***  This field, if present, indicates that the target device supports scheduled location requests – i.e., supports the IE *ScheduledLocationTime* in IE *CommonIEsRequestLocationInformation* – and the time base(s) supported for the scheduled location time. |
| ***nr-dl-prs-AssistanceDataValidity***  This field, if present, indicates that the target device supports validity conditions for pre-configured assistance data and comprises the following subfields:  - ***area-validity*** indicates that the target device supports pre-configured assistance data with area validity. The integer number indicates the maximum number of areas the target device supports*.* |
| ***multiMeasInSameMeasReport***  This field, if present, indicates that the target device supports multiple measurement instances in a single measurement report. |
| ***mg-ActivationRequest***  This field, if present, indicates that the target device supports low latency measurement gap activation request for DL-PRS measurements. The UE can include this field only if the UE supports *mg-ActivationRequestPRS-Meas* and *mg-ActivationCommPRS-Meas* defined in TS 38.331 [35]. |

## 6.6 Multiplicity and type constraint values

#### *– Multiplicity and type constraint definitions*

-- ASN1START

maxEARFCN INTEGER ::= 65535 -- Maximum value of EUTRA carrier frequency

maxEARFCN-Plus1 INTEGER ::= 65536 -- Lowest value extended EARFCN range

maxEARFCN2 INTEGER ::= 262143 -- Highest value extended EARFCN range

maxMBS-r14 INTEGER ::= 64

maxWLAN-AP-r13 INTEGER ::= 64

maxKnownAPs-r14 INTEGER ::= 2048

maxVisibleAPs-r14 INTEGER ::= 32

maxWLAN-AP-r14 INTEGER ::= 128

maxWLAN-DataSets-r14 INTEGER ::= 8

maxBT-Beacon-r13 INTEGER ::= 32

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

-- UE capability.

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

nrMaxFreqLayers-1-r16 INTEGER ::= 3

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

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

nrMaxResourceIDs-r16 INTEGER ::= 64 -- Max Resource IDs

nrMaxResourceOffsetValue-1-r16 INTEGER ::= 511

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

nrMaxSetsPerTrpPerFreqLayer-r16 INTEGER ::= 2 -- Maximum resource sets for one TRP

nrMaxSetsPerTrpPerFreqLayer-1-r16 INTEGER ::= 1

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

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

nrMaxTRPsPerFreq-1-r16 INTEGER ::= 63

maxSimultaneousBands-r16 INTEGER ::= 4 -- Maximum number of simultaneously

-- measured bands

maxBandComb-r16 INTEGER ::= 1024

nrMaxConfiguredBands-r16 INTEGER ::= 16

maxNumOfRxTEGs-r17 INTEGER ::= 32

maxNumOfRxTEGs-1-r17 INTEGER ::= 31

maxNumOfTxTEGs-1-r17 INTEGER ::= 7

maxTxTEG-Sets-r17 INTEGER ::= 256 -- Maximum applicable number is 64

maxNumOfRxTxTEGs-1-r17 INTEGER ::= 255

maxNumOfTRP-TxTEGs-1-r17 INTEGER ::= 7

maxNumOfSRS-PosResources-r17 INTEGER ::= 64

maxNumOfSRS-PosResources-1-r17 INTEGER ::= 63

maxNumResourcesPerAngle-r17 INTEGER ::= 24

maxNumPrioResources-r17 INTEGER ::= 24

maxAddMeasTDOA-r17 INTEGER ::= 31

maxAddMeasAoD-r17 INTEGER ::= 23

maxAddMeasRTT-r17 INTEGER ::= 31

maxOD-DL-PRS-Configs-r17 INTEGER ::= 8

maxCellIDsPerArea-r17 INTEGER ::= 256

maxNrOfAreas-r17 INTEGER ::= 16

maxMeasInstances-r17 INTEGER ::= 32

-- ASN1STOP