3GPP TSG-RAN WG2 Meeting #122***R2-23xxxxx***

Incheon, Korea, May 22 – 26, 2023

**Agenda item:** 6.5.1

**Source:** CATT (Rapporteur)

**Title:** [Pre122][407][POS] Summary of AI 6.5.1 on Rel-17 positioning (CATT)

**Document for:**  Discussion

# 1. Introduction

This document summarizes the following contributions submitted for Agenda Item 6.5.1 (Corrections of Rel-17 NR positioning enhancements).

Corrections on LPP:

[1] R2-2305895 Miscelaneous LPP Corrections Qualcomm Incorporated (Rapporteur) CR Rel-17 37.355 17.4.0 0448 - F NR\_pos\_enh-Core

[2] R2-2306025 Miscellaneous corrections and additions Ericsson, Fraunhofer IIS, Fraunhofer HHI CR Rel-17 37.355 17.4.0 0449 - F NR\_pos\_enh-Core

[3] R2-2306026 Missing finer periodicities than 1s Ericsson CR Rel-17 37.355 17.4.0 0450 - F NR\_pos\_enh-Core

[4] R2-2306259 NR-TRP-LocationInfo for UE-based DL-TDOA and DL-AoD positioning Nokia, Nokia Shanghai Bell CR Rel-17 37.355 17.4.0 0454 - F NR\_pos\_enh-Core

Correction on MAC:

[5] R2-2304803 Correction to MAC spec for Positoning Enhancements Huawei, HiSilicon, Ericsson, ZTE CR Rel-17 38.321 17.4.0 1614 - F NR\_pos\_enh-Core

Correction on RRC:

[6] R2-2305363 Correction on PosSRS-RRC-Inactive-OutsideInitialUL-BWP Huawei, HiSilicon CR Rel-17 38.331 17.4.0 4102 - F NR\_pos\_enh-Core

Correction on Stage-2:

[7] R2-2306258 Alert Limit Nokia, Nokia Shanghai Bell CR Rel-17 38.305 17.4.0 0136 - F NR\_pos\_enh-Core

# 2. Essential Corrections on LPP

## 2.1 Miscellaneous LPP corrections

|  |  |  |  |
| --- | --- | --- | --- |
| [1] | **R2-2305895** | Miscelaneous LPP Corrections (Rapporteur)  | Qualcomm Incorporated |

According to [1], the main Reason for change is

(1)

The field descriptions for nr-DL-TDOA-AdditionalMeasurements and nr-Multi-RTT-AdditionalMeasurements are currently missing.

The corresponding changes can be found below:

***nr-DL-TDOA-AdditionalMeasurements***

This field provides up to 3 additional RSTD measurements per pair of TRPs, with each measurement between a different pair of DL-PRS Resources or DL-PRS Resource Sets of the DL-PRS for those TRPs [45].

If this field is present, the field *nr-DL-TDOA-AdditionalMeasurementsExt* should not be present.

***nr-Multi-RTT-AdditionalMeasurements***

This field provides up to 3 additional UE Rx-Tx time difference measurements corresponding to a single configured SRS Resource or Resource Set for positioning. Each measurement corresponds to a single received DL-PRS Resource or DL-PRS Resource Set [45].

If this field is present, the field *nr-Multi-RTT-AdditionalMeasurementsExt* should not be present.

(2)

As a general drafting rule in RAN2, requirements are specified for the UE, whereas the expected behaviour for the network node (location server) is specified without any explicit "shall" requirement. However, in the LPP specification, a few "shall" requirements for the location server are defined.

The coresponding changes can be found below:

#### – *GNSS-ReferenceTime*

The IE *GNSS-ReferenceTime* is used by the location server to provide the GNSS specific system time with uncertainty and the relationship between GNSS system time and network air-interface timing of the eNodeB/NodeB/BTS transmission in the reference cell.

If the IE *networkTime* is present, the IEs *gnss-SystemTime* and *networkTime* provide a valid relationship between GNSS system time and air-interface network time, as seen at the approximate location of the target device, i.e. the propagation delay from the gNB/ng-eNB/eNodeB/NodeB/BTS to the target device is compensated for by the location server. Depending on implementation, the relation between GNSS system time and air-interface network time may have varying accuracy. The uncertainty of this timing relation is provided in the IE *referenceTimeUnc*. If the propagation delay from the eNodeB/NodeB/BTS to the target device is not accurately known, the location server uses the best available approximation of the propagation delay and take the corresponding delay uncertainty into account in the calculation of the IE *referenceTimeUnc*.

If the IE *networkTime* is not present, the IE *gnssSystemTime* is an estimate of current GNSS system time at time of reception of the IE *GNSS-ReferenceTime* by the target device. The location server should achieve an accuracy of +/- 3 seconds for this estimate including allowing for the transmission delay between the location server and the target device. Note that the target device should further compensate *gnss-SystemTime* for the time between the reception of *GNSS-ReferenceTime* and the time when the *gnss-SystemTime* is used.

The location server provides a value for the *gnss-TimeID* only for GNSSs supported by the target device.

***pseudoRangeCor***

This field specifies the correction to the pseudorange for the particular satellite at *dgnss-RefTime*, t0. The value of this field is given in metres and the scale factor is 0.32 metres in the range of ±655.04 metres. The method of calculating this field is described in [11].

If the location server has received a request for GNSS assistance data from a target device which included a request for the GNSS Navigation Model and DGNSS, the location server determines, for each satellite, if the navigation model stored by the target device is still suitable for use with DGNSS corrections and if so and if DGNSS corrections are supported the location server should send DGNSS corrections without including the GNSS Navigation Model.

The *iod* value sent for a satellite shall always be the IOD value that corresponds to the navigation model for which the pseudo-range corrections are applicable.

***rangeRateCor***

This field specifies the rate-of-change of the pseudorange correction for the particular satellite, using the satellite ephemeris and clock corrections identified by the *iod* field. The value of this field is given in metres per second and the resolution is 0.032 metres/second in the range of ±4.064 metres/second. For some time t1 > t0, the corrections for *iod* are estimated by

 PRC(t1,IOD) = PRC(t0, IOD) + RRC(t0,IOD)⋅(t1 - t0),

and the target device uses this to correct the pseudorange it measures at t1, PRm(t1,IOD), by

 PR(t1, IOD) = PRm(t1, IOD) + PRC(t1, IOD) .

The location server always sends the RRC value that corresponds to the PRC value that it sends. The target device shall only use the RRC value when the *iod* value received matches its available navigation model.

Scale factor 0.032 metres/second.

#### – *GNSS-NavigationModel*

The IE *GNSS-NavigationModel* is used by the location server to provide precise navigation data to the GNSS capable target device. In response to a request from a target device for GNSS Assistance Data, the location server determines whether to send the navigation model for a particular satellite to a target device based upon factors like the T-Toe limit specified by the target device and any request from the target device for DGNSS (see also *GNSS-DifferentialCorrections*). GNSS Orbit Model can be given in Keplerian parameters or as state vector in Earth-Centered Earth-Fixed coordinates, dependent on the *GNSS-ID* and the target device capabilities. The meaning of these parameters is defined in relevant ICDs of the particular GNSS and GNSS specific interpretations apply. For example, GPS and QZSS use the same model parameters but some parameters have a different interpretation [7].

***standardClockModelList***

*gnss-ClockModel* Model-1 contains one or two clock model elements. If included, clock Model-1 shall be included once or twice depending on the target device capability.

If the target device is supporting multiple Galileo signals, the location server includes both F/Nav and I/Nav clock models in *gnss-ClockModel* if the location server assumes the target device to perform location information calculation using multiple signals.

#### – *GNSS-RealTimeIntegrity*

The IE *GNSS-RealTimeIntegrity* is used by the location server to provide parameters that describe the real-time status of the GNSS constellations. *GNSS-RealTimeIntegrity* data communicates the health of the GNSS signals to the mobile in real‑time.

The location server always transmits the *GNSS-RealTimeIntegrity* with the current list of unhealthy signals (i.e., not only for signals/SVs currently visible at the reference location), for any GNSS positioning attempt and whenever GNSS assistance data are sent. If the number of bad signals is zero, then the *GNSS-RealTimeIntegrity* IE is omitted.

#### – *GNSS-AcquisitionAssistance*

The IE *GNSS-AcquisitionAssistance* is used by the location server to provide parameters that enable fast acquisition of the GNSS signals. Essentially, these parameters describe the range and derivatives from respective satellites to the reference location at the reference time *GNSS-SystemTime* provided in IE *GNSS-ReferenceTime*.

Whenever *GNSS-AcquisitionAssistance* is provided by the location server, the IE *GNSS-ReferenceTime* is provided as well. E.g., even if the target device request for assistance data includes only a request for *GNSS-AcquisitionAssistance,* the location server also provides the corresponding IE *GNSS-ReferenceTime.*

Figure 6.5.2.2-1 illustrates the relation between some of the fields, using GPS TOW as exemplary reference.

***kepSV-StatusFNAV***

This field contains the F/NAV signal health status [8], clause 5.1.10 ,E5aHS. If the target device is supporting multiple Galileo signals, the location server includes this field.

***gnss-TOD-msec***

This field specifies the GNSS TOD for which the measurements and/or location estimate are valid. The 22 bits of GNSS TOD are the least significant bits. The most significant bits are derived by the location server to unambiguously derive the GNSS TOD.

The value for GNSS TOD is derived from the GNSS specific system time indicated in *gnss-TimeID* rounded down to the nearest millisecond unit.

Scale factor 1 millisecond.

(3)

Minor editorial mistakes.

Rapporteur's Comment:

- The changes of field descriptions for nr-DL-TDOA-AdditionalMeasurements and nr-Multi-RTT-AdditionalMeasurements are essential and correct.

- The changes of "shall" requirements for the location server are essential.

- The changes of Editorial errors are essential.

So from the rapporteur’s perspective, the CR (**R2-2305895)** can be agreed.

- Cover sheet issues:

The index of Editorial errors remain in ***Consequences if not approved*** should be (3).

**Proposal 1:** The CR in

R2-2305895 Miscelaneous LPP Corrections Qualcomm Incorporated (Rapporteur) CR Rel-17 37.355 17.4.0 0448 - F NR\_pos\_enh-Core

is essential correction. Update the Cover Sheet: The index of Editorial errors remain in Consequences if not approved should be (3).

## 2.2 Miscellaneous corrections and additions

|  |  |  |  |
| --- | --- | --- | --- |
| [2] | **R2-2306025** | Miscellaneous corrections and additions | Ericsson, Fraunhofer IIS, Fraunhofer HHI |

According to [2], the Reason for change are

(1)

The definition of area for preconfigured assistance data is not clear. If NW configures the same cell in different area, then a UE camped in that cell would have ambiguity as which AD is valid in that area. Hence, clarification is needed that a cell is included in only one area.

The corresponding changes can be found below:

#### – *AreaID-CellList*

The IE *AreaID-CellList* provides the NR Cell-IDs of the TRPs belonging to a particular network area where the associated assistance data are valid. Each cell is included in only one area.

(2)

Currently, there is no field description for the nr-DL-PRS-PrioResourceSetID and nr-DL-PRS-PrioResourceID. Instead, the field description for **dl-PRS-ResourcePrioritySubset is provided but dl-PRS-ResourcePrioritySubset is not defined as field.** It is difficult to search for the field description defintion and does not reflect the ASN.1. Further the field description of nr-DL-PRS-ResourceID is missing.

The corresponding changes can be found below:

|  |
| --- |
| *NR-DL-PRS-Info* field descriptions |
| ***nr-DL-PRS-ResourceID***This field specifies the DL-PRS Resource ID, which is used to identify the DL-PRS beam associated to DL-PRS Resource Set of the TRP across all the frequency layers. |
| ***dl-PRS-QCL-Info***This field specifies the QCL indication with other DL reference signals for serving and neighbouring cells and comprises the following subfields:- ***ssb*** indicates the SSB information for QCL source and comprises the following sub-fields:- ***pci*** specifies the physical cell ID of the cell with the SSB that is configured as the source reference signal for the DL-PRS. The UE obtains the SSB configuration for the SSB configured as source reference signal for the DL-PRS by indexing to the field *nr-SSB-Config* with this physical cell identity.- ***ssb-Index*** indicates the index for the SSB configured as the source reference signal for the DL-PRS.- ***rs-Type*** indicates the QCL type.- ***dl-PRS*** indicates the PRS information for QCL source reference signal and comprises the followings sub-fields:- ***qcl-DL-PRS-ResourceID*** specifies DL-PRS Resource ID of the DL-PRS resource used as the source reference signal.- ***qcl-DL-PRS-ResourceSetID*** indicates the DL-PRS Resource Set ID of the DL-PRS Resource Set used as the source reference signal. |
| ***nr-DL-PRS-PrioResourceSetID***This fied indicates a subset of DL-PRS resource set(s) for the purpose of prioritization of DL-AOD reporting, as specified in TS 38.214 [45].NOTE: This field is only applicable to DL-AoD positioning method and should be ignored for DL-TDOA and Multi-RTT positioning. |
| ***nr-DL-PRS-PrioResourceID***This fied indicates a subset of DL-PRS resource ID(s) for the purpose of prioritization of DL-AOD reporting, as specified in TS 38.214 [45].NOTE: This field is only applicable to DL-AoD positioning method and should be ignored for DL-TDOA and Multi-RTT positioning. |
|  |

Rapporteur's Comment:

- For change 1, it is essential.

- For change2:

* The deletion of ***dl-PRS-ResourcePrioritySubset*** is not essential because this field provides a subset of DL-PRS Resources **which is associated with this DL PRS resource**, where the subset of DL PRS resources associated with the DL PRS resource can be in the same or different DL PRS resource set than the DL PRS resource, for the purpose of prioritization of DL-AoD reporting, according to the TS 38.214. The purpose of ***dl-PRS-ResourcePrioritySubset*** is described clearly in TS 38.214. From rapporteur’s view, the description of ***dl-PRS-ResourcePrioritySubset*** is required.

Please find the related description of *dl-PRS-ResourcePrioritySubset* in TS 38.214 as below:

- *dl-PRS-ResourcePrioritySubset* defines a subset of DL-PRS resources for the DL PRS resource for the purpose of prioritization of measurement reporting as described in [17, TS 37.355].

The UE may include UE measurements for the subset of DL PRS resources in *NR-DL-AoD-AdditionalMeasurementElement* if the UE measurements of the associated PRS resource are reported, where the UE measurement can be DL PRS-RSRP and/or DL PRS-RSRPP. The UE may report DL PRS-RSRP and/or DL PRS-RSRPP measurements only for the subset of DL PRS resources.

* The addition description of ***nr-DL-PRS-PrioResourceSetID*** is not correct because this field indicates the DL-PRS Resource Set ID of the DL-PRS Resource Set clearly, not s subset. The suggested description is meaningless.
* The addition description of ***nr-DL-PRS-PrioResourceID*** is not correct because this field specifies DL-PRS Resource ID of the DL-PRS resource clearly, not s subset. The purpose of ***nr-DL-PRS-PrioResourceID*** is clarified clearly in TS 38.214: The UE may include UE measurements for the subset of DL PRS resources in *NR-DL-AoD-AdditionalMeasurementElement* if the UE measurements of the associated PRS resource are reported. No need to put the further description in TS 37.355.
* The addition description of ***nr-DL-PRS-ResourceID*** is not essential because this field in NR-DL-PRS-Resource-r16 shares the meaning of *NR-DL-PRS-ResourceID* in common*.*

#### – *NR-DL-PRS-ResourceID*

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

**Proposal 2-1:** The 1st change in CR

R2-2306025 Miscellaneous corrections and additions Ericsson, Fraunhofer IIS, Fraunhofer HHI CR Rel-17 37.355 17.4.0 0449 - F NR\_pos\_enh-Core

can be merged into rapporteur CR (LPP):

#### – *AreaID-CellList*

The IE *AreaID-CellList* provides the NR Cell-IDs of the TRPs belonging to a particular network area where the associated assistance data are valid. Each cell is included in only one area.

**Proposal 2-2:** The 2nd changes in CR

R2-2306025 Miscellaneous corrections and additions Ericsson, Fraunhofer IIS, Fraunhofer HHI CR Rel-17 37.355 17.4.0 0449 - F NR\_pos\_enh-Core

are not essential.

## 2.3 Correction on missing finer periodicities than 1s

|  |  |  |  |
| --- | --- | --- | --- |
| [3] | **R2-2306026** | Missing finer periodicities than 1s  | Ericsson |

According to [3], the Reason for change are: The industrial IoT use cases adressed in Rel 17 brought more specific time requirements on location information. This has partly been reflected by the introduction of the fine scheduled location time and response time, as well as a fine timestamp, but requested periodicities finer than 1s is missing. NRPPa already supports measurement report periodicity finer than 1s, including the below reasons:

1. The measurements also need to be aligned to the DL-PRS occasions, otherwise the latency requirement cannot be met, since it includes both the measurement time, the time between measurement instant and reporting instant and reporting time. Furthermore, there is a mismatch between what periodicities that can be supported over NRPPa, so a correction is indeed needed.
2. Finer LPP periodicities are relevant for Observation 2/3
3. Observations 2 and 3 in R2-2304051are about relations between on the one hand the finer response time introduced in Rel 17 and NRPPa sub 1s periodicities and on the other the need for correcting Rel 17 to also support sub 1s periodicity over LPP.
4. Finer LPP periodicities is not related to scheduled location time or response time, Observation 1 not supported
5. No agreement in Rel 17 to align DL-PRS occasions with reporting intervals
6. Support only needed for NR E-CID, NR DL-TDOA, NR DL-AoD, and NR Multi-RTT positioning methods
7. LPP periodic reporting is legacy from UMTS and cannot be changed
8. Shall the finer LPP periodicity be enumerated or 0-999 in milliseconds

According to [3], in order to match fine scheduled location time and response time together with DL-PRS and/or UL-SRS periodicities, more flexibility is needed. Therefore, a millisecond representation is suggested to allow needed flexibility now and in later releases.

Parts of corresponding corrections can be found as below according to [3]:

– *CommonIEsRequestLocationInformation*

 ]],

 []

 periodicalReportingExt-r17 PeriodicalReportingCriteriaExt-r17 OPTIONAL, -- Need ON

 ]]

}

}

PeriodicalReportingCriteriaExt-r17 ::= SEQUENCE {

 reportingAmount ENUMERATED {

 ra1, ra2, ra4, ra8, ra16, ra32,

 ra64, ra-Infinity

 } DEFAULT ra-Infinity,

 reportingIntervalMs INTEGER (1..999),

 ...

}

Rapporteur's Comment:

- The *CommonIEsRequestLocationInformation* carries common IEs for a Request Location Information LPP message Type. This IE needs to be aligned with the definition by CT4 in TS 29.002. However the ReportingInterval defined in the latest version (h20) is still in seconds.

**PeriodicLDRInfo** ::= SEQUENCE {

 reportingAmount ReportingAmount,

 reportingInterval ReportingInterval,

 ...}

-- reportingInterval x reportingAmount shall not exceed 8639999 (99 days, 23 hours,

-- 59 minutes and 59 seconds) for compatibility with OMA MLP and RLP

**ReportingAmount** ::= INTEGER (1..maxReportingAmount)

**maxReportingAmount** INTEGER ::= 8639999

**ReportingInterval** ::= INTEGER (1..maxReportingInterval)

-- ReportingInterval is in seconds

- This CRcan be further discussed after the **ReportingInterval** in TS 29.002 is changed into ms which is under discussion in CT4 now.

- RAN2 may also discuss if the CR is essential correction at this meeting.

**Proposal 3:** RAN2 to discuss if this CR

R2-2306026 Missing finer periodicities than 1s Ericsson CR Rel-17 37.355 17.4.0 0450 - F NR\_pos\_enh-Core

is essential correction or can be postponed waiting for the ReportingInterval updated as ms in CT4.

## 2.4 NR-TRP-LocationInfo for UE-based DL-TDOA and DL-AoD positioning

|  |  |  |  |
| --- | --- | --- | --- |
| [4] | **R2-2306259** | NR-TRP-LocationInfo for UE-based DL-TDOA and DL-AoD positioning | Nokia, Nokia Shanghai Bell |

According to [4], the reasons for change of this CR are:

1. Field description of nr-TRP-LocationInfo in NR-PositionCalculationAssistance provides not only the ARP location but also the TRP location. Also, the ARP is associated with Resource Sets and Resources of the TRP and this detail is missing.

2. NR-TRP-LocationInfo is a list and NR-TRP-LocationInfoPerFreqLayer is an entry in the list but the field description for referencePoint and the explanation for conditional presence tag ‘NotSameAsPrev’ refers to NR-TRP-LocationInfoPerFreqLayer as the list.

So the corresponding changes can be found as below, according to [4]:

1. Clarified that TRP location in addition to ARP location is provided by nr-TRP-LocationInfo and ARP is associatd with DL-PRS Resource Set(s) and DL-PRS Resources of the TRPs.

| *NR-PositionCalculationAssistance* field descriptions |
| --- |
| ***nr-TRP-LocationInfo***This field provides the location coordinates of the TRPs and location coordinates of antenna reference points for DL-PRS Resource Set(s) and DL-PRS Resources of the TRPs. |

#### *–* *NR-TRP-LocationInfo*

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

2. Corrected the field description for referencePoint and the explanation for conditional presence tag ‘NotSameAsPrev’ to refer to NR-TRP-LocationInfo as the list IE.

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

| *NR-TRP-LocationInfo* field descriptions |
| --- |
| ***referencePoint***This field specifies the reference point used to define the location of TRPs provided in the *trp-LocationInfoList*. If this field is absent, the reference point is the same as in the previous entry of the *NR-TRP-LocationInfoPerFreqLayer* in the *NR-TRP-LocationInfo* list. |
| ***trp-LocationInfoList***This field provides the antenna reference point locations of the DL-PRS Resources for the TRPs and comprises the following sub-fields:- ***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, and is associated to a single TRP.- ***nr-PhysCellID***: This field specifies the physical cell identity of the associated TRP.- ***nr-CellGlobalID***: This field specifies the NCGI, the globally unique identity of a cell in NR, of the associated TRP.- ***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*.- ***associated-DL-PRS-ID***: This field, if present, specifies the *dl-PRS-ID* of the associated TRP from which the *trp-location* information is adopted. If the field is present, the field *trp-Location* shall be absent.- ***trp-Location***: This field provides the location of the TRP relative to the *referencePoint* location. If this field is absent the TRP location coincides with the *referencePoint* location, unless the field *associated-dl-PRS-ID*is present, in which case the *trp-Location* is adopted from the associated TRP indicated by *associated-dl-PRS-ID*.- ***trp-DL-PRS-ResourceSets***: This field provides the antenna reference point location(s) of the DL-PRS Resource Set(s) associated with this TRP. If this field is absent, the antenna reference point location(s) of the DL-PRS Resource Set(s) coincides with the *trp-Location* location. This field comprises the following sub-fields:- ***dl-PRS-ResourceSetARP***: This field provides the antenna reference point location of the DL-PRS Resource Set relative to the *trp-Location* location. If this field is absent, the antenna reference point location of this DL-PRS Resource Set coincides with the *trp-Location* location.- ***dl-PRS-Resource-ARP-List***: This field provides the antenna reference point location(s) of the DL-PRS Resource(s) associated with this Resource Set of the TRP. If this field is absent, the antenna reference point location(s) of the DL-PRS Resources coincides with the *dl-PRS-ResourceSetARP* location. This field comprises the following sub-fields:- ***dl-PRS-Resource-ARP-location***: This field provides the antenna reference point location of the DL-PRS Resource associated with the DL-PRS Resource Set of the TRP relative to the *dl-PRS-ResourceSetARP* location. If this field is absent, the antenna reference point location of this DL-PRS Resource coincides with the *dl-PRS-ResourceSetARP* location. |

Rapporteur's Comment:

- For change 1, it seems that the clarification of TRP location in addition to ARP location is correct, according to the asn.1.

TRP-LocationInfoElement-r16 ::= SEQUENCE {

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

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

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

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

    associated-DL-PRS-ID-r16        INTEGER (0..255)            OPTIONAL,   -- Need OP

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

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

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

    ...

}

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

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

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

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

    ...

}

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

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

    ...

}

- For change 2, the correction seems an editorial correction.

**Proposal 4-1:** The 1st change as below in CR

R2-2306259 NR-TRP-LocationInfo for UE-based DL-TDOA and DL-AoD positioning Nokia, Nokia Shanghai Bell CR Rel-17 37.355 17.4.0 0454 - F NR\_pos\_enh-Core,

is essential correction.

***nr-TRP-LocationInfo***

This field provides the location coordinates of the TRPs and location coordinates of antenna reference points for DL-PRS Resource Set(s) and DL-PRS Resources of the TRPs.

#### *–* *NR-TRP-LocationInfo*

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

**Proposal 4-2:** The 2nd changes in CR

R2-2306259 NR-TRP-LocationInfo for UE-based DL-TDOA and DL-AoD positioning Nokia, Nokia Shanghai Bell CR Rel-17 37.355 17.4.0 0454 - F NR\_pos\_enh-Core

are editorial corrections and correct.

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

| *NR-TRP-LocationInfo* field descriptions |
| --- |
| ***referencePoint***This field specifies the reference point used to define the location of TRPs provided in the *trp-LocationInfoList*. If this field is absent, the reference point is the same as in the previous entry of the *NR-TRP-LocationInfoPerFreqLayer* in the *NR-TRP-LocationInfo* list. |
| ***trp-LocationInfoList***This field provides the antenna reference point locations of the DL-PRS Resources for the TRPs and comprises the following sub-fields:- ***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, and is associated to a single TRP.- ***nr-PhysCellID***: This field specifies the physical cell identity of the associated TRP.- ***nr-CellGlobalID***: This field specifies the NCGI, the globally unique identity of a cell in NR, of the associated TRP.- ***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*.- ***associated-DL-PRS-ID***: This field, if present, specifies the *dl-PRS-ID* of the associated TRP from which the *trp-location* information is adopted. If the field is present, the field *trp-Location* shall be absent.- ***trp-Location***: This field provides the location of the TRP relative to the *referencePoint* location. If this field is absent the TRP location coincides with the *referencePoint* location, unless the field *associated-dl-PRS-ID*is present, in which case the *trp-Location* is adopted from the associated TRP indicated by *associated-dl-PRS-ID*.- ***trp-DL-PRS-ResourceSets***: This field provides the antenna reference point location(s) of the DL-PRS Resource Set(s) associated with this TRP. If this field is absent, the antenna reference point location(s) of the DL-PRS Resource Set(s) coincides with the *trp-Location* location. This field comprises the following sub-fields:- ***dl-PRS-ResourceSetARP***: This field provides the antenna reference point location of the DL-PRS Resource Set relative to the *trp-Location* location. If this field is absent, the antenna reference point location of this DL-PRS Resource Set coincides with the *trp-Location* location.- ***dl-PRS-Resource-ARP-List***: This field provides the antenna reference point location(s) of the DL-PRS Resource(s) associated with this Resource Set of the TRP. If this field is absent, the antenna reference point location(s) of the DL-PRS Resources coincides with the *dl-PRS-ResourceSetARP* location. This field comprises the following sub-fields:- ***dl-PRS-Resource-ARP-location***: This field provides the antenna reference point location of the DL-PRS Resource associated with the DL-PRS Resource Set of the TRP relative to the *dl-PRS-ResourceSetARP* location. If this field is absent, the antenna reference point location of this DL-PRS Resource coincides with the *dl-PRS-ResourceSetARP* location. |

# 3. Essential Corrections on MAC

|  |  |  |  |
| --- | --- | --- | --- |
| [5] | **R2-2304803** | Correction to MAC spec for Positoning Enhancements | Huawei, HiSilicon, Ericsson, ZTE |

It is stated in [5] that,

In section 5.25 it mentions to trigger a Scheduling Request for Positioning Measurement Gap Activation/Deactivation Request MAC CE. However, it is unclear as what configurations UE shall check before triggering the SR. the reference for section 5.4.4 should be provided.

The semi-persistent SRS is still subject to the activation/deactivation command from the network and is not solely dependent on the validation for SRS transmission in RRC\_INACTIVE. This needs to be clarified in the spec.

There is a typo in the section for SP positoning SRS activation/deactivation MAC CE.

|  |  |
| --- | --- |
| Change 1 | 5.25 Positioning Measurement Gap Activation/Deactivation RequestIf the UE is configured with pre-configured positioning measurement gap and the request of the activation/deactivation of the positioning measurement gap by UL MAC CE, the UE may request the network to activate or deactivate the Positioning measurement gap with UL MAC CE for Positioning Measurement Gap Activation/Deactivation Request in clause 6.1.3.40.The MAC entity shall, when triggered by the upper layer to send Positioning Measurement Gap Activation/Deactivation Request, cancel the triggered Positioning Measurement Gap Activation/Deactivation Request, if any and trigger another Positioning Measurement Gap Activation/Deactivation Request according to the upper layer's request.The MAC entity shall,1>if Positioning Measurement Gap Activation/Deactivation Request MAC CE has been triggered, and not cancelled:2> if indication from upper layer has been received that the triggered Positioning Measurement Gap Activation/Deactivation Request MAC CE should be cancelled; or2> if the pre-configured measurement gap indicated in the Positioning Measurement Gap Activation/Deactivation Request MAC CE has already been activated/deactivated according to clause 5.18.20:3> cancel the triggered Positioning Measurement Gap Activation/Deactivation Request MAC CE.2> if UL-SCH resources are available for a new transmission and these UL-SCH resources can accommodate the Positioning Measurement Gap Activation/Deactivation Request MAC CE plus its subheader as a result of logical channel prioritization:3> instruct the Multiplexing and Assembly procedure to generate the Positioning Measurement Gap Activation/Deactivation Request MAC CE according to the upper layer's request;3> cancel triggered Positioning Measurement Gap Activation/Deactivation Request MAC CE.2> else:3> trigger a Scheduling Request for Positioning Measurement Gap Activation/Deactivation Request MAC CE as specified in clause 5.4.4. |
| Change 2 | 5.26 Positioning SRS transmission in RRC\_INACTIVE5.26.1 GeneralPeriodic and semi-persistent Positioning SRS can be configured for Positioning SRS transmission in RRC\_INACTIVE.The MAC entity shall, if the TA of the configured Positioning SRS is valid according to clause 5.26.2, and the conditions for positioning SRS transmission in clause 7.3.1 of TS 38.213 [6] and clause 6.2.1.4 of TS 38.214 [7] are satisfied:- instruct to the lower layer according to TS 38.214 [7] to transmit Positioning Periodic SRS or activated Semi-Persistent SRS according to clause 5.18.17,. |
| Change 3 | C: This field indicates whether the octets containing Resource Serving Cell ID field(s) and Resource BWP ID field(s) within the field Spatial Relation for Resource ID i are present, except for Spatial Relation Resource IDi with DL-PRS or SSB. When A/D is set to 1, if this field is set to 1, the octets containing Resource Serving Cell ID field(s) and Resource BWP ID field(s) in the field Spatial Relation for Resource IDi are present, otherwise if this field is set to 0, they are not present. When A/D is set to 0, this field is always set to 0 that they are not present; |

Rapporteur's Comment:

- For change 1, the correction is correct.

- For change 2, the clause 5.18.17 is the behaviour of how to Activation/Deactivation of Semi-Persistent Positioning SRS, it is not suitable to qualify the nouns “activated Semi-Persistent SRS”. The suggested wording online in last meeting seems better, i.e. “Semi-Persistent SRS that is activated according to clause 5.18.17”.

- For change 3, the editor change can be agreed.

- Issues on the coversheet:

The impact analysis should be moved to Summary of change.

**Proposal 5:** The corrections in CR
R2-2304803 Correction to MAC spec for Positoning Enhancements Huawei, HiSilicon, Ericsson, ZTE CR Rel-17 38.321 17.4.0 1614 - F NR\_pos\_enh-Core
are essential corrections.
For change 2, take the suggest wording “Semi-Persistent SRS that is activated according to clause 5.18.17” into consideration according to the comments at last meeting.
For the coversheet, the impact analysis should be moved to Summary of change.

# 4. Essential Corrections on RRC

|  |  |  |  |
| --- | --- | --- | --- |
| [6] | **R2-2305363** | Correction on PosSRS-RRC-Inactive-OutsideInitialUL-BWP | Huawei, HiSilicon |

It is stated in [6], the the meaning of the enumerated values for IE *maxSRSposBandwidthForEachSCS-withinCC-FR1-r17* and *maxSRSposBandwidthForEachSCS-withinCC-FR2-r17* are ambiguous. According to the definition in TS 38.306, the unit of this two parameters should be MHz.

|  |
| --- |
| ***posSRS-RRC-Inactive-OutsideInitialUL-BWP-r17***Indicates support of Positioning SRS transmission in RRC\_INACTIVE state configured outside initial UL BWP. The capability signalling comprises the following parameters:- *maxSRSposBandwidthForEachSCS-withinCC-FR1-r17* Indicates the maximum SRS bandwidth supported for each SCS that UE supports within a single CC for FR1*;*- *maxSRSposBandwidthForEachSCS-withinCC-FR2-r17* indicates the maximum SRS bandwidth supported for each SCS that UE supports within a single CC for FR2; |

|  |
| --- |
| –– *PosSRS-RRC-Inactive-OutsideInitialUL-BWP*The IE *PosSRS-RRC-Inactive-OutsideInitialUL-BWP* is used to convey the capabilities supported by the UE for Positioning SRS transmission in RRC\_INACTIVE state configured outside initial UL BWP.***PosSRS-RRC-Inactive-OutsideInitialUL-BWP* information element**-- ASN1START-- TAG-POSSRS-RRC-INACTIVE-OUTSIDEINITIALUL-BWP-STARTPosSRS-RRC-Inactive-OutsideInitialUL-BWP-r17::= SEQUENCE { -- R1 27-15b: Positioning SRS transmission in RRC\_INACTIVE state configured outside initial UL BWP maxSRSposBandwidthForEachSCS-withinCC-FR1-r17 ENUMERATED {mhz5, mhz10, mhz15, mhz20, mhz25, mhz30, mhz35, mhz40, mhz45, mhz50, mhz60, mhz70, mhz80, mhz90, mhz100} OPTIONAL, maxSRSposBandwidthForEachSCS-withinCC-FR2-r17 ENUMERATED {mhz50, mhz100, mhz200, mhz400} 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, switchingTimeSRS-TX-OtherTX-r17 ENUMERATED {us100, us140, us200, us300, us500} OPTIONAL, -- R1 27-15c: Support of positioning SRS transmission in RRC\_INACTIVE state outside initial BWP with semi-persistent SRS 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, ...}-- TAG-POSSRS-RRC-INACTIVE-OUTSIDEINITIALUL-BWP-STOP-- ASN1STOP |

Rapporteur's Comment:

- Firstly, according to description in 38.306, it cannot to determine that the unit of the values is MHz.

- Although the candidate values come from RAN1 in feature list, there is no unit for the candidate values in TS 38.882 (UE feature list) shown as below. But according to the common understanding of SRS resource bandwidth, the unit is MHz. This issue can be further confirmed by companies.

|  |
| --- |
| Component 1 candidate values:a) FR1 bands: {5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90, 100}b) FR2 bands: {50, 100, 200, 400} |

- Issues on the coversheet:

The reason for change in the coversheet is not sufficient.

 **Proposal 6:** For the correction in CR
R2-2305363 Correction on PosSRS-RRC-Inactive-OutsideInitialUL-BWP Huawei, HiSilicon CR Rel-17 38.331 17.4.0 4102 - F NR\_pos\_enh-Core
confirm online whether the unit of the maxSRSposBandwidthForEachSCS-withinCC-FR1-r17 and maxSRSposBandwidthForEachSCS-withinCC-FR2-r17 is MHz. If yes, this CR is essential correction.

# 5. Essential Corrections on Stage-2

|  |  |  |  |
| --- | --- | --- | --- |
| [7] | **R2-2306258** | Alert Limit | Nokia, Nokia Shanghai Bell |

It is stated in [7], the defination of AL is missed. [7] proposed to add the following defination in the stage 2 spec.

|  |
| --- |
| **Alert Limit (AL)**: The maximum allowable positioning error. If the positioning error is beyond this limit, the integrity results of the calculated location may not meet the LCS client service requirement. |

Rapporteur's Comment:

- The definition of AL needs to be illustrated. The change proposed in [3] is essential.

- Besides AL, the definition of TIR is also missed in all normative specifications. Suggest adding the definition of the AL and TIR according to the agreement achieved in RAN2#111.

Target Integrity Risk (TIR)

The probability that the positioning error exceeds the Alert Limit (AL) without warning the user within the required Time-to-Alert (TTA).

NOTE: The TIR is usually defined as a probability rate per some time unit (e.g. per hour, per second or per independent sample).

Alert Limit (AL)

The maximum allowable positioning error such that the positioning system is available for the intended application. If the positioning error is beyond the AL, operations are hazardous and the positioning system should be declared unavailable for the intended application to prevent loss of integrity.

NOTE: When the AL bounds the positioning error in the horizontal plane or on the vertical axis then it is called Horizontal Alert Limit (HAL) or Vertical Alert Limit (VAL) respectively.

- The impact analysis part should follow the prescribed format.

**Proposal 7-1:** The correction in CR
R2-2306258 Alert Limit Nokia, Nokia Shanghai Bell CR Rel-17 38.305 17.4.0 0136 - F NR\_pos\_enh-Core
is essential correction but RAN2 to further review the definition of AL following the agreement achieved in RAN2#111. Update the impact analysis to satisfy the prescribed format.

**Alert Limit (AL)**: The maximum allowable positioning error. If the positioning error is beyond this limit, the integrity results of the calculated location may not meet the LCS client service requirement.

**Proposal 7-2:** Beside the definition of AL, add the definition of TIR to this CR together.

# 6. Summary

*LPP CR:*

**Proposal 1:** The CR in

R2-2305895 Miscelaneous LPP Corrections Qualcomm Incorporated (Rapporteur) CR Rel-17 37.355 17.4.0 0448 - F NR\_pos\_enh-Core

is essential correction. Update the Cover Sheet: The index of Editorial errors remain in Consequences if not approved should be (3).

**Proposal 2-1:** The 1st change in CR

R2-2306025 Miscellaneous corrections and additions Ericsson, Fraunhofer IIS, Fraunhofer HHI CR Rel-17 37.355 17.4.0 0449 - F NR\_pos\_enh-Core

can be merged into rapporteur CR (LPP):

#### – *AreaID-CellList*

The IE *AreaID-CellList* provides the NR Cell-IDs of the TRPs belonging to a particular network area where the associated assistance data are valid. Each cell is included in only one area.

**Proposal 2-2:** The 2nd changes in CR

R2-2306025 Miscellaneous corrections and additions Ericsson, Fraunhofer IIS, Fraunhofer HHI CR Rel-17 37.355 17.4.0 0449 - F NR\_pos\_enh-Core

are not essential.

**Proposal 3:** RAN2 to discuss if this CR

R2-2306026 Missing finer periodicities than 1s Ericsson CR Rel-17 37.355 17.4.0 0450 - F NR\_pos\_enh-Core

is essential correction or can be postponed waiting for the ReportingInterval updated as ms in CT4.

**Proposal 4-1:** The 1st change as below in CR

R2-2306259 NR-TRP-LocationInfo for UE-based DL-TDOA and DL-AoD positioning Nokia, Nokia Shanghai Bell CR Rel-17 37.355 17.4.0 0454 - F NR\_pos\_enh-Core,

is essential correction.

***nr-TRP-LocationInfo***

This field provides the location coordinates of the TRPs and location coordinates of antenna reference points for DL-PRS Resource Set(s) and DL-PRS Resources of the TRPs.

#### *–* *NR-TRP-LocationInfo*

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

**Proposal 4-2:** The 2nd changes in CR

R2-2306259 NR-TRP-LocationInfo for UE-based DL-TDOA and DL-AoD positioning Nokia, Nokia Shanghai Bell CR Rel-17 37.355 17.4.0 0454 - F NR\_pos\_enh-Core

are editorial corrections and correct.

*MAC CR:*

**Proposal 5:** The corrections in CR
R2-2304803 Correction to MAC spec for Positoning Enhancements Huawei, HiSilicon, Ericsson, ZTE CR Rel-17 38.321 17.4.0 1614 - F NR\_pos\_enh-Core
are essential corrections.
For change 2, take the suggest wording “Semi-Persistent SRS that is activated according to clause 5.18.17” into consideration according to the comments at last meeting.
For the coversheet, the impact analysis should be moved to Summary of change.

*RRC CR:*

**Proposal 6:** For the correction in CR
R2-2305363 Correction on PosSRS-RRC-Inactive-OutsideInitialUL-BWP Huawei, HiSilicon CR Rel-17 38.331 17.4.0 4102 - F NR\_pos\_enh-Core
confirm online whether the unit of the maxSRSposBandwidthForEachSCS-withinCC-FR1-r17 and maxSRSposBandwidthForEachSCS-withinCC-FR2-r17 is MHz. If yes, this CR is essential correction.

 maxSRSposBandwidthForEachSCS-withinCC-FR1-r17 ENUMERATED {mhz5, mhz10, mhz15, mhz20, mhz25, mhz30, mhz35, mhz40, mhz45, mhz50, mhz60, mhz70, mhz80, mhz90, mhz100} OPTIONAL,

 maxSRSposBandwidthForEachSCS-withinCC-FR2-r17 ENUMERATED {mhz50, mhz100, mhz200, mhz400} OPTIONAL,

*Stage-2 CR:*

**Proposal 7-1:** The correction in CR
R2-2306258 Alert Limit Nokia, Nokia Shanghai Bell CR Rel-17 38.305 17.4.0 0136 - F NR\_pos\_enh-Core
is essential correction but RAN2 to further review the definition of AL following the agreement achieved in RAN2#111. Update the impact analysis to satisfy the prescribed format.

**Alert Limit (AL)**: The maximum allowable positioning error. If the positioning error is beyond this limit, the integrity results of the calculated location may not meet the LCS client service requirement.

**Proposal 7-2:** Beside the definition of AL, add the definition of TIR to this CR together.