**3GPP TSG-RAN WG2 Meeting #131 *R2-2506513***

**Bengaluru, India, Aug. 25th – 29th 2025**

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| *CR-Form-v12.3* | | | | | | | | |
| **CHANGE REQUEST** | | | | | | | | |
|  | | | | | | | | |
|  | **38.305** | **CR** | **0190** | **rev** | **1** | **Current version:** | **18.6.0** |  |
|  | | | | | | | | |
| *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 | **x** | Core Network | **x** |

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|  | | | | | | | | | | |
| ***Title:*** | Introduction of AIML Positioning | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Source to WG:*** | CATT | | | | | | | | | |
| ***Source to TSG:*** | R2 | | | | | | | | | |
|  |  | | | | | | | | | |
| ***Work item code:*** | NR\_AIML\_air-Core | | | | |  | ***Date:*** | | | 2025-09-01 |
|  |  | | | |  | |  | | |  |
| ***Category:*** | **B** |  | | | | | ***Release:*** | | | Rel-19 |
|  | *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-17 (Release 17) Rel-18 (Release 18) Rel-19 (Release 19)  Rel-20 (Release 20)* | |
|  |  | | | | | | | | | |
| ***Reason for change:*** | | Introduction of UE-based DL AI/ML positioning with UE-side model (case 1), NG-RAN node assisted positioning with gNB-side model (case 3a) and NG-RAN node assisted positioning with LMF-side model (case 3b) in Rel-19. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Summary of change:*** | | The following stage 2 descriptions have been added:   1. Functional Description of Elements for UE-based DL AI/ML positioning with UE-side model (case 1), NG-RAN node assisted positioning with gNB-side model (case 3a) and NG-RAN node assisted positioning with LMF-side model (case 3b). 2. Multi-RTT positioning and UL-TDOA positioning methods enhanced by AI/ML Model Inference. 3. New UE-based DL AI/ML positioning method enabled by AI/ML Model Inference. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Consequences if not approved:*** | | No support of UE-based DL AI/ML positioning with UE-side model (case 1), NG-RAN node assisted positioning with gNB-side model (case 3a) or NG-RAN node assisted positioning with LMF-side model (case 3b) in Rel-19. | | | | | | | | |
|  | |  | | | | | | | | |
| ***Clauses affected:*** | | 3.2, 4.3.1, 4.3.X, 5.4.1, 5.4.2, 5.4.4, 6.3.1, 7.13.1, 7.x, 8.10.1, 8.10.2.3, 8.10.2.4, 8.10.3.0, 8.10.3.2.2, 8.10.3.2.x, 8.13.1, 8.13.2.2, 8.13.2.3, 8.13.3.0, 8.13.3.3, 8.13.3.3b, 8.X | | | | | | | | |
|  | |  | | | | | | | | |
|  | | **Y** | **N** |  | | | |  | | |
| ***Other specs*** | | **x** |  | Other core specifications | | | | TS 37.355 CR 0559  TS 38.455 CR 0190  TS 38.473 CR 1575  TS 38.413 CR 1285  TS 38.401 CR 0477  TS 38.300 CR 1006 | | |
| ***affected:*** | |  | **x** | Test specifications | | | | TS/TR ... CR ... | | |
| ***(show related CRs)*** | |  | **x** | O&M Specifications | | | | TS/TR ... CR ... | | |
|  | |  | | | | | | | | |
| ***Other comments:*** | |  | | | | | | | | |
|  | |  | | | | | | | | |
| ***This CR's revision history:*** | | Rev0: R2-2505212  Rev1: Implementation of agreements from RAN2#131 and merging RAN3 TP R3-255976 | | | | | | | | |

*START OF CHANGES*

## 3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

5GC 5G Core Network

5GS 5G System

A-AoA Azimuth-Angle of Arrival

ADR Accumulated Delta Range

AI Artificial Intelligence

AL Alert Limit

AoA Angle of Arrival

AP Access Point

APC Antenna Phase Center

ARP Antenna Reference Point

BDS BeiDou Navigation Satellite System

BSSID Basic Service Set Identifier

CID Cell-ID (positioning method)

CLAS Centimetre Level Augmentation Service

DL-AoD Downlink Angle-of-Departure

DL-PRS Downlink Positioning Reference Signal

DL-RSCP Downlink Reference Signal Carrier Phase

DL-RSCPD Downlink Reference Signal Carrier Phase Difference

DL-TDOA Downlink Time Difference Of Arrival

DNU Do Not Use

DRX Discontinuous Reception

E-SMLC Enhanced Serving Mobile Location Centre

E-CID Enhanced Cell-ID (positioning method)

ECEF Earth-Centered, Earth-Fixed

ECI Earth-Centered-Inertial

eDRX Extended Discontinuous Reception

EGNOS European Geostationary Navigation Overlay Service

E-UTRAN Evolved Universal Terrestrial Radio Access Network

FDMA Frequency Division Multiple Access

FKP Flächenkorrekturparameter (Engl: Area Correction Parameters)

GAGAN GPS Aided Geo Augmented Navigation

GCS Global Coordinate System (as defined in TR 38.901 [55])

GLONASS GLObal'naya NAvigatsionnaya Sputnikovaya Sistema (Engl.: Global Navigation Satellite System)

GMLC Gateway Mobile Location Centre

GNSS Global Navigation Satellite System

GPS Global Positioning System

GRS80 Geodetic Reference System 1980

HESSID Homogeneous Extended Service Set Identifier

IOD Issue of Data

LCS LoCation Services

Local Coordinate System (as defined in TR 38.901 [55])

LCS-UP Location Services User Plane

LCS-UPP Location Services User Plane Protocol

LMF Location Management Function

LPP LTE Positioning Protocol

MAC Master Auxiliary Concept

MBS Metropolitan Beacon System

ML Machine Learning

MO-LR Mobile Originated Location Request

MT-LR Mobile Terminated Location Request

Multi-RTT Multi-Round Trip Time

NavIC NAVigation with Indian Constellation

NG-C NG Control plane

NG-AP NG Application Protocol

NI-LR Network Induced Location Request

N-RTK Network – Real-Time Kinematic

NRPPa NR Positioning Protocol A

NTN Non-Terrestrial Network

OTDOA Observed Time Difference Of Arrival

PCO Phase Center Offset

PCV Phase Center Variation

PDU Protocol Data Unit

posSI Positioning System Information

posSIB Positioning SIB

PPP Precise Point Positioning

PPP-RTK Precise Point Positioning – Real-Time Kinematic

PRS Positioning Reference Signal (for E-UTRA)

PRU Positioning Reference Unit

QZSS Quasi-Zenith Satellite System

RP Reception Point

RRM Radio Resource Management

RSPP Ranging/SL Positioning Protocol

RSRP Reference Signal Received Power

RSRPP Reference Signal Received Path Power

RSRQ Reference Signal Received Quality

RSSI Received Signal Strength Indicator

RSTD Reference Signal Time Difference

RTD Relative Time Difference

RTK Real-Time Kinematic

SBAS Space Based Augmentation System

SDT Small Data Transmission

SET SUPL Enabled Terminal

SIB System Information Block

SL Sidelink

SL-PRS Sidelink Positioning Reference Signal

SL-PRS-RSRP Sidelink PRS Reference Signal Received Power

SL-PRS-RSRPP Sidelink PRS Reference Signal Received Path Power

SL-RSTD Sidelink Reference Signal Time Difference

SL-RTOA Sidelink Relative Time of Arrival

SLP SUPL Location Platform

SLPP Sidelink Positioning Protocol

SP Semi-Persistent

SRS Sounding Reference Signal

SSB Synchronization Signal Block

SSID Service Set Identifier

SSR State Space Representation

STEC Slant TEC

SUPL Secure User Plane Location

TADV Timing Advance

TBS Terrestrial Beacon System

TEC Total Electron Content

TEG Timing Error Group

TP Transmission Point

TRP Transmission-Reception Point

TTA Time To Alert

TxTEG Tx Timing Error Group

UE User Equipment

UL-AoA Uplink Angle of Arrival

UL-RSCP Uplink Reference Signal Carrier Phase

UL-RTOA Uplink Relative Time of Arrival

UL-SRS Uplink Sounding Reference Signal

UL SRS-TDCP UL SRS Time Domain Channel Power

UL SRS-TDCT UL SRS Time Domain Channel Timing

UL-TDOA Uplink Time Difference of Arrival

UPF User Plane Function

URA User Range Accuracy

WAAS Wide Area Augmentation System

WGS-84 World Geodetic System 1984

WLAN Wireless Local Area Network

Z-AoA Zenith Angles of Arrival

*NEXT CHANGE*

## 4.3 Standard UE Positioning Methods

### 4.3.1 Introduction

The standard positioning methods supported for NG-RAN access are:

- network-assisted GNSS methods;

- observed time difference of arrival (OTDOA) positioning based on LTE signals;

- enhanced cell ID methods based on LTE signals;

- WLAN positioning;

- Bluetooth positioning;

- terrestrial beacon system (TBS) positioning;

- sensor based methods:

- barometric Pressure Sensor;

- motion sensor.

- NR enhanced cell ID methods (NR E-CID) based on NR signals;

- Multi-Round Trip Time Positioning (Multi-RTT based on NR signals);

- Downlink Angle-of-Departure (DL-AoD) based on NR signals;

- Downlink Time Difference of Arrival (DL-TDOA) based on NR signals;

- Uplink Time Difference of Arrival (UL-TDOA) based on NR signals;

- Uplink Angle-of-Arrival (UL-AoA), including A-AoA and Z-AoA based on NR signals;

- SL positioning and Ranging based on sidelink signals, incl.:

- Sidelink Round Trip Time Positioning (SL-RTT);

- Sidelink Angle-of-Arrival (SL-AoA);

- Sidelink Time Difference of Arrival (SL-TDOA);

- Sidelink Time of Arrival (SL-TOA).

- Downlink AI/ML positioning based on NR signals.

Hybrid positioning using multiple methods from the list of positioning methods above is also supported.

Standalone mode (e.g. autonomous, without network assistance) using one or more methods from the list of positioning methods above is also supported.

These positioning methods (except SL positioning and ranging methods) may be supported in UE-based, UE-assisted/LMF-based, and NG-RAN node assisted versions. Table 4.3.1-1 indicates which of these versions are supported in this version of the specification for the standardised positioning methods.

Table 4.3.1-1: Supported versions of UE positioning methods

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Method | UE-based | UE-assisted, LMF-based | NG-RAN node assisted | SUPL Note 8 |
| A-GNSS | Yes | Yes | No | Yes |
| OTDOA Note1, Note 2 | No | Yes | No | Yes |
| E-CID Note 4, Note 7 | No | Yes | Yes | Yes for E-UTRA |
| Sensor | Yes | Yes | No | No |
| WLAN | Yes | Yes | No | Yes |
| BluetoothNote 9 | Yes | Yes | No | No |
| TBS Note 5 | Yes | Yes | No | Yes (MBS) |
| DL-TDOA | Yes | Yes | No | Yes |
| DL-AoD | Yes | Yes | No | Yes |
| Multi-RTT | No | Yes | Yes | Yes |
| NR E-CID | No | Yes | Yes | Yes (DL NR E-CID) |
| UL-TDOA | No | No | Yes | Yes |
| UL-AoA | No | No | Yes | Yes |
| DL AI/ML | Yes | No | No | N/A |
| NOTE 1: This includes TBS positioning based on PRS signals.  NOTE 2: In this version of the specification only OTDOA based on LTE signals is supported.  NOTE 3: Void  NOTE 4: This includes Cell-ID for NR method when UE is served by gNB.  NOTE 5: In this version of the specification only for TBS positioning based on MBS signals.  NOTE 6: Void  NOTE 7: Enhanced Cell ID based on LTE signals.  NOTE 8: This shows whether the positioning method is supported by SUPL ULP [16].  NOTE 9: UE-based positioning mode is supported only for Bluetooth AoD positioning method. | | | | |

Sensor, WLAN, Bluetooth, and TBS positioning methods based on MBS signals are also supported in standalone mode, as described in the corresponding clauses.

The SL positioning and ranging methods may be supported in SL-Target UE-based or SL-Target UE-assisted/server-based mode, where "server" may be a SL Server UE or LMF. Table 4.3.1-2 indicates which of these versions are supported in this version of the specification for the SL positioning and ranging methods.

Table 4.3.1-2: Supported versions of SL positioning and ranging methods.

|  |  |  |
| --- | --- | --- |
| Method | SL-Target UE-based | SL-Target UE-assisted, server-based |
| SL-RTTNOTE 1 | Yes | Yes |
| SL-AoANOTE 2 | Yes | Yes |
| SL-TDOA | Yes | Yes |
| SL-TOA | Yes | Yes |
| NOTE 1: The SL-RTT method may also be used for ranging between UEs.  NOTE 2: The SL-AoA method may also be used to obtain direction between UEs. | | |

*NEXT CHANGE*

### 4.3.X DL AI/ML positioning

The DL AI/ML positioning method makes use of the downlink signals received from multiple TPs to determine AI/ML model input at the UE. The UE performs inference using AI/ML model with assistance data received from the positioning server and other configuration information to locate the UE.

The operation of the UE-based DL AI/ML positioning method is described in clause 8.X.

*NEXT CHANGE*

5.4 Functional Description of Elements Related to UE Positioning in NG-RAN

### 5.4.1 User Equipment (UE)

The UE may make measurements of downlink signals from NG-RAN, sidelink signals from other UEs, and other sources such as E-UTRAN, different GNSS and TBS systems, WLAN access points, Bluetooth beacons, UE barometric pressure and motion sensors. The measurements to be made will be determined by the chosen positioning method.

The UE may also contain LCS applications, or access an LCS application either through communication with a network accessed by the UE or through another application residing in the UE. This LCS application may include the needed measurement and calculation functions to determine the UE's position with or without network assistance. This is outside of the scope of this specification.

The UE may also, for example, contain an independent positioning function (e.g., GPS) and thus be able to report its position, independent of the NG-RAN transmissions. The UE with an independent positioning function may also make use of assistance information obtained from the network.

The UE may use AI/ML models to infer the UE location using measurements of downlink signals from NG-RAN.

5.4.2 gNB

The gNB is a network element of NG-RAN that may provide measurement information for a target UE and communicates this information to an LMF.

To support NR RAT-Dependent positioning, the gNB may make measurements of radio signals for a target UE, and provide measurement results for position estimation. A gNB may serve several TRPs, including for example remote radio heads, and UL-SRS only RPs and DL-PRS-only TPs. For NTN, a TRP may be located on board the satellite.

A gNB may host AI/ML models to infer the measurements from radio signals transmitted by a target UE. The AI/ML model that is used for measurement inference by the gNB may have been trained by the gNB.

A gNB may broadcast assistance data information, received from an LMF, in positioning System Information messages.

5.4.3 ng-eNB

The ng-eNB is a network element of NG-RAN that may provide measurement results for position estimation and makes measurements of radio signals for a target UE and communicates these measurements to an LMF.

The ng-eNB makes its measurements in response to requests from the LMF (on demand or periodically).

An ng-eNB may serve several TPs, including for example remote radio heads and PRS-only TPs for PRS-based TBS positioning for E-UTRA.

An ng-eNB may broadcast assistance data information, received from an LMF, in positioning System Information messages.

5.4.4 Location Management Function (LMF)

The LMF manages the support of different location services for target UEs, including positioning of UEs and delivery of assistance data to UEs. The LMF may interact with the serving gNB or serving ng-eNB for a target UE in order to obtain position measurements for the UE, including uplink measurements made by an NG-RAN and downlink measurements made by the UE that were provided to an NG-RAN as part of other functions such as for support of handover.

The LMF may interact with a target UE in order to deliver assistance data if requested for a particular location service, or to obtain a location estimate if that was requested.

The LMF may interact with multiple NG-RAN nodes to provide assistance data information for broadcasting. The assistance data information for broadcast may optionally be segmented and/or ciphered by the LMF. The LMF may also interact with AMFs to provide ciphering key data information to the AMF as described in greater detail in TS 23.273 [35].

For positioning of a target UE, the LMF decides on the position methods to be used, based on factors that may include the LCS Client type, the required QoS, UE positioning capabilities, gNB positioning capabilities and ng-eNB positioning capabilities. The LMF then invokes these positioning methods in the UE, serving gNB and/or serving ng‑eNB. The positioning methods may yield a location estimate for UE-based position methods and/or positioning measurements for UE-assisted and network-based position methods. The LMF may combine all the received results and determine a single location estimate for the target UE (hybrid positioning). Additional information like accuracy of the location estimate and velocity may also be determined.

The LMF may interact with the AMF to provide (updated) UE Positioning Capability to AMF and to receive stored UE Positioning Capability from AMF as described in TS 23.273 [35].

For NTN, the LMF is configured by the OAM with satellite related information (described in TS 38.300 [52]), as well as the association between TRP(s) and satellite(s), the association between gNB and TRP(s).

The LMF may host AI/ML models to infer the target UE location from measurement information received from gNBs. The AI/ML model that is used for UE location inference by the LMF may have been trained by the LMF.

The LMF may provide ground truth labels and related data to the gNB, if requested, for NG-RAN node assisted positioning with gNB side model, as specified in 7.x.

5.4.5 Positioning Reference Unit (PRU)

A Positioning Reference Unit (PRU) at a known location can perform positioning measurements (e.g., RSTD, RSRP, UE Rx-Tx Time Difference measurements, DL-RSCPD, DL-RSCP, etc.) and report these measurements to a location server. In addition, the PRU can transmit SRS to enable TRPs to measure and report UL positioning measurements (e.g., RTOA, UL-AoA, gNB Rx-Tx Time Difference, UL-RSCP, etc.) from PRU at a known location. The PRU measurements can be compared by a location server with the measurements expected at the known PRU location to determine correction terms for other nearby target devices. The DL- and/or UL location measurements for other target devices can then be corrected based on the previously determined correction terms.

PRU measurements may also be provided to the target device in the assistance data as described in clause 8.12.

From a location server perspective, the PRU functionality is realized by a UE with known location.

*NEXT CHANGE*

6.3 NG-RAN Node terminated protocols

6.3.1 NR Positioning Protocol A (NRPPa)

The NR Positioning Protocol A (NRPPa) carries information between the NG-RAN Node and the LMF. It is used to support the following positioning functions:

- E-CID for E-UTRA where measurements are transferred from the ng-eNB to the LMF.

- Data collection from ng-eNB's and gNB's for support of OTDOA positioning for E-UTRA.

- Cell-ID and Cell Portion ID retrieval from gNB's for support of NR Cell ID positioning method.

- Exchange of information between LMF and NG-RAN node for the purpose of assistance data broadcasting.

- NR E-CID where measurements are transferred from the gNB to the LMF.

- NR Multi-RTT where measurements are transferred from the gNB to the LMF.

- NR UL-AoA where measurements are transferred from the gNB to the LMF.

- NR UL-TDOA where measurements are transferred from the gNB to the LMF.

- Data collection from gNBs for support of DL-TDOA, DL-AoD, Multi-RTT, UL-TDOA, UL-AoA.

- Measurement Preconfiguration Information Transfer which allows the LMF to request the NG-RAN node to pre-configure and activate/deactivate measurement gap and/or PRS processing window.

- Area-specific SRS Information Transfer which allows the LMF to notify the NG-RAN node about area-specific SRS configuration information.

- Positioning Data Collection Information Transfer from LMF to gNB, e.g., to support NG-RAN node assisted positioning with gNB-side model.

The NRPPa protocol is transparent to the AMF. The AMF routes the NRPPa PDUs transparently based on a Routing ID corresponding to the involved LMF over NG-C interface without knowledge of the involved NRPPa transaction. It carries the NRPPa PDUs over NG-C interface either in UE associated mode or non-UE associated mode.

In case of a split gNB architecture, the NRPPa protocol is terminated at the gNB-CU.

*NEXT CHANGE*

## 7.13 Positioning Integrity

### 7.13.1 General

Positioning Integrity is supported for the following positioning methods:

- GNSS positioning methods as specified in clause 8.1;

- Multi-RTT positioning as specified in clause 8.10;

- DL-AoD positioning as specified in clause 8.11;

- DL-TDOA positioning as specified in clause 8.12;

- UL-TDOA positioning as specified in clause 8.13;

- UL-AoA positioning as specified in clause 8.14;

- DL AI/ML positioning as specified in clause 8.X.

NOTE: The local errors/threats associated with the UE and TRP measurements are implementation dependent. For UE-based mode, local UE errors/threats may be addressed by the UE when determining protection levels.   
For UE-assisted mode and network-based positioning, an LMF may address the UE and TRP local errors from UE and/or TRP measurement results. A specific method for determining local UE and TRP errors/threats is not specified as this is implementation defined.

*NEXT CHANGE*

## 7.x NG-RAN node assisted positioning with gNB side model

### 7.x.1 General

The gNB that supports NG-RAN node assisted positioning with gNB side model may require ground truth labels and related data from the LMF and measurements from the TRPs.

### 7.x.2 Positioning Data Collection Procedure

Figure 7.x.2-1 shows the Positioning Data Collection procedure used to collect positioning data information for a UE that is undergoing a positioning process.

Figure 7.x.2-1: Positioning Data Collection Procedure

1. The LMF sends the NRPPa MEASUREMENT REQUEST message to one or more gNBs according to UL related positioning procedures described in clause 8.

2. The gNB(s) determines that data collection is needed for the UE being positioned.

3. The gNB(s) sends the NRPPa MEASUREMENT RESPONSE message to the LMF and indicates that data collection is needed for the UE being positioned.

NOTE: Steps 1 to 3 may occur while the LMF performs one or more of the positioning procedures described in clause 8. The gNB may use the NRPPa MEASUREMENT REPORT message to indicate that data collection is needed.

4. The LMF sends a NRPPa POSITIONING DATA COLLECTION REPORT message to the gNB(s) which indicated in step 3 that positioning data collection is needed.

*NEXT CHANGE*

# 8 Positioning methods and Supporting Procedures

[…]

8.10 Multi-RTT positioning

8.10.1 General

In the Multi-RTT positioning method, the UE position is estimated based on measurements performed at both, UE and TRPs. The measurements performed at the UE and TRPs are UE/gNB Rx-Tx time difference measurements (and optionally DL-PRS-RSRP, DL-PRS-RSRPP, UL-SRS-RSRP, UL-SRS-RSRPP, and/or DL-RSCP/UL-RSCP) of DL-PRS and UL-SRS, which are used by an LMF to determine the RTTs.

The gNB Rx-Tx time difference measurements may also be derived by the AI/ML Model Inference located at the gNB.

For network verification of UE location in NTN, the measurements can be performed at a single TRP at different time instances. The additional measurements performed at UE are the UE Rx – Tx time difference subframe offset in unit of subframe and the DL timing drift due to Doppler in service link between UE and satellite as defined in TS 38.215 [37].

The UE may require measurement gaps to perform the Multi-RTT measurements from NR TRPs. The UE may request measurement gaps from a gNB using the procedure described in clause 7.4.1.1. The UE may also request to activate pre-configured measurement gaps as described in clause 7.7.2.

NOTE: Multi-RTT positioning with aperiodic or semi-persistent SRS is not supported for a U2N Remote UE.

[…]

8.10.2.3 Information that may be transferred from the gNB to LMF

[…]

The measurement results that may be signalled from gNBs to the LMF is listed in Table 8.10.2.3-3.

Table 8.10.2.3-3: Measurement results that may be transferred from gNBs to the LMF

|  |
| --- |
| **Measurement results** |
| NCGI and TRP ID of the measurement |
| gNB Rx-Tx time difference measurement NOTE 2 |
| UL-SRS-RSRP |
| UL-SRS-RSRPP |
| UL-RSCP measurement |
| UL Angle of Arrival (azimuth and/or elevation) NOTE 1 |
| Multiple UL Angle of Arrival (azimuth and/or elevation) NOTE 1 |
| SRS Resource Type |
| Time stamp of the measurement |
| Quality for each measurement |
| Beam Information of the measurement |
| LoS/NLoS information for each measurement NOTE 2 |
| ARP ID of the measurement |
| Mobile TRP Location Information |
| Measured frequency hops |
| Aggregated positioning SRS resource ID list |
| Measurement based on aggregated resources indication |
| NOTE 1: When used with UL-AoA for hybrid positioning.  NOTE 2: These measurements may also be inferred. |

#### 8.10.2.4 Information that may be transferred from the LMF to gNBs

The requested UL-SRS transmission characteristics information that may be signalled from the LMF to the gNB is listed in Table 8.10.2.4-1.

Table 8.10.2.4-1: Requested UL-SRS transmission characteristics information that may be transferred from LMF to gNB.

|  |
| --- |
| Information |
| Number Of Transmissions/duration for which the UL-SRS is requested |
| Bandwidth |
| Resource type (periodic, semi-persistent, aperiodic) |
| Number of requested SRS resource sets and SRS resources per set |
| Pathloss reference:  - PCI, SSB Index  - DL-PRS ID, DL-PRS Resource Set ID, DL-PRS Resource ID |
| Spatial relation info  - PCI, SSB Index  - DL-PRS ID, DL-PRS Resource Set ID, DL-PRS Resource ID  - NZP CSI-RS Resource ID  - SRS Resource ID  - Positioning SRS Resource ID |
| Periodicity of the SRS for each SRS resource set |
| SSB Information |
| Carrier frequency of SRS transmission bandwidth |
| Bandwidth aggregation request indication |
| Positioning validity area cell list |
| Validity area specific SRS information |

The TRP measurement request information that may be signalled from the LMF to the gNBs is listed in Table 8.10.2.4-2.

Table 8.10.2.4-2: TRP Measurement request information that may be transferred from LMF to gNBs.

|  |
| --- |
| Information |
| TRP ID, and NCGI of the TRP to receive UL-SRS |
| UE-SRS configuration |
| UL timing information together with timing uncertainty, for reception of SRS by candidate TRPs |
| Report characteristics for the measurements |
| Measurement Quantities |
| Measurement periodicity and amount |
| Measurement beam information request |
| Search window information |
| Expected UL AoA/ZoA and uncertainty range |
| Number of TRP Rx TEGs |
| Number of TRP RxTx TEGs |
| Response time |
| Measurement characteristics request indicator |
| Measurement time occasions for a measurement instance |
| Time window information for measurements |

The Positioning Activation/Deactivation request information that may be signalled from the LMF to the gNB is listed in Table 8.10.2.4-3.

Table 8.10.2.4-3: Requested positioning activation/deactivation information that may be transferred from LMF to gNB.

|  |
| --- |
| Information |
| SP UL-SRS:  - Activation or Deactivation request  - Positioning SRS Resource Set ID which is to be activated/deactivated  - Spatial relation for Resource IDi  - Activation Time |
| Aperiodic UL-SRS  - Aperiodic SRS Resource Trigger List  - Activation Time |
| UL-SRS:  - Release all |

The positioning data information for data collection that may be signalled from the LMF to the gNB is listed in Table 8.10.2.4-x.

Table 8.10.2.4-x: Positioning data information for data collection that may be transferred from LMF to gNB.

|  |
| --- |
| Information |
| TRP ID for which the ground-truth label data are provided |
| gNB Rx-Tx time difference ground-truth label |
| LoS/NLoS information ground-truth label |
| Time Stamp when the ground-truth label data are valid |
| Quality information of the ground-truth label data |

[…]

8.10.3 Multi-RTT Positioning Procedures

8.10.3.0 General

The procedures described in this clause support Multi-RTT positioning measurements obtained by the UE and TRPs/gNB.

The procedures for data collection e.g., to support NG-RAN node assisted positioning with gNB-side model for Multi-RTT positioning measurement inference are described in Clause 7.x.

[…]

#### 8.10.3.2 Procedures between LMF and gNB

[…]

##### 8.10.3.2.2 Location Information Transfer/Assistance Data Transfer Procedure

The purpose of this procedure is to enable the LMF to request position measurements from a gNB for position calculation of the UE and also provide necessary assistance data to the gNB.

Figure 8.10.3.2.2-1 shows the messaging between the LMF and the gNB to perform this procedure.



Figure 8.10.3.2.2-1: LMF-initiated Location Information Transfer Procedure

(1) The LMF sends a NRPPa message to the selected gNB to request Multi-RTT measurement information. The message includes any information required for the gNB to perform the measurements as defined in Table 8.10.2.4-2.

(2) If the report characteristics in step 1 is set to "on demand", the gNB obtains the requested Multi-RTT measurements and returns them in a Measurement Response message to the LMF. The Measurement Response message includes the obtained Multi-RTT measurements as defined in Table 8.10.2.3-3.

If the report characteristics in step 1 is set to "periodic", the gNB replies with a Measurement Response message without including any measurements in the message. The gNB then periodically initiates the Measurement Report procedure in step 3 for the Multi-RTT measurements, with the requested reporting periodicity.  
  
If the gNB is not able to accept the Measurement Request message in step 1, the gNB returns a failure message indicating the cause of the failure.

NOTE: The Measurement Response and Measurement Report message may also include an indication that positioning data collection is needed as described in clause 7.x.2.

(3) The gNB periodically provides the Multi-RTT measurements as defined in Table 8.10.2.3-3. to the LMF if that was requested at step 1.

(4) At any time after step 2, the LMF may send a Measurement Update message to the gNB providing updated information required for the gNB to perform the Multi-RTT measurements as defined in Table 8.10.2.4-2. Upon receiving the message, the gNB overwrites the previously received measurement configuration information.

(5) If the previously requested Multi-RTT measurements can no longer be reported, the gNB notifies the LMF by sending a Measurement Failure Indication message.

(6) When the LMF wants to abort an ongoing Multi-RTT measurement it sends a Measurement Abort message to the gNB.

[…]

##### 8.10.3.2.x Positioning Data Collection Information Transfer Procedure

The purpose of this procedure is to enable the LMF to provide positioning data information to the gNB e.g., to support NG-RAN node assisted positioning with gNB-side model.

Figure 8.10.3.2.x-1 shows the messaging between the LMF and the gNB to perform this procedure.



Figure 8.10.3.2.x-1: Positioning Data Collection Information Transfer Procedure.

1. The LMF sends the NRPPa Positioning Data Collection Report message to the gNB which previously requested Positioning Data Information in a NRPPa Measurement Response or Measurement Report message as described in clause 8.10.3.2.2. The message contains the ground-truth label information as listed in Table 8.10.2.4-x. If the LMF is not able to provide the requested data, the LMF provides an appropriate reason in the NRPPa Positioning Data Collection Report message.

[…]

*NEXT CHANGE*

8.13 UL-TDOA positioning

8.13.1 General

In the UL-TDOA positioning method, the UE position is estimated based on UL-RTOA (and optionally UL-SRS-RSRP and/or UL-SRS-RSRPP and/or UL-RSCP) measurements taken at different TRPs of uplink radio signals from UE, along with other configuration information.

The UL-RTOA measurements may also be derived by the AI/ML Model Inference located at the gNB.

The LMF may also use a trained AI/ML model hosted by the LMF to infer directly the UE location using the TRP measurements.

The specifics of any UL-TDOA positioning methods or techniques used to estimate the UE's location from these measurements are beyond the scope of this specification.

In order to obtain uplink measurements, the TRPs need to know the characteristics of the SRS signal transmitted by the UE for the time period required to perform uplink measurement. These characteristics should be static over the periodic transmission of SRS during the uplink measurements. Hence, the LMF will indicate to the serving gNB the need to direct the UE to transmit SRS signals for uplink positioning. It is up to the serving gNB to make the final decision on resources to be assigned and to communicate this SRS configuration information back to the LMF so that LMF can forward the SRS configuration to the TRPs. The gNB may decide (e.g., in case no resources are available) to configure no resources for the UE and report the empty resource configuration to the LMF.

NOTE: UL-TDOA positioning with aperiodic or semi-persistent SRS is not supported for a U2N Remote UE.

[…]

8.13.2 Information to be transferred between NG-RAN/5GC Elements

This clause defines the information that may be transferred between LMF and gNB/TRPs.

[…]

8.13.2.2 Location Information that may be transferred from the gNBs to LMF

The information that may be transferred from gNBs to the LMF include measurement results listed in Table 8.13.2.2-1. The individual measurements are defined in TS 38.215 [37].

Table 8.13.2.2-1: Measurement results that may be transferred from gNBs to the LMF

|  |
| --- |
| **Measurement results** |
| NCGI and TRP ID of the measurement |
| UL-RTOA NOTE 2 |
| UL-SRS-RSRP |
| UL-SRS-RSRPP |
| UL-RSCP measurement |
| UL Angle of Arrival (azimuth and/or elevation) NOTE 1 |
| Multiple UL Angle of Arrival (azimuth and/or elevation) NOTE 1 |
| SRS Resource Type |
| Time stamp of the measurement |
| Quality for each measurement |
| Beam Information for each measurement |
| LoS/NLoS information for each measurement NOTE 2 |
| ARP ID of the measurement |
| Mobile TRP Location Information |
| Measured frequency hops |
| Aggregated positioning SRS resource ID list |
| Measurement based on aggregated resources indication |
| Time domain channel measurements (additional-path list or UL SRS TDCT/UL SRS TDCP) NOTE 3 |
| NOTE 1: When used with UL-AoA for hybrid positioning.  NOTE 2: These measurements may also be inferred.  NOTE 3: These measurements may be used by an LMF to directly infer the UE’s location. |

8.13.2.3 Information that may be transferred from the LMF to gNBs

The requested UL-SRS transmission characteristics information that may be signalled from the LMF to the gNB is listed in Table 8.13.2.3-1.

Table 8.13.2.3-1: Requested UL-SRS transmission characteristics information that may be transferred from LMF to gNB.

|  |
| --- |
| **Information** |
| Number Of Transmissions/duration for which the UL-SRS is requested |
| Bandwidth |
| Resource type (periodic, semi-persistent, aperiodic) |
| Pathloss reference:  - PCI, SSB Index, SSB configuration (time/frequency occupancy of SSBs)  - DL-PRS ID, DL-PRS Resource Set ID, DL-PRS Resource ID |
| Spatial relation info  - PCI, SSB Index, SSB configuration (time/frequency occupancy of SSBs)  - DL-PRS ID, DL-PRS Resource Set ID, DL-PRS Resource ID  - NZP CSI-RS Resource ID  - SRS Resource ID  - Positioning SRS Resource ID |
| SSB Information |
| Periodicity of the SRS for each SRS resource set |
| Carrier frequency of SRS transmission bandwidth |
| Bandwidth aggregation request indication |
| Positioning validity area cell list |
| Validity area specific SRS information |

The TRP measurement request information that may be signalled from the LMF to the gNB is listed in table 8.13.2.3-2.

Table 8.13.2.3-2: TRP Measurement request information that may be transferred from LMF to gNB.

|  |
| --- |
| **Information** |
| TRP ID, cell ID of the TRP to receive UL-SRS |
| UE-SRS configuration |
| UL timing information together with timing uncertainty, for reception of SRS by candidate TRPs |
| Report characteristics for the measurements |
| Measurement Quantities |
| Measurement periodicity and amount |
| Measurement beam information request |
| Search window information |
| Expected UL AoA/ZoA and uncertainty range |
| Number of TRP Rx TEGs |
| Response time |
| Measurement characteristics request indicator |
| Measurement time occasions for a measurement instance |
| Time window information for measurements |
| Information on time window size and number of channel response samples for UL SRS-TDCT. |

The Positioning Activation/Deactivation request information that may be signalled from the LMF to the gNB is listed in Table 8.13.2.3-3.

Table 8.13.2.3-3: Requested positioning activation/deactivation information that may be transferred from LMF to gNB.

|  |
| --- |
| **Information** |
| SP UL-SRS:  - Activation or Deactivation request  - Positioning SRS Resource Set ID which is to be activated/deactivated  - Spatial relation for Resource IDi  - Activation Time |
| Aperiodic UL-SRS:  - Aperiodic SRS Resource Trigger List  - Activation time |
| UL-SRS:  - Release all |

The positioning data information for data collection that may be signalled from the LMF to the gNB is listed in Table 8.13.2.3-x.

Table 8.13.2.3-x: Positioning data information for data collection that may be transferred from LMF to gNB.

|  |
| --- |
| Information |
| TRP ID for which the ground-truth label data are provided |
| UL-RTOA ground-truth label |
| LoS/NLoS information ground-truth label |
| Time Stamp when the ground-truth label data are valid |
| Quality information of the ground-truth label data |

[…]

8.13.3 UL-TDOA Positioning Procedures

8.13.3.0 General

The procedures described in this clause support UL-TDOA positioning measurements obtained by the gNB and provided to the LMF using NRPPa.

The procedures for data collection e.g., to support NG-RAN node assisted positioning with gNB-side model for UL-TDOA measurement inference are described in Clause 7.x.

The procedures for data collection to support direct positioning with LMF-side model are described in TS 23.273 [35].

[…]

#### 8.13.3.3 Location Information Transfer/Assistance Data Transfer Procedure

The purpose of this procedure is to enable the LMF to request position measurements from a gNB for position calculation of the UE and also provide necessary assistance data to the gNB.

Figure 8.13.3.3-1 shows the messaging between the LMF and the gNB to perform this procedure.



Figure 8.13.3.3-1: LMF-initiated Location Information Transfer Procedure

(1) The LMF sends a NRPPa message to the selected gNB to request UL-TDOA measurement information. The message includes any information required for the gNB to perform the measurements as defined in Table 8.13.2.3-2.

(2) If the report characteristics in step 1 is set to "on demand", the gNB obtains the requested UL-TDOA measurements and returns them in a Measurement Response message to the LMF. The Measurement Response message includes the obtained UL-TDOA measurements as defined in Table 8.13.2.2-1.

If the report characteristics in step 1 is set to "periodic", the gNB replies with a Measurement Response message without including any measurements in the message. The gNB then periodically initiates the Measurement Report procedure in step 3 for the UL-TDOA measurements, with the requested reporting periodicity.  
  
If the gNB is not able to accept the Measurement Request message in step 1, the gNB returns a failure message indicating the cause of the failure.

NOTE: The Measurement Response and Measurement Report message may also include an indication that positioning data information is needed as described in clause 7.x.2.

(3) The gNB periodically provides the UL-TDOA measurements as defined in Table 8.13.2.2-1 to the LMF if that was requested at step 1.

(4) At any time after step 2, the LMF may send a Measurement Update message to the gNB providing updated information required for the gNB to perform the UL-TDOA measurements as defined in Table 8.13.2.3-2. Upon receiving the message, the gNB overwrites the previously received measurement configuration information.

(5) If the previously requested UL-TDOA measurements can no longer be reported, the gNB notifies the LMF by sending a Measurement Failure Indication message.

(6) When the LMF wants to abort an ongoing UL-TDOA measurement it sends a Measurement Abort message to the gNB.

[…]

#### 8.13.3.3b Positioning Data Collection Information Transfer Procedure

The purpose of this procedure is to enable the LMF to provide positioning data information to the gNB e.g., to support NG-RAN node assisted positioning with gNB-side model.

Figure 8.13.3.3b-1 shows the messaging between the LMF and the gNB to perform this procedure.



Figure 8.13.3.3b-1: Positioning Data Collection Information Transfer Procedure.

1. The LMF sends the NRPPa Positioning Data Collection Report message to the gNB which previously requested Positioning Data Information in a NRPPa Measurement Response or Measurement Report message as described in clause 8.13.3.3. The message contains the ground-truth label information as listed in Table 8.13.2.3-x. If the LMF is not able to provide the requested data, the LMF provides an appropriate reason in the NRPPa Positioning Data Collection Report message.

*NEXT CHANGE*

## 8.X UE-based DL AI/ML positioning

### 8.X.1 General

In the DL AI/ML positioning method, the UE position is inferred as an output of the AI/ML model.

The inference technique using AI/ML model for UE positioning is up to implementation and beyond the scope of this specification.

### 8.X.2 Information to be transferred between NG-RAN/5GC Elements

#### 8.X.2.0 General

This clause defines the information that may be transferred between LMF and UE/gNB.

#### 8.X.2.1 Information that may be transferred from the LMF to UE

##### 8.X.2.1.0 General

The information that may be transferred from the LMF to the UE are listed in table 8.X.2.1.0-1.

Table 8.X.2.1.0-1: Assistance data that may be transferred from LMF to the UE

|  |
| --- |
| Information |
| Physical cell IDs (PCIs), global cell IDs (GCIs), ARFCN, and PRS IDs of candidate NR TRPs for measurement |
| Timing relative to the serving (reference) TRP of candidate NR TRPs |
| DL-PRS configuration of candidate NR TRPs |
| Indication of which DL-PRS Resource Sets across DL-PRS positioning frequency layers are linked for DL-PRS bandwidth aggregation |
| SSB information of the TRPs (the time/frequency occupancy of SSBs) |
| Spatial direction information (e.g. azimuth, elevation etc.) of the DL-PRS Resources of the TRPs served by the gNB |
| Geographical coordinates of the TRPs served by the gNB (include a transmission reference location for each DL-PRS Resource ID, reference location for the transmitting antenna of the reference TRP, relative locations for transmitting antennas of other TRPs) |
| Associated ID for the TRPs |
| Fine Timing relative to the serving (reference) TRP of candidate NR TRPs |
| PRS-only TP indication |
| The association information of DL-PRS resources with TRP Tx TEG ID |
| LOS/NLOS indicators |
| On-Demand DL-PRS-Configurations, possibly together with information on which configurations are available for DL-PRS bandwidth aggregation |
| Validity Area of the Assistance Data |
| PRU measurements together with the location information of the PRU |
| Data facilitating the integrity results determination of the calculated location |

##### 8.X.2.1.1 Mapping of integrity parameters

Table 8.X.2.1.1-1 shows the mapping between the integrity fields and the assistance data according to the Integrity Principle of Operation (Clause 7.13.2). The corresponding field descriptions for each of the field names listed in Table 8.X.2.1.1-1 are specified in TS 37.355 [42].

Table 8.X.2.1.1-1: Mapping of Integrity Parameters

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Error | NR Assistance Data | Integrity Fields | | | | |
| Integrity Alerts | Integrity Bounds (Mean) | Integrity Bounds (StdDev) | Residual Risks | Integrity Correlation Times |
| TRP location | *NR-TRP-LocationInfo* | TRP DNU | Mean TRP/ARP location error | Standard deviation TRP/ARP location error | Probability of Onset of TRP fault  Mean TRP fault duration | TRP/ARP location error correlation time |
| Inter-TRP synchronization | *NR-RTD-Info* | RTD DNU | Mean RTD error | Standard deviation RTD error | RTD error correlation time |

#### 8.X.2.2 Information that may be transferred from the UE to LMF

##### 8.X.2.2.0 General

The information that may be signalled from UE to the LMF is listed in Table 8.X.2.2.0-1.

Table 8.X.2.2.0-1: Measurement results that may be transferred from UE to the LMF

|  |
| --- |
| Information |
| Latitude/Longitude/Altitude, together with uncertainty shape |
| Time stamp of location estimate |
| Protection Level, optionally together with achievable Target Integrity Risk |

#### 8.X.2.3 Information that may be transferred from the gNB to LMF

##### 8.X.2.3.0 General

The assistance data that may be transferred from gNB to the LMF is listed in Table 8.X.2.3.0-1.

Table 8.X.2.3.0-1: Assistance data that may be transferred from gNB to the LMF

|  |
| --- |
| Information |
| PCI, GCI, ARFCN, and TRP IDs of the TRPs served by the gNB |
| Timing information of TRPs served by the gNB |
| DL-PRS configuration of the TRPs served by the gNB |
| Indication of which DL-PRS Resource Sets across DL-PRS positioning frequency layers are linked for DL-PRS bandwidth aggregation |
| SSB information of the TRPs (the time/frequency occupancy of SSBs) |
| Spatial direction information of the DL-PRS Resources of the TRPs served by the gNB |
| Geographical coordinates information of the DL-PRS Resources of the TRPs served by the gNB |
| TRP type |
| On-demand DL-PRS information, possibly together with information on which configurations are available for DL-PRS bandwidth aggregation |
| TRP Tx TEG association information |
| Mobile TRP Location Information |
| Mobile IAB-MT UE ID NOTE 1 |
| NOTE 1: If TRP Type is Mobile TRP. |

### 8.X.3 DL AI/ML Positioning Procedures

#### 8.X.3.0 General

The procedures described in this clause support UE-based DL AI/ML positioning.

#### 8.X.3.1 Procedures between LMF and UE

##### 8.X.3.1.1 Capability Transfer Procedure

The Capability Transfer procedure for DL AI/ML positioning is described in clause 7.1.2.1.

For the DL AI/ML positioning, the LPP Capability Indication procedure, i.e., the unsolicited capability transfer, enables the UE to indicate to the LMF whether the DL AI/ML positioning method is applicable, as determined by the UE based on assistance data provided by the LMF as defined in Table 8.X.2.1.0-1, UE-side internal conditions and model availability in the UE. When the applicability of the DL AI/ML positioning method changes, the UE reports updated information of applicability.

##### 8.X.3.1.2 Assistance Data Transfer Procedure

###### 8.X.3.1.2.0 General

The purpose of this procedure is to enable the LMF to provide assistance data to the UE (e.g., as part of a positioning procedure) and the UE to request assistance data from the LMF (e.g., as part of a positioning procedure). The LMF may provide the pre-configured DL-PRS assistance data (with associated validity criteria) to the UE (before or during an ongoing LPP positioning session), to be utilized for potential positioning measurements at a future time. Pre-configured DL-PRS assistance data may consist of multiple instances, where each instance is applicable to a different area within the network. One or more assistance data instances may be provided. Each instance is provided in one LPP Assistance Data message.

If a UE receives assistance data for a TRP for which it has already stored assistance data, it overwrites the stored assistance data, whereas if a UE receives assistance data for a TRP for which it has not stored assistance data, it stores the assistance data for the TRP and maintains the already stored assistance data for other TRPs. The TRPs are uniquely identified using a combination of PRS-ID and Cell-ID. The number TRPs for which the UE can store Assistance Data is a UE capability and is indicated by the number of areas a UE can support.

###### 8.X.3.1.2.1 LMF initiated Assistance Data Delivery

Figure 8.X.3.1.2.1-1 shows the Assistance Data Delivery operations for the DL AI/ML positioning method when the procedure is initiated by the LMF.



Figure 8.X.3.1.2.1-1: LMF-initiated Assistance Data Delivery Procedure

1. The LMF determines that assistance data needs to be provided to the UE (e.g., as part of a positioning procedure) and sends an LPP Provide Assistance Data message to the UE. This message may include any of the DL AI/ML positioning assistance data defined in Table 8.X.2.1.0-1.

###### 8.X.3.1.2.2 UE initiated Assistance Data Transfer

Figure 8.X.3.1.2.2-1 shows the Assistance Data Transfer operations for the DL AI/ML positioning method when the procedure is initiated by the UE.



Figure 8.X.3.1.2.2-1: UE-initiated Assistance Data Transfer Procedure

(1) The UE determines that certain DL AI/ML positioning assistance data are desired (e.g., as part of a positioning procedure when the LMF provided assistance data are not sufficient for the UE to fulfil the request) and sends an LPP Request Assistance Data message to the LMF. This request includes an indication of which specific AI/ML assistance data are requested. Additional information concerning the UE's approximate location and serving and neighbour cells may also be provided in the Request Assistance Data message and/or in an accompanying Provide Location Information message to help the LMF provide appropriate assistance data. This additional data may include the UE's last known location if available, the cell IDs of the UE serving NG-RAN node and possibly neighbour NG-RAN nodes, as well as NR E-CID measurements.

(2) The LMF provides the requested assistance in an LPP Provide Assistance Data message, if available at the LMF. If any of the UE requested assistance data in step (1) are not provided in step 2, the UE shall assume that the requested assistance data are not supported, or currently not available at the LMF. If none of the UE requested assistance data in step (1) can be provided by the LMF, return any information that can be provided in an LPP message of type Provide Assistance Data which includes a cause indication for the not provided assistance data.

##### 8.X.3.1.3 Location Information Transfer Procedure

###### 8.X.3.1.3.0 General

The purpose of this procedure is to enable the LMF to request the UE location inferred by the UE.

###### 8.X.3.1.3.1 LMF-initiated Location Information Transfer Procedure

Figure 8.X.3.1.3.1-1 shows the Location Information Transfer operations for the DL AI/ML positioning method when the procedure is initiated by the LMF.



Figure 8.X.3.1.3.1-1: LMF-initiated Location Information Transfer Procedure

(1) The LMF sends an LPP Request Location Information message to the UE. This request includes an indication of AI/ML inference for location coordinates.

(2) The UE then sends an LPP Provide Location Information message to the LMF, and includes the inferred location coordinates. If the UE is unable to perform the DL AI/ML positioning, the UE returns LPP Provide Location Information message with error cause.

#### 8.X.3.2 Procedures between LMF and gNB

##### 8.X.3.2.1 Assistance Data Delivery procedure

###### 8.X.3.2.1.0 General

The purpose of this procedure is to enable the gNB to provide assistance data to the LMF, for subsequent delivery to the UE using the procedures of clause 8.X.3.1.2.

###### 8.X.3.2.1.1 LMF-initiated assistance data delivery to the LMF

Figure 8.X.3.2.1.1-1 shows the TRP Information Exchange operation from the gNB to the LMF for the DL AI/ML positioning method.



Figure 8.X.3.2.1.1-1: LMF-initiated TRP Information Exchange Procedure

(1) The LMF determines that certain TRP configuration information is desired (e.g., as triggered by OAM) and sends an NRPPa TRP INFORMATION REQUEST message to the gNB. This request includes an indication of which specific TRP configuration information is requested.

(2) The gNB provides the requested TRP information in an NRPPa TRP INFORMATION RESPONSE message, if available at the gNB. If the gNB is not able to provide any information, it returns an TRP INFORMATION FAILURE message indicating the cause of the failure.

*END OF CHANGE*