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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

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shall not indicates an interdiction (prohibition) to do something

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may indicates permission to do something

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can indicates that something is possible

cannot indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

will indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

will not indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document

might indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

might not indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

is (or any other verb in the indicative mood) indicates a statement of fact

is not (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

1 Scope

The present document specifies the stage 3 protocol and data model for the Nlmf Service Based Interface. It provides stage 3 protocol definitions and message flows, and specifies the API for each service offered by the LMF.

The 5G System stage 2 architecture and procedures are specified in 3GPP TS 23.501 [2] and 3GPP TS 23.502 [3].

The Technical Realization of the Service Based Architecture and the Principles and Guidelines for Services Definition are specified in 3GPP TS 29.500 [4] and 3GPP TS 29.501 [5].

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".

[3] 3GPP TS 23.502: "Procedures for the 5G System; Stage 2".

[4] 3GPP TS 29.500: "5G System; Technical Realization of Service Based Architecture; Stage 3".

[5] 3GPP TS 29.501: "5G System; Principles and Guidelines for Services Definition; Stage 3".

[6] IETF RFC 4776: "Dynamic Host Configuration Protocol (DHCPv4 and DHCPv6) Option for Civic Addresses Configuration Information".

[7] IETF RFC 5139: "Revised Civic Location Format for Presence Information Data Format Location Object (PIDF-LO)".

[8] 3GPP TS 29.571: "5G System; Common Data Types for Service Based Interfaces; Stage 3".

[9] 3GPP TS 33.501: "Security architecture and procedures for 5G system".

[10] IETF RFC 6749: "The OAuth 2.0 Authorization Framework".

[11] 3GPP TS 29.510: "Network Function Repository Services; Stage 3".

[12] IETF RFC 9113: "HTTP/2".

[13] IETF RFC 8259: "The JavaScript Object Notation (JSON) Data Interchange Format".

[14] OpenAPI Initiative, "OpenAPI Specification Version 3.0.0", https://spec.openapis.org/oas/v3.0.0.

[15] IETF RFC 9457: "Problem Details for HTTP APIs".

[16] 3GPP TR 21.900: "Technical Specification Group working methods".

[17] 3GPP TS 22.071: "Location Services (LCS); Service description; Stage 1".

[18] 3GPP TS 29.002: "Mobile Application Part (MAP) specification".

[19] 3GPP TS 23.273: "5G System (5GS) Location Services (LCS); Stage 2".

[20] 3GPP TS 24.080: "Mobile radio interface layer 3 Supplementary services specification; Formats and coding".

[21] 3GPP TS 37.355: " LTE Positioning Protocol (LPP)".

[22] 3GPP TS 24.501: "Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".

[23] 3GPP TS 29.518: "Access and Mobility Management Services".

[24] 3GPP TS 29.171: "Location Services (LCS); LCS Application Protocol (LCS-AP) between the Mobile Management Entity (MME) and Evolved Serving Mobile Location Centre (E-SMLC); SLs interface".

[25] IETF RFC 4119: "A Presence-based GEOPRIV Location Object Format".

[26] 3GPP TS 33.256: "Security aspects of Uncrewed Aerial Systems (UAS)".

[27] 3GPP TS 29.515: "5G System; Gateway Mobile Location Services Stage 3".

[28] 3GPP TS 29.515: "5G System; Gateway Mobile Location Services Stage 3".

[29] 3GPP TS 29.122: "T8 reference point for Northbound APIs".

[30] 3GPP TS 38.355: "NR; Sidelink Positioning Protocol (SLPP); Protocol Specification".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in 3GPP TR 21.905 [1].

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP 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 3GPP TR 21.905 [1].

LDR	Location Deferred Request
LIR	Location Immediate Request
LMF	Location Management Function
LPHAP	Low Power and High Accuracy Positioning

4 Overview

The Location Management Function (LMF) is the network entity in the 5G Core Network (5GC) supporting the following functionality:

- Supports location determination for a UE.
- Obtains downlink location measurements or a location estimate from the UE.
- Obtains uplink location measurements from the NG RAN.
- Obtains non-UE associated assistance data from the NG RAN.

- Provides broadcast assistance data to UEs and forwards associated ciphering keys to an AMF.

Other functions of an LMF are listed in clause 4.3.8 of 3GPP TS 23.273 [19].

Figure 4-1 provides the reference model (in service based interface representation and in reference point representation), with focus on the LMF:

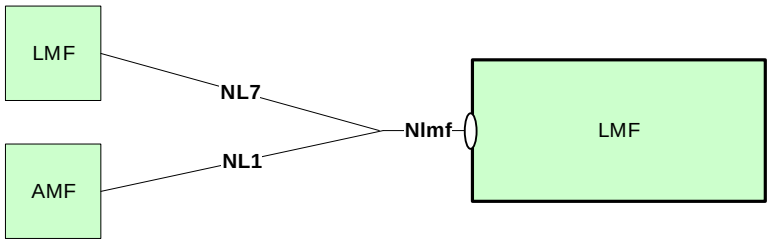

Figure 4-1: Reference model – LMF

5 Services Offered by the LMF

5.1 Introduction

The LMF offers to other NFs the following services:

- Nlmf_Location
- Nlmf_Broadcast

Table 5.1-1 summarizes the corresponding APIs defined for this specification.

Table 5.1-1: API Descriptions

Service Name	Clause	Description	OpenAPI Specification File	apiName	Annex
Nlmf_Location	6.1	LMF Location Service	TS29572_Nlmf_Location.yaml	nlmf-loc	A.2
Nlmf_Broadcast	6.2	LMF Broadcast Service	TS29572_Nlmf_Broadcast.yaml	nlmf-broadcast	A.3

5.2 Nlmf_Location Service

5.2.1 Service Description

The Nlmf_Location service enables an NF to request location determination (current geodetic and optionally local and/or civic location) for a target UE or to request periodic or triggered location for a target UE.

5.2.2 Service Operations

5.2.2.1 Introduction

The service operations defined for the Nlmf_Location service are as follows:

- DetermineLocation: It provides UE location information to the consumer NF.
- EventNotify: It notifies the consumer NF of an event for periodic or triggered location for a target UE, or cumulative event report for the location reporting over user plane from the UE.
- CancelLocation: It enables a consumer NF to cancel an ongoing periodic or triggered location for a target UE.
- LocationContextTransfer: It enables a consumer NF to transfer location context information for periodic or triggered location of a target UE to a new LMF.
- MeasurementData: It enables a consumer NF to request the PRU location measurements from PRU serving LMFs.
- UPSubscribe: It enables a consumer NF to subscribe the status of a secure LCS-UP connection for a target UE.
- UPUnSubscribe: It enables the consumer NF to unsubscribe the status of a secure LCS-UP connection for a target UE.
- UPNotify: It notifies the consumer NF of the status or modification of a secure LCS-UP connection for a target UE.
- UPConfig: It enables a consumer NF to set up, modify or terminate a secure LCS-UP connection for a target UE.

5.2.2.2 DetermineLocation

5.2.2.2.1 General

The following procedures are defined, using the "DetermineLocation" service operation:

- Retrieve UE Location
- Retrieve UE Location for 5G-MO-LR
- Retrieve UE Location for Ranging and Sidelink Positioning

5.2.2.2.2 Retrieve UE Location

This procedure allows a consumer NF to request the location information (geodetic location and, optionally, local and/or civic location) for a target UE or to activate periodic or triggered deferred location for a target UE.

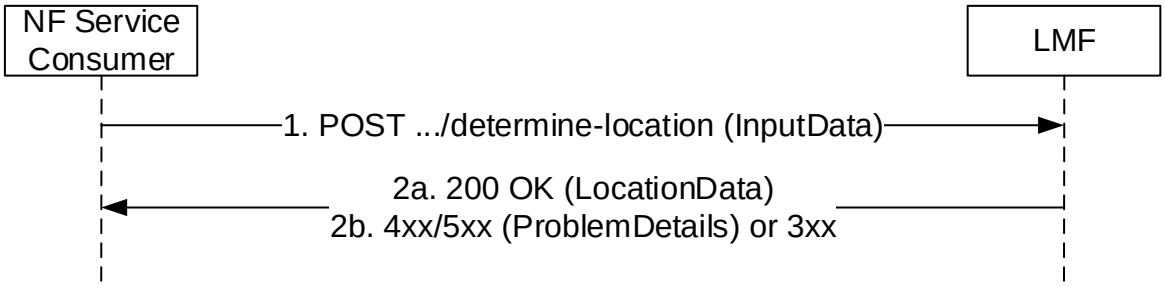

Figure 5.2.2.2.2-1: DetermineLocation Request

1. The NF Service Consumer shall send an HTTP POST request to the resource URI associated with the "determine-location" custom operation. The input parameters for the request (external client type, LCS correlation identifier, serving cell identifier, location QoS, mapped location QoS applicable to EPS, supported GAD shapes, LDR Type, H-GMLC address, LDR Reference, UE connectivity state per access type, TNAP identifier, TWAP identifier, scheduled location time, LpHapType, UE User Plane Positioning Capability, reporting indication, MBSR Info, Additional UE Info, integrity requirements, requested ranging_SL location results, related UEs ….) may be included in the HTTP POST request body;

   If UE geographical area identified by the country, area within a country or international area needs to be determined, the NF Service Consumer shall include UE geographical area determination indication for PLMN selection verification in the request;

   If UE Unaware Positioning is required, the NF Service Consumer shall include UE unaware indication in the request;

   If UE LCS Capability is received in the request indicating LPP is not supported by the UE, the LMF shall not send LPP messages to the UE in subsequent positioning procedures.

   During 5GC-MT-LR multiple location procedure for regulatory location service, the AMF shall also include the indication of acceptance for intermediate response and the maximum response time, the GMLC callback address and the LIR reference number, if received from the GMLC. The AMF may overwrite the received maximum response time (e.g. to avoid HTTP service request timeout) when passing it to the LMF.

   For deferred periodic or triggered 5GC-MT-LR procedures, if the NF Service Consumer requests the location reporting over user plane, the NF Service Consumer shall include the endpoint address of the location reporting over user plane, the cumulative event report timer, or the maximum number of location reports over user plane.

2a. On success, "200 OK" shall be returned. The response body shall contain the parameters related to the determined position of the UE if any (geodetic position, local location, civic location, positioning methods, LOS/NLOS measurement indication, …);

   If the NF service consumer has requested to determine UE country, area within a country or international area, the LMF shall also include ueAreaInd.

   If the indication of acceptance for intermediate response was received in the request, the LMF shall perform positioning procedures and determines multiple location estimates within the maximum response time. The LMF shall include the FINAL location in the content of this response message. If any intermediate location(s) are determined, the LMF shall send intermediate location reporting event notification(s) to the GMLC (see clause 5.2.2.3.3).

   During deferred periodic or triggered 5GC-MT-LR procedures, if the mapped location QoS applicable to EPS was received in the request and if the access type allowed for the UE for event reporting includes "E-UTRAN connected to EPC", the LMF shall forward the mapped location QoS applicable to EPS to the UE.

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.4.2.2-2 shall be returned. For a 4xx/5xx response, the message body should contain a ProblemDetails structure with the "cause" attribute set to one of the application error listed in Table 6.1.4.2.2-2.

5.2.2.2.3 Retrieve UE Location for 5G-MO-LR

This procedure allows a consumer NF (i.e. an AMF) to request the location information or location assistance data for a target UE which initiates MO-LR procedure (see 3GPP TS 23.273 [19]).

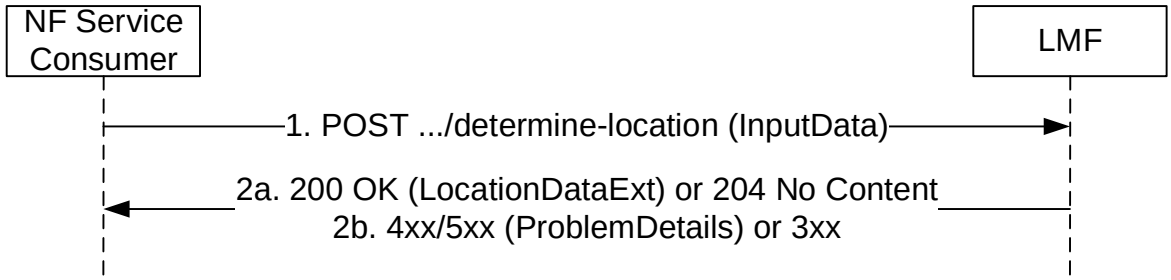

Figure 5.2.2.2.3-1: DetermineLocation Request for 5G-MO-LR

The same requirements in clause 5.2.2.2.2 shall be applied with following modifications:

1. Same as step 1 of figure 5.2.2.2.2-1, the request body shall include the following additional information:
   - The indication received from UE indicating whether a location estimate or location assistance data is required.
   - The LPP messages if received in MO-LR Request from UE
   - UE's subscribed assistance data for 5GC-MO-LR if received from UDM.

2a. Same as step 2a of figure 5.2.2.2.2-1 if a consumer NF requests the location information for a target UE. If a NF consumer requests location assistance data for a target UE and LMF has successfully delivered location assistance data to the UE, 204 No Content shall be returned.

2b. Same as step 2b of figure 5.2.2.2.2-1.

This procedure is also used to retrieve UE Location for Ranging and Sidelink Positioning.

5.2.2.3 EventNotify

5.2.2.3.1 General

The following procedures are defined, using the "EventNotify" service operation:

- Periodic or Triggered Event Notification

5.2.2.3.2 Periodic or Triggered Event Notification

This procedure notifies the NF Service Consumer (i.e. GMLC) about event information related to periodic or triggered location of a target UE. The notification is delivered to:

- the callback URI of an H-GMLC received (from an AMF) during an earlier DetermineLocation service operation if still available and if the LMF is configured for direct access to the H-GMLC;
- the callback URI of an H-GMLC received (from another LMF) during an earlier LocationContextTransfer service operation if still available and if the LMF is configured for direct access to the H-GMLC;
- the callback URI of an H-GMLC received (from the target UE) in a supplementary services event report if the LMF is configured for direct access to the H-GMLC;

otherwise (if not available),

- the callback URI of a V-GMLC registered in the NRF, if the V-GMLC registered to the NRF with notification endpoints for periodic or triggered event notifications; or

otherwise (if not available),

- the URI of a V-GMLC locally provisioned in the LMF.

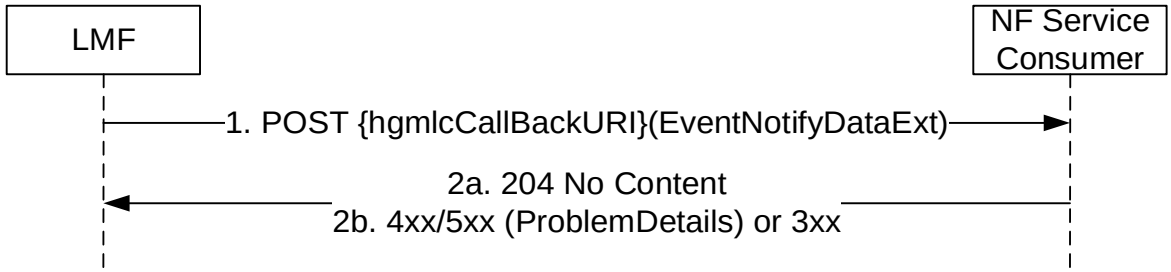

Figure 5.2.2.3.2-1: EventNotify Request

1. The LMF shall send a POST request to the GMLC callback URI determined as described above. The request body shall include a notification correlation ID (LDR reference), the UE identification (SUPI and if available GPSI), the type of event and may include a geodetic location, local location, civic location, position methods used, and other available parameters related to the position if any (e.g. Velocity, Altitude etc.), H-GMLC callback URI (if the NF consumer is a V-GMLC), serving LMF identification, LOS/NLOS measurement indication, and the statistics on the location reporting over user plane.

2a. On success, "204 No content" shall be returned by the NF Service Consumer.

2b. On failure or redirection, one of the appropriate HTTP status code listed in Table 6.1.5.1.3.1-2 shall be returned. For a 4xx/5xx response, the message body should contain a ProblemDetails structure indicating appropriate additional error information.

5.2.2.3.3 Intermediate location reporting Event Notification

This procedure notifies the NF Service Consumer (i.e. GMLC) about event information related to intermediate location of a target UE. The notification is delivered to:

- the callback URI of the GMLC for multiple location request received (from an AMF) during an earlier DetermineLocation service operation (see clause 5.2.2.2.2).

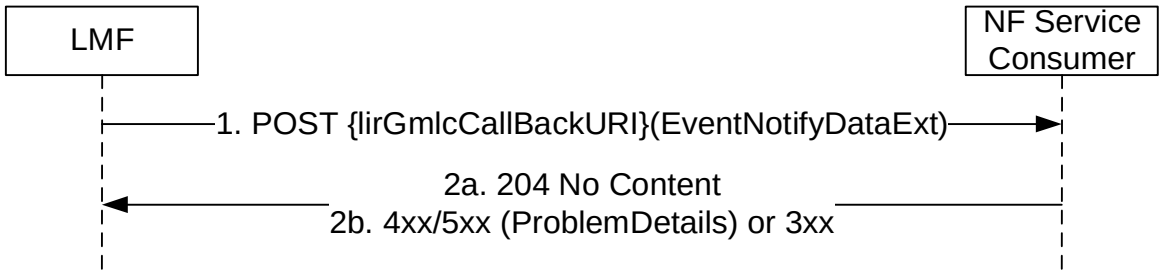

Figure 5.2.2.3.3-1: Intermediate location reporting Event Notification Request

1. The LMF shall send a POST request to the GMLC callback URI determined as described above. The request body shall include the associated LIR reference number, the UE identification (SUPI and if available GPSI), the type of event ("INTERMEDIATE_EVENT") and the intermediate location of the UE (geodetic location, local location, civic location, position methods used), and other available parameters related to the position if any (e.g. Velocity, Altitude etc.).

2a. On success, "204 No content" shall be returned by the NF Service Consumer.

2b. On failure or redirection, one of the appropriate HTTP status code listed in Table 6.1.5.1.3.1-2 shall be returned. For a 4xx/5xx response, the message body should contain a ProblemDetails structure indicating appropriate additional error information.

5.2.2.4 CancelLocation

5.2.2.4.1 General

The following procedures are defined, using the "CancelLocation" service operation:

- Cancel Periodic or Triggered Location

5.2.2.4.2 Cancel Periodic or Triggered Location

This procedure allows a consumer NF to cancel periodic or triggered location for a target UE. The cancellation is delivered to a resource URI on the serving LMF identified by the serving LMF identification provided to the consumer NF (i.e. AMF) by a V-GMLC or H-GMLC (see 3GPP TS 23.273 [19]).

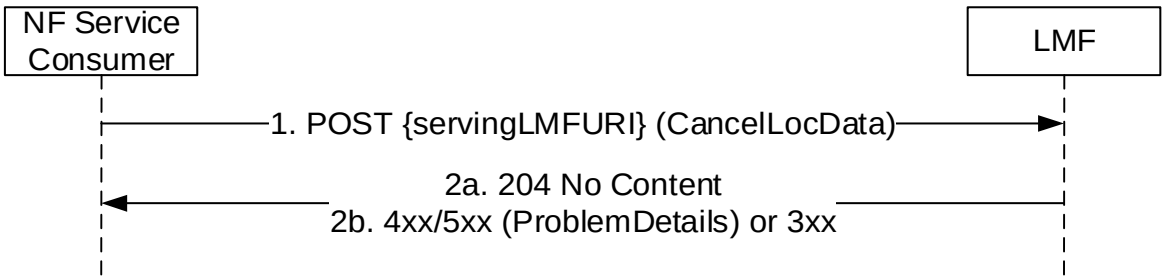

Figure 5.2.2.4.2-1: CancelLocation Request

1. The NF Service Consumer shall send an HTTP POST request to the resource URI of "cancel-location" custom operation on the serving LMF. The request body shall include a notification correlation ID (LDR reference) and an H-GMLC callback URI.

2a. On success, "204 No content" shall be returned by the LMF.

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.4.3.2-2 shall be returned. For a 4xx/5xx response, the message body should contain a ProblemDetails structure with the "cause" attribute set to one of the application errors listed in Table 6.1.4.3.2-2.

5.2.2.5 LocationContextTransfer

5.2.2.5.1 General

The following procedures are defined, using the "LocationContextTransfer" service operation:

- Transfer Location Context

5.2.2.5.2 Transfer Location Context

This procedure allows a NF service consumer (e.g. the old LMF) to transfer location context information for periodic or triggered location for a target UE (see clause 6.4 and clause 6.7.2 of 3GPP TS 23.273 [19]). The NF service consumer discovers the service URI of the new LMF by performing a discovery via NRF using:

- the identification of the LMF received (from an AMF) during an earlier Namf_Communication_N1MessageNotify service operation to the consumer NF;

otherwise (if not available),

- the identification of an LMF locally provisioned in the consumer NF.

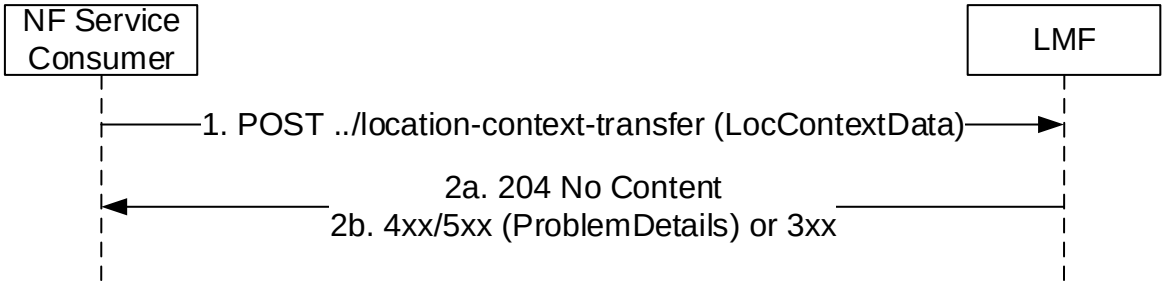

Figure 5.2.2.5.2-1: LocationContextTransfer Request

1. The NF Service Consumer shall send an HTTP POST request to the Custom operation URI ("/location-context-transfer") on the Service URI discovered as described above. The request body shall include an AMF identity, Deferred location type, Deferred location parameters, Notification Target Address (H-GMLC callback URI), Notification Correlation ID (LDR reference), an embedded event report message and may include an event reporting status, UE location information, scheduled location time and LOS/NLOS measurement indication, and shall include an indication of Control Plane CIoT 5GS Optimisation if N1 message is received from the UE with Control Plane CIoT 5GS Optimisation. If the location context information for periodic or triggered location for a target UE includes the endpoint address of the location reporting over user plane, the NF Service Consumer may include the cumulative event report timer, or the maximum number of location reports over user plane.

2a. On success, "204 No content" shall be returned by the LMF.

2b. On failure or redirection, one of the HTTP status codes listed in Table 6.1.4.4.2-2 shall be returned. For a 4xx/5xx response, the message body should contain a ProblemDetails structure with the "cause" attribute set to one of the application error listed in Table 6.1.4.4.2-2.

5.2.2.6 MeasurementData

5.2.2.6.1 General

The following procedures are defined, using the "MeasurementData" service operation:

- Location Measurements

5.2.2.6.2 Location Measurements

This procedure allows a consumer NF (e.g. LMF) to request PRU location measurements from PRU serving LMF.

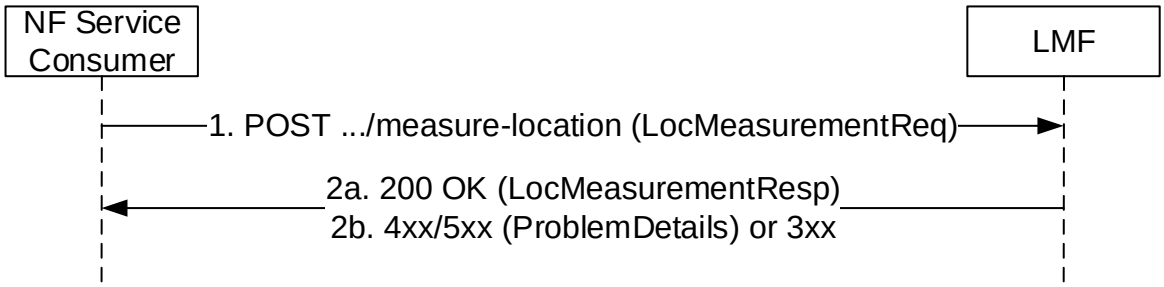

Figure 5.2.2.6.2-1: DetermineLocation Request

1. The NF Service Consumer shall send an HTTP POST request to the resource URI associated with the "measure-location" custom operation. The request body shall include target UE cell ID and may include the Pre-calculated location of target UE and time windows.

2a. On success, "200 OK" shall be returned. The response body shall contain the parameters related to the location measurements of the PRU and the known location of the associated PRU.

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.4.5.2-2 shall be returned. For a 4xx/5xx response, the message body should contain a ProblemDetails structure with the "cause" attribute set to one of the application error listed in Table 6.1.4.5.2-2.

5.2.2.7 UPSubscribe

5.2.2.7.1 General

The following procedures are defined, using the "UPSubscribe" service operation:

- Subscribe to Notification of LCS-UP connection status

5.2.2.7.2 Subscribe to Notification of LCS-UP connection status

This procedure allows a consumer NF to subscribe the status of a secure LCS-UP connection for a target UE.

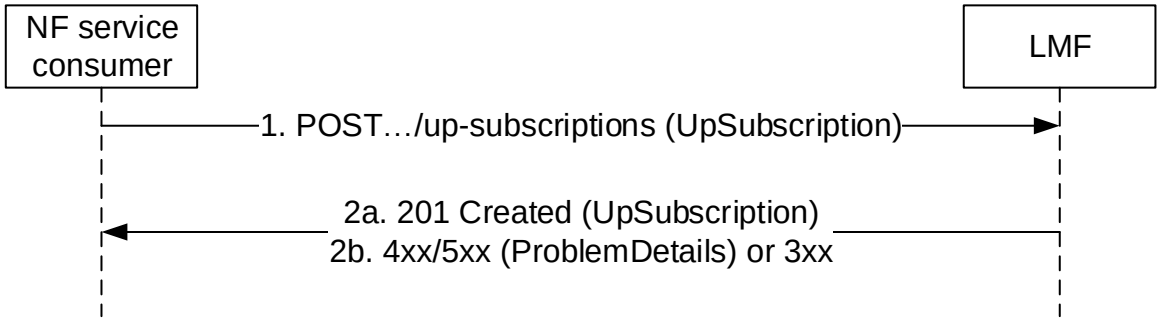

Figure 5.2.2.7.2-1: NF service consumer subscribes to notifications

1. The NF service consumer shall send a POST request to the resource URI representing the "up-subscriptions" collection resource.

   The callback URI of the NF service consumer shall be include in the request content to receive notifications of LCS-UP connection status from the LMF.

2a. On success, the LMF responds with "201 Created". The response shall contain the data related to the created subscription, and the HTTP Location header shall contain the URI of the created subscription.

2b. On failure or redirection, one of the HTTP status code listed in Table Table 6.1.3.2.3.1-3 shall be returned. For a 4xx/5xx response, the message body containing a ProblemDetails structure with the "cause" attribute set to one of the application error listed in Table Table 6.1.3.2.3.1-3.

5.2.2.8 UPNotify

5.2.2.8.1 General

The following procedures are defined, using the "UPNotify" service operation:

- Notification of LCS-UP connection

5.2.2.8.2 Notification of LCS-UP connection

This procedure notifies the NF Service Consumer (i.e. AMF) about status or modification of a secure LCS-UP connection for a target UE.

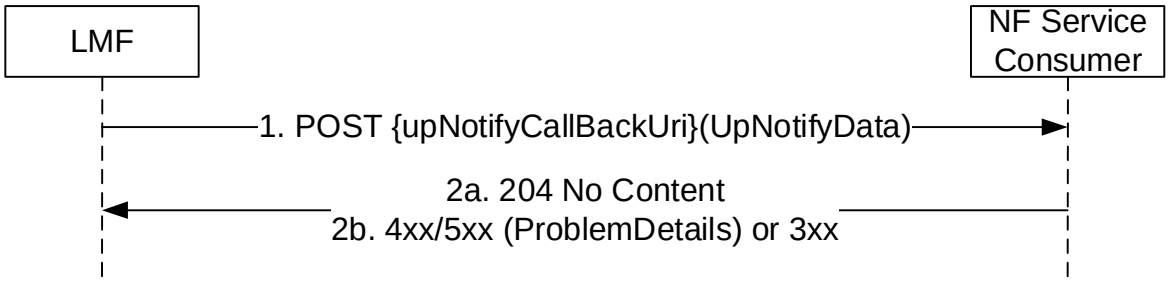

Figure 5.2.2.8.2-1: UPNotify

1. The LMF shall send a POST request to the upNotifyCallBackUri. The request body shall include a notification correlation ID, LCS-UP connection status and may include a target LMF identifier.

2a. On success, "204 No content" shall be returned by the NF Service Consumer.

2b. On failure or redirection, one of the appropriate HTTP status code listed in Table 6.1.5.1.3.1-2 shall be returned. For a 4xx/5xx response, the message body should contain a ProblemDetails structure indicating appropriate additional error information.

5.2.2.9 UPConfig

5.2.2.9.1 General

The following procedures are defined, using the "UPConfig" service operation:

- Configure LCS-UP connection

5.2.2.9.2 Configure LCS-UP connection

This procedure allows a consumer NF to set up, modify or terminate a secure LCS-UP connection for a target UE.

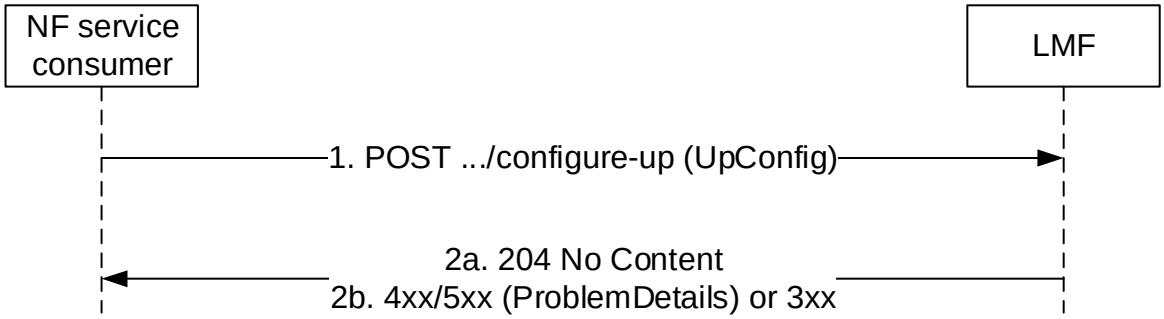

Figure 5.2.2.9.2-1: LCS-UP connection

1. The NF service consumer shall send an HTTP POST request to the resource URI associated with the "configure-up" custom operation to set up, modify or terminate LCS-UP connection. The request content shall include a UP notify callback URI, a notification correlation ID, and the UE identity.

2a. On success, "204 No Content" shall be returned.

2b. On failure or redirection, one of the HTTP status code listed in Table 6.1.4.7.2-2 shall be returned. For a 4xx/5xx response, the message body may contain a ProblemDetails structure with the "cause" attribute set to one of the application errors listed in Table 6.1.4.7.2-2.

5.2.2.10 UPUnSubscribe

5.2.2.10.1 General

The following procedure is defined using the "UPUnSubscribe" service operation:

- Unsubscribe to notification of LCS-UP connection status

5.2.2.10.2 Unsubscribe to notification of LCS-UP connection status

This procedure allows the consumer NF to unsubscribe the status of a secure LCS-UP connection for a target UE.

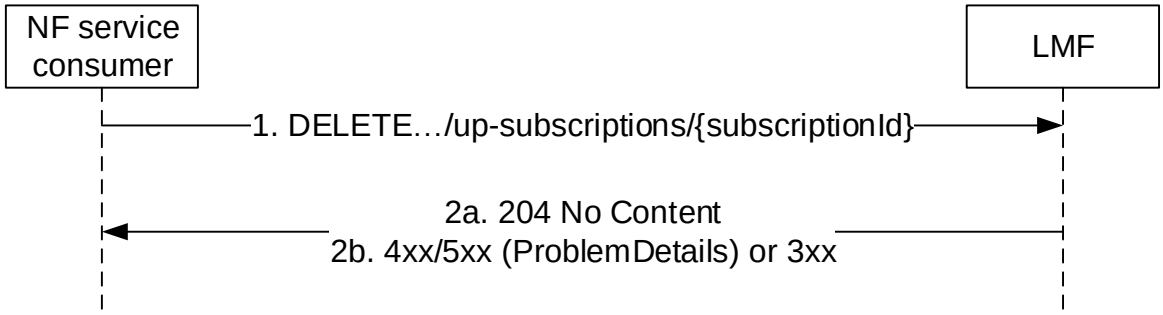

Figure 5.2.2.10.2-1: NF service consumer unsubscribes to notifications

1. The NF service consumer shall send a DELETE request to the resource identified by the URI previously received during subscription creation.

2a. On success, the LMF responds with "204 No Content".

2b. On failure or redirection, one of the HTTP status code listed in Table Table 6.1.3.3.3.1-3 shall be returned. For a 4xx/5xx response, the message body containing a ProblemDetails structure with the "cause" attribute set to one of the application error listed in Table Table 6.1.3.3.3.1-3.

5.3 Nlmf_Broadcast Service

5.3.1 Service Description

The Nlmf_Broadcast service enables an NF to obtain ciphering keys and associated parameters applicable to location assistance data that is broadcast to subscribed UEs in ciphered form.

5.3.2 Service Operations

5.3.2.1 Introduction

The service operations defined for the Nlmf_Broadcast service are as follows:

- CipheringKeyData: It provides the ciphering key information to the consumer NF.

5.3.2.2 CipheringKeyData

5.3.2.2.1 General

The following procedures are defined, using the "CipheringKeyData" service operation:

- Request Ciphering Key Information
- Provide Ciphering Key Information

NOTE: The Request Ciphering Key procedure is included in order to provide a valid context in OpenAPI version 3 for the Provide Ciphering Key Information procedure. The Request Ciphering Key procedure is not used for support of ciphering key transfer in 3GPP TS 23.273 [19] and hence need not be supported by an NF Service Consumer or by an LMF.

5.3.2.2.2 Request Ciphering Key Information

This procedure allows a consumer NF to request ciphering key information.

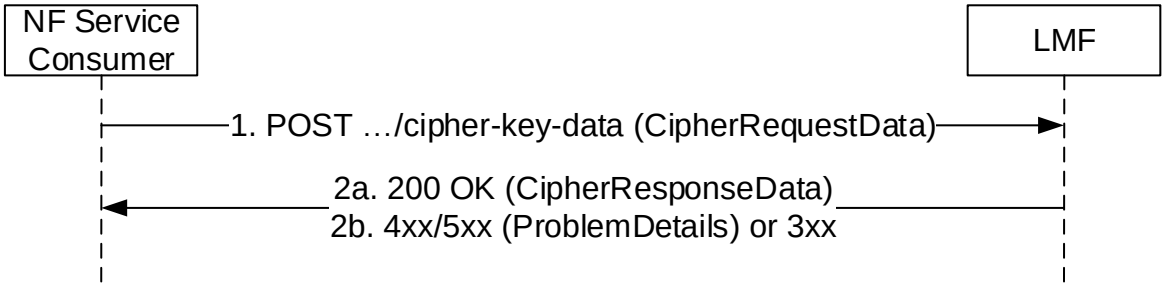

Figure 5.3.2.2.2-1: CipheringKeyData Request

1. The NF Service Consumer shall send an HTTP POST request to the resource URI associated with the "cipher-key-data" custom operation. The request body shall include a notification callback URI.

2a. On success, "200 OK" shall be returned. The response body shall indicate whether the LMF has ciphering key data. If the LMF has ciphering key data, the Provide Ciphering Key Information procedure is used to provide the ciphering key data to the NF Service Consumer.

2b. On failure or redirection, one of the HTTP status codes listed in Table 6.2.4.4.2-2 shall be returned. For a 4xx/5xx response, the message body shall contain a ProblemDetails structure with the "cause" attribute set to one of the application errors listed in Table 6.2.7.3-1.

5.3.2.2.3 Provide Ciphering Key Information

This procedure notifies the NF Service Consumer (i.e. AMF) about updated ciphering key information applicable to broadcast of location assistance data in ciphered form to subscribed UEs. The notification is delivered to:

- the callback URI of an AMF received during an earlier CipheringKeyData request service operation if still available; or
- a callback URI registered in the NRF, if the AMF registered to the NRF with notification endpoints for ciphering key data notifications;

Otherwise (if not available),

- an AMF callback URI locally provisioned in the LMF.

The procedure is invoked by issuing a POST request to the callback URI of the NF Service Consumer. See figure 5.3.2.2.3-1.

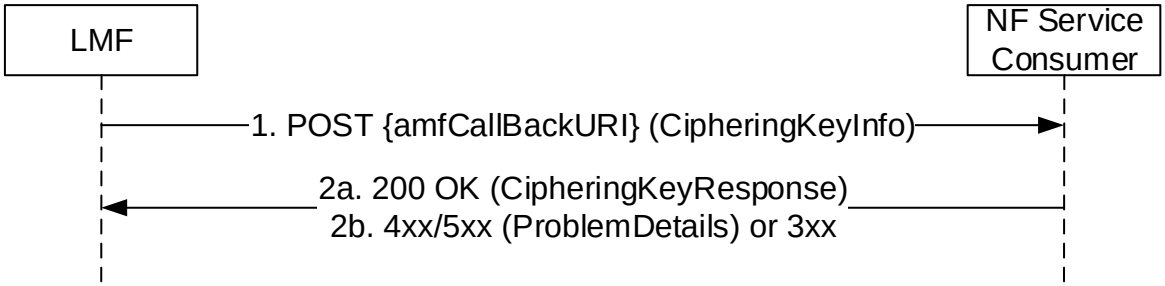

Figure 5.3.2.2.3-1: CipheringKeyData Notify

1. The LMF shall send an HTTP POST request to the callback URI for the NF service consumer determined as described above. The request body shall include one or more ciphering keys and for each ciphering key may include a ciphering key value, ciphering key identifier, validity period and set of applicable types of broadcast assistance data.

2a. On success or partial success, "200 OK" shall be returned. The response body shall indicate which ciphering key information was successfully stored by the NF service consumer.

2b. On failure or redirection to store any ciphering key information, one of the HTTP status codes listed in table 6.2.5.1.3.1-2 shall be returned. For a 4xx/5xx response, the message body shall contain a ProblemDetails structure with the "cause" attribute set to one of the application errors listed in table 6.2.5.1.3.1-2.

6 API Definitions

6.1 Nlmf_Location Service API

6.1.1 API URI

The Nlmf_Location service shall use the Nlmf_Location API.

The API URI of the Nlmf_Location API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URI used in HTTP requests from the NF service consumer towards the NF service producer shall have the Resource URI structure defined in clause 4.4.1 of 3GPP TS 29.501 [5], i.e.:

{apiRoot}/<apiName>/<apiVersion>/<apiSpecificResourceUriPart>

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [5].
- The <apiName> shall be "nlmf-loc".
- The <apiVersion> shall be "v1".
- The <apiSpecificResourceUriPart> shall be set as described in clause 6.1.3.

6.1.2 Usage of HTTP

6.1.2.1 General

HTTP/2, as defined in IETF RFC 9113 [12], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [4].

HTTP messages and bodies for the Nlmf_Location service shall comply with the OpenAPI [14] specification contained in Annex A.

6.1.2.2 HTTP Standard Headers

6.1.2.2.1 General

6.1.2.2.2 Content type

The following content types shall be supported:

- JSON, as defined in IETF RFC 8259 [13], shall be used as content type of the HTTP bodies specified in the present specification as indicated in clause 5.4 of 3GPP TS 29.500 [4].
- The Problem Details JSON Object (IETF RFC 9457 [15]). The use of the Problem Details JSON object in a HTTP response body shall be signalled by the content type "application/problem+json".

Multipart messages shall also be supported (see clause 6.1.2.4) using the content type "multipart/related", comprising:

- one JSON body part with the "application/json" content type; and
- one or more binary body parts with 3gpp vendor specific content subtypes.

The 3gpp vendor specific content subtypes defined in Table 6.1.2.2.2-1 shall be supported.

Table 6.1.2.2.2-1: 3GPP vendor specific content subtypes

content subtype	Description
vnd.3gpp.lpp	Binary encoded payload, encoding LTE Positioning Protocol (LPP) IEs, as specified in 3GPP TS 37.355 [21].
NOTE: Using 3GPP vendor content subtypes allows to describe the nature of the opaque payload (e.g. LPP information) without having to rely on metadata in the JSON payload.	

See clause 6.1.2.4 for the binary payloads supported in the binary body part of multipart messages.

6.1.2.3 HTTP custom headers

6.1.2.3.1 General

The following HTTP custom headers shall be supported:

- 3gpp-Sbi-Message-Priority: See 3GPP TS 29.500 [4], clause 5.2.3.2.2.

This API does not define any new HTTP custom headers.

6.1.2.4 HTTP multipart messages

HTTP multipart messages shall be supported, to transfer opaque LPP Information, in the following service operations (and HTTP messages):

- DetermineLocation Request (POST);

HTTP multipart messages shall include one JSON body part and one or more binary body parts comprising:

- one LPP payload (see clause 6.1.6.4).

The JSON body part shall be the "root" body part of the multipart message. It shall be encoded as the first body part of the multipart message. The "Start" parameter does not need to be included.

The multipart message shall include a "type" parameter (see IETF RFC 2387 [9]) specifying the media type of the root body part, i.e. "application/json".

NOTE: The "root" body part (or "root" object) is the first body part the application processes when receiving a multipart/related message, see IETF RFC 2387 [9]. The default root is the first body within the multipart/related message. The "Start" parameter indicates the root body part, e.g. when this is not the first body part in the message.

For each binary body part in a HTTP multipart message, the binary body part shall include a Content-ID header (see IETF RFC 2045 [10]), and the JSON body part shall include an attribute, defined with the RefToBinaryData type, that contains the value of the Content-ID header field of the referenced binary body part.

6.1.3 Resources

6.1.3.1 Overview

The structure of the Resource URIs of the Nlmf_Location service is shown in figure 6.1.3.1-1.

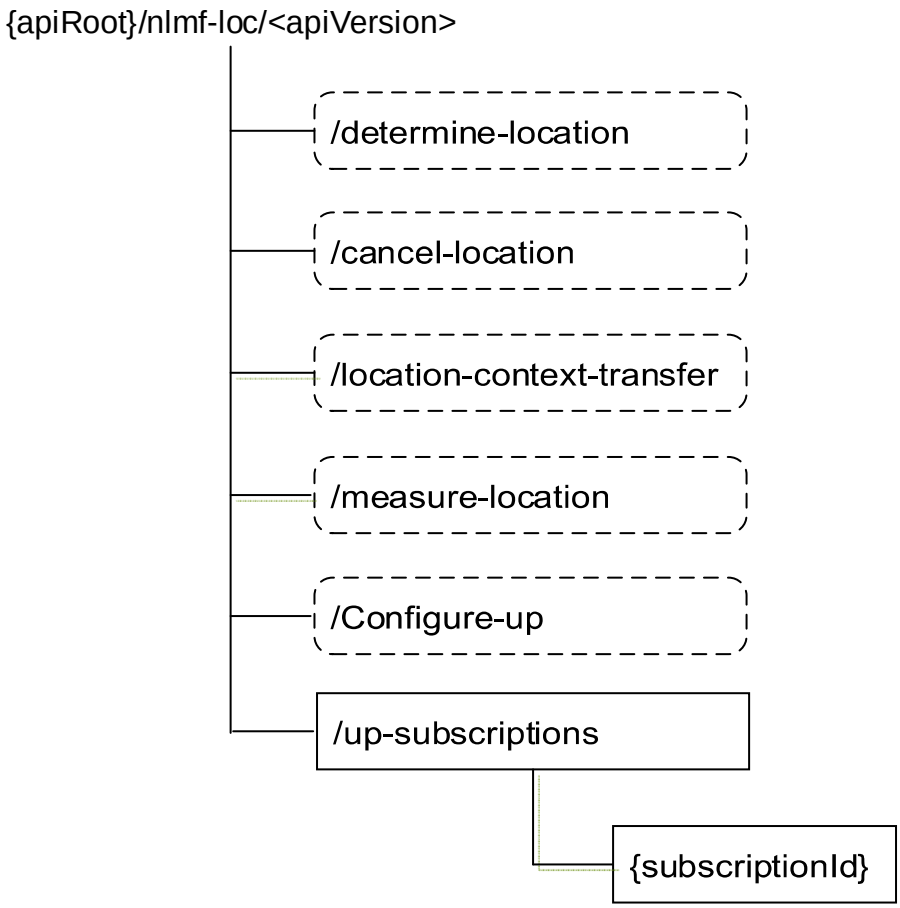

Figure 6.1.3.1-1: Resource URI structure of the Nlmf_Location API

Table 6.1.3.1-1 provides an overview of the resources and applicable HTTP methods.

Table 6.1.3.1-1: Resources and methods overview

Resource name	Resource URI	HTTP method or custom operation	Description
up-subscriptions (Collection)	/up-subscriptions	POST	Create a subscription
up-subscription (Document)	/up-subscriptions/{subscriptionId}	DELETE	Delete the subscription identified by {subscriptionId}

6.1.3.2 Resource: up-subscriptions (Collection)

6.1.3.2.1 Description

This resource represents a collection of subscriptions to notifications.

6.1.3.2.2 Resource Definition

Resource URI: **{apiRoot}/nlmf-loc/v1/up-subscriptions**

This resource shall support the resource URI variables defined in table 6.1.3.2.2-1.

Table 6.1.3.2.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.1.1

6.1.3.2.3 Resource Standard Methods

6.1.3.2.3.1 POST

This method creates a new subscription. This method shall support the URI query parameters specified in table 6.1.3.2.3.1-1.

Table 6.1.3.4.3.1-1: URI query parameters supported by the POST method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 6.1.3.2.3.1-2 and the response data structures and response codes specified in table 6.1.3.2.3.1-3.

Table 6.1.3.2.3.1-2: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
UpSubscription	M	1	Input parameters to the "UPSubscribe" operation

Table 6.1.3.2.3.1-3: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
UpSubscription	M	1	201 Created	This case represents the successful creation of a subscription. Upon success, the HTTP response shall include a "Location" HTTP header that contains the resource URI of the created resource.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection.
NOTE: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] other than those specified in the table above also apply, with a ProblemDetails data type (see clause 5.2.7 of 3GPP TS 29.500 [4]).				

Table 6.1.3.2.3.1-4: Headers supported by the 201 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	Contains the URI of the newly created resource, according to the structure: {apiRoot}/nlmf-loc/v1/up-subscriptions/{subscriptionId}

Table 6.1.3.2.3.1-5: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set. Or the same URI, if a request is redirected to the same target resource via a different SCP.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected

Table 6.1.3.2.3.1-6: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set. Or the same URI, if a request is redirected to the same target resource via a different SCP.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected

6.1.3.3 Resource: up-subscription (Document)

6.1.3.3.1 Description

This resource represents an individual subscription.

6.1.3.3.2 Resource Definition

Resource URI: **{apiRoot}/nlmf-loc/v1/up-subscriptions/{subscriptionId}**

This resource shall support the resource URI variables defined in table 6.1.3.5.2-1.

Table 6.1.3.3.2-1: Resource URI variables for this resource

Name	Data type	Definition
apiRoot	string	See clause 6.1.1
subscriptionId	string	Represents a specific subscription

6.1.3.3.3 Resource Standard Methods

6.1.3.3.3.1 DELETE

This method terminates an existing subscription. This method shall support the URI query parameters specified in table 6.1.3.3.3.1-1.

Table 6.1.3.5.3.1-1: URI query parameters supported by the DELETE method on this resource

Name	Data type	P	Cardinality	Description
n/a				

This method shall support the request data structures specified in table 6.1.3.3.3.1-2 and the response data structures and response codes specified in table 6.1.3.3.3.1-3.

Table 6.1.3.3.3.1-2: Data structures supported by the DELETE Request Body on this resource

Data type	P	Cardinality	Description
n/a			

Table 6.1.3.3.3.1-3: Data structures supported by the DELETE Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection.
NOTE: The mandatory HTTP error status codes for the DELETE method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] other than those specified in the table above also apply, with a ProblemDetails data type (see clause 5.2.7 of 3GPP TS 29.500 [4]).				

Table 6.1.3.3.3.1-4: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set. Or the same URI, if a request is redirected to the same target resource via a different SCP.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected

Table 6.1.3.3.3.1-5: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set. Or the same URI, if a request is redirected to the same target resource via a different SCP.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected

6.1.4 Custom Operations without associated resources

6.1.4.1 Overview

The URI structure for Custom Operations without associated resources is included as part of the Figure 6.1.3.1-1

Table 6.1.4.1-1: Custom operations without associated resources

Operation Name	Custom operation URI	Mapped HTTP method	Description (Service Operation)
determine-location	/determine-location	POST	Determine Location
cancel-location	/cancel-location	POST	Cancel Location
location-context-transfer	/location-context-transfer	POST	Transfer Location Context
measure-location	/ measure-location	POST	Location Measure
configure-up	/configure-up	POST	Create, Modify or Terminate the LCS-UP connection

NOTE: The Custom operation URI above are deviating from the URI Path Segment Naming Conventions defined in clause 5.1.3.2 of 3GPP TS 29.501 [5], but they are not changed to maintain backwards compatibility.

6.1.4.2 Operation: determine-location

6.1.4.2.1 Description

This clause will describe the custom operation and what it is used for, and the custom operation's URI.

6.1.4.2.2 Operation Definition

This operation shall support the response data structures and response codes specified in tables 6.1.4.2.2-1 and 6.1.4.2.2-2.

Table 6.1.4.2.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
InputData	M	1	Input parameters to the "Determine Location" operation

Table 6.1.4.2.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
LocationDataExt	M	1	200 OK	This case represents the successful retrieval of the location of the UE or successful activation of periodic or triggered location in the UE. Upon success, a response body is returned containing the different parameters of the location data with one or more corresponding UEs if obtained, such as: - Geographic Area - Civic Location - Local location, - Positioning methods
n/a			204 No Content	This case represents the successful delivery of location assistance data to the UE, during MO-LR requesting for location assistance data for the UE.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
ProblemDetails	O	0..1	403 Forbidden	The "cause" attribute may be used to indicate the following application errors: - POSITIONING_DENIED - UNSPECIFIED - UNSUPPORTED_BY_UE - PAGING_NOT_ALLOWED See table 6.1.7.3-1 for the description of these errors.
ProblemDetails	O	0..1	500 Internal Server Error	The "cause" attribute may be used to indicate the following application error: - POSITIONING_FAILED See table 6.1.7.3-1 for the description of these errors.
ProblemDetails	O	0..1	504 Gateway Timeout	The "cause" attribute may be used to indicate the following application error: - UNREACHABLE_USER See table 6.1.7.3-1 for the description of this error.
NOTE 1: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] other than those specified in the table above also apply, with a ProblemDetails data type (see clause 5.2.7 of 3GPP TS 29.500 [4]). NOTE 2: RedirectResponse may be inserted by an SCP, see clause 6.10.9.1 of 3GPP TS 29.500 [4].				

Table 6.1.4.2.2-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set. For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected

Table 6.1.4.2.2-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set. For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected

6.1.4.3 Operation: cancel-location

6.1.4.3.1 Description

This clause describes the custom operation and what it is used for.

6.1.4.3.2 Operation Definition

This operation shall support the request and response data structures and response codes specified in table 6.1.4.3.2-1 and table 6.1.4.3.2-2.

Table 6.1.4.3.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
CancelLocData	M	1	The information used to cancel location.

Table 6.1.4.3.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	This case represents successful cancellation of location.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
ProblemDetails	O	0..1	403 Forbidden	The "cause" attribute may be used to indicate the following application errors: - UNSPECIFIED - LOCATION_SESSION_UNKNOWN See table 6.1.7.3-1 for the description of this error.
NOTE 1: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] other than those specified in the table above also apply, with a ProblemDetails data type (see clause 5.2.7 of 3GPP TS 29.500 [4]). NOTE 2: RedirectResponse may be inserted by an SCP, see clause 6.10.9.1 of 3GPP TS 29.500 [4].				

Table 6.1.4.3.2-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set. For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected

Table 6.1.4.3.2-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set. For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected

6.1.4.4 Operation: location-context-transfer

6.1.4.4.1 Description

This clause will describe the custom operation and what it is used for.

6.1.4.4.2 Operation Definition

This operation shall support the request and response data structures and response codes specified in table 6.1.4.4.2-1 and table 6.1.4.4.2-2.

Table 6.1.4.4.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
LocContextData	M	1	Input parameters to the "Location Context Transfer" operation

Table 6.1.4.4.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	This case represents successful transfer of the location context.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
ProblemDetails	O	0..1	403 Forbidden	The "cause" attribute may be used to indicate the following application errors: - UNSPECIFIED - LOCATION_TRANSFER_NOT SUPPORTED - INSUFFICIENT_RESOURCES - EVENT_REPORT_UNRECOGNIZED See table 6.1.7.3-1 for the description of this error.
NOTE 1: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] other than those specified in the table above also apply, with a ProblemDetails data type (see clause 5.2.7 of 3GPP TS 29.500 [4]). NOTE 2: RedirectResponse may be inserted by an SCP, see clause 6.10.9.1 of 3GPP TS 29.500 [4].				

Table 6.1.4.4.2-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set. For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected

Table 6.1.4.4.2-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set. For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected

6.1.4.5 Operation: measure-location

6.1.4.5.1 Description

This clause will describe the custom operation and what it is used for, and the custom operation's URI.

6.1.4.5.2 Operation Definition

This operation shall support the response data structures and response codes specified in tables 6.1.4.5.2-1 and 6.1.4.5.2-2.

Table 6.1.4.5.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
LocMeasurementReq	M	1	Input parameters to the "MeasurementData" operation

Table 6.1.4.5.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
LocMeasurementResp	M	1	200 OK	This case represents the successful retrieval of the location measurements of the PRU.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set.
ProblemDetails	O	0..1	403 Forbidden	The "cause" attribute may be used to indicate the following application errors: - UNSPECIFIED - LOCATION_MEASUREMENT_UNKNOWN See table 6.1.7.3-1 for the description of these errors.
NOTE: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] other than those specified in the table above also apply, with a ProblemDetails data type (see clause 5.2.7 of 3GPP TS 29.500 [4]).				

Table 6.1.4.5.2-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set. Or the same URI, if a request is redirected to the same target resource via a different SCP.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected

Table 6.1.4.5.2-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set. Or the same URI, if a request is redirected to the same target resource via a different SCP.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected

6.1.4.6 Void

6.1.4.7 Operation: configure-up

6.1.4.7.1 Description

This clause will describe the custom operation and what it is used for, and the custom operation's URI.

6.1.4.7.2 Operation Definition

This operation shall support the response data structures and response codes specified in tables 6.1.4.7.2-1 and 6.1.4.7.2-2.

Table 6.1.4.7.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
UpConfig	M	1	Input parameters to the "UPConfig" operation

Table 6.1.4.7.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	This case represents the successful set up, modify or terminate LCS-UP connection.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set.
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. The response shall include a Location header field containing a different URI, or the same URI if a request is redirected to the same target resource via a different SCP. In the former case, the URI shall be an alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set.
ProblemDetails	O	0..1	403 Forbidden	The "cause" attribute may be used to indicate the following application errors: - UNSPECIFIED See table 6.1.7.3-1 for the description of these errors.
NOTE: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] other than those specified in the table above also apply, with a ProblemDetails data type (see clause 5.2.7 of 3GPP TS 29.500 [4]).				

Table 6.1.4.7.2-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set. Or the same URI, if a request is redirected to the same target resource via a different SCP.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected

Table 6.1.4.7.2-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set. Or the same URI, if a request is redirected to the same target resource via a different SCP.
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected

6.1.5 Notifications

This clause specifies the notifications provided by the Nlmf_Location service.

Table 6.1.5.1-1: Notifications overview

Notification	Callback URI	HTTP method or custom operation	Description (service operation)
EventNotify	{hgmlcCallBackURI}	POST	

6.1.5.1 EventNotify

6.1.5.1.1 Description

The EventNotify operation is used to notify the occurrence of periodic or triggered location event for a target UE to a consumer NF (e.g. GMLC).

6.1.5.1.2 Notification Definition

Callback URI: {hgmlcCallBackURI}

See clause 5.2.2.2.2 for the description of how the LMF obtains the Callback URI of the NF Service Consumer (e.g. GMLC).

6.1.5.1.3 Notification Standard Methods

6.1.5.1.3.1 POST

This method sends a Location event notify to the NF Service Consumer.

This method shall support the request and response data structures and response codes specified in table 6.1.5.1.3.1-1 and table 6.1.5.1.3.1-2.

Table 6.1.5.1.3.1-1: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
EventNotifyDataExt	M	1	Input parameters to the "Location Event Notify" operation

Table 6.1.5.1.3.1-2: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	This case represents successful notification of the event.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
ProblemDetails	O	0..1	403 Forbidden	The "cause" attribute may be used to indicate the following application errors: - UNSPECIFIED - LOCATION_SESSION_UNKNOWN See table 6.1.7.3-1 for the description of this error.
NOTE 1: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] other than those specified in the table above also apply, with a ProblemDetails data type (see clause 5.2.7 of 3GPP TS 29.500 [4]). NOTE 2: RedirectResponse may be inserted by an SCP, see clause 6.10.9.1 of 3GPP TS 29.500 [4].				

Table 6.1.5.1.3.1-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	A URI pointing to the endpoint of NF service consumer to which the notification should be sent. For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the notification is redirected

Table 6.1.5.1.3.1-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	A URI pointing to the endpoint of NF service consumer to which the notification should be sent. For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the notification is redirected

6.1.5.2 UPNotify

6.1.5.2.1 Description

The UPNotify operation is used to notify the status or modification of a secure LCS-UP connection for a target UE to a consumer NF (e.g. AMF).

6.1.5.2.2 Notification Definition

Callback URI: {upNotifyCallBackUri}

See clause 5.2.2.7.2 for the description of how the LMF obtains the Callback URI of the NF Service Consumer (e.g. AMF).

6.1.5.2.3 Notification Standard Methods

6.1.5.2.3.1 POST

This method sends a notificaiton of LCS-UP connection status to the NF service consumer.

This method shall support the request and response data structures and response codes specified in table 6.1.5.2.3.1-1 and table 6.1.5.2.3.1-2.

Table 6.1.5.2.3.1-1: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
UpNotifyData	M	1	Input parameters to the "UPNotify" operation

Table 6.1.5.2.3.1-2: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
n/a			204 No Content	This case represents successful notification of the event.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
ProblemDetails	O	0..1	403 Forbidden	The "cause" attribute may be used to indicate the following application errors: - UNSPECIFIED - LOCATION_SESSION_UNKNOWN See table 6.1.7.3-1 for the description of this error.
NOTE 1: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] other than those specified in the table above also apply, with a ProblemDetails data type (see clause 5.2.7 of 3GPP TS 29.500 [4]). NOTE 2: RedirectResponse may be inserted by an SCP, see clause 6.10.9.1 of 3GPP TS 29.500 [4].				

Table 6.1.5.2.3.1-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	A URI pointing to the endpoint of NF service consumer to which the notification should be sent. For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the notification is redirected

Table 6.1.5.2.3.1-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	A URI pointing to the endpoint of NF service consumer to which the notification should be sent. For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the notification is redirected

6.1.6 Data Model

6.1.6.1 General

This clause specifies the application data model supported by the API.

Table 6.1.6.1-1 specifies the data types defined for the Nlmf_Location service based interface protocol.

Table 6.1.6.1-1: Nlmf_Location specific Data Types

Data type	Clause defined	Description
InputData	6.1.6.2.2	Information within Determine Location Request
LocationData	6.1.6.2.3	Information within Determine Location Response
GeographicalCoordinates	6.1.6.2.4	Geographical coordinates
GeographicArea	6.1.6.2.5	Geographic area specified by different shape
Point	6.1.6.2.6	Ellipsoid Point
PointUncertaintyCircle	6.1.6.2.7	Ellipsoid point with uncertainty circle
PointUncertaintyEllipse	6.1.6.2.8	Ellipsoid point with uncertainty ellipse
Polygon	6.1.6.2.9	Polygon
PointAltitude	6.1.6.2.10	Ellipsoid point with altitude
PointAltitudeUncertainty	6.1.6.2.11	Ellipsoid point with altitude and uncertainty ellipsoid
EllipsoidArc	6.1.6.2.12	Ellipsoid Arc
LocationQoS	6.1.6.2.13	QoS of Location request
CivicAddress	6.1.6.2.14	Indicates a Civic address
PositioningMethodAndUsage	6.1.6.2.15	Indicates the usage of a positioning method
GnssPositioningMethodAndUsage	6.1.6.2.16	Indicates the usage of a Global Navigation Satellite System (GNSS) positioning method
VelocityEstimate	6.1.6.2.17	Velocity estimate
HorizontalVelocity	6.1.6.2.18	Horizontal velocity
HorizontalWithVerticalVelocity	6.1.6.2.19	Horizontal and vertical velocity
HorizontalVelocityWithUncertainty	6.1.6.2.20	Horizontal velocity with speed uncertainty
HorizontalWithVerticalVelocityAndUncertainty	6.1.6.2.21	Horizontal and vertical velocity with speed uncertainty
UncertaintyEllipse	6.1.6.2.22	Ellipse with uncertainty
UeLcsCapability	6.1.6.2.23	Indicates the LCS capability supported by the UE.
PeriodicEventInfo	6.1.6.2.24	Indicates the information of periodic event reporting
AreaEventInfo	6.1.6.2.25	Indicates the information of area based event reporting
ReportingArea	6.1.6.2.26	Indicates an area for event reporting
MotionEventInfo	6.1.6.2.27	Indicates the information of motion based event reporting
CancelLocData	6.1.6.2.29	Information within Cancel Location Request
LocContextData	6.1.6.2.30	Information within Transfer Location Context Request
EventReportMessage	6.1.6.2.31	Indicates an event report message
EventReportingStatus	6.1.6.2.32	Indicates the status of event reporting
UELocationInfo	6.1.6.2.33	Indicates location information of a UE
EventNotifyData	6.1.6.2.34	Information within Event Notify Request
UeConnectivityState	6.1.6.2.35	Indicates the connectivity state of a UE
LocalOrigin	6.1.6.2.36	Indicates a Local origin in a reference system.
RelativeCartesianLocation	6.1.6.2.37	Relative Cartesian Location
Local2dPointUncertaintyEllipse	6.1.6.2.38	Local 2D point with uncertainty ellipse
Local3dPointUncertaintyEllipsoid	6.1.6.2.39	Local 3D point with uncertainty ellipsoid
UncertaintyEllipsoid	6.1.6.2.40	Ellipsoid with uncertainty
LocalArea	6.1.6.2.41	Local area specified by different shape
UeAreaIndication	6.1.6.2.42	UE area Indication
MinorLocationQoS	6.1.6.2.43	Minor Location QoS
MbsrInfo	6.1.6.2.44	MBSR Information
LocMeasurementReq	6.1.6.2.45	Location Measurement Request
LocMeasurementResp	6.1.6.2.46	Location Measurement Response
LocMeasurements	6.1.6.2.47	Location Measurements result
HighAccuracyGnssMetrics	6.1.6.2.48	High Accuracy GNSS Metrics
UpNotifyData	6.1.6.2.49	UP Notify Data
UpSubscription	6.1.6.2.50	UP Subscription
RelatedUE	6.1.6.2.51	Specifies information for related UE for ranging and sidelink positioning
UpConfig	6.1.6.2.52	UP Config
RangeDirection	6.1.6.2.53	Represents the distance and direction between two points.

2DRelativeLocation	6.1.6.2.54	Represents 2D local co-ordinates with origin corresponding to another known point.
3DRelativeLocation	6.1.6.2.55	Represents 3D local co-ordinates with origin corresponding to another known point.
AddLocationDatas	6.1.6.2.56	Contains one or more LocationData.
AddEventNotifyDatas	6.1.6.2.57	Contains one or more EventNotifyData.
LocationDataExt	6.1.6.2.58	Represents location data with one or more corresponding UEs.
EventNotifyDataExt	6.1.6.2.59	Represents notified data with one or more corresponding UEs, containing one or more EventNotifyData.
MappedLocationQoSEps	6.1.6.2.60	Mapped Location QoS for EPS
AdditionalUeInfo	6.1.6.2.61	MBSR UE Information
Altitude	6.1.6.3.2	Indicates value of altitude
Angle	6.1.6.3.2	Indicates value of angle
Uncertainty	6.1.6.3.2	Indicates value of uncertainty
Orientation	6.1.6.3.2	Indicates value of orientation angle
Confidence	6.1.6.3.2	Indicates value of confidence
Accuracy	6.1.6.3.2	Indicates value of accuracy
InnerRadius	6.1.6.3.2	Indicates value of the inner radius
CorrelationID	6.1.6.3.2	LCS Correlation ID
AgeOfLocationEstimate	6.1.6.3.2	Indicates value of the age of the location estimate
HorizontalSpeed	6.1.6.3.2	Indicates value of horizontal speed
VerticalSpeed	6.1.6.3.2	Indicates value of vertical speed
SpeedUncertainty	6.1.6.3.2	Indicates value of speed uncertainty
BarometricPressure	6.1.6.3.2	Specifies the measured uncompensated atmospheric pressure
LcsServiceType	6.1.6.3.2	LCS service type
LdrReference	6.1.6.3.2	LDR Reference
LirReference	6.1.6.3.2	LIR Reference
ReportingAmount	6.1.6.3.2	Number of required periodic event reports
ReportingInterval	6.1.6.3.2	Event reporting periodic interval
MinimumInterval	6.1.6.3.2	Minimum interval between event reports
MaximumInterval	6.1.6.3.2	Maximum interval between event reports
SamplingInterval	6.1.6.3.2	Maximum time interval between consecutive evaluations by a UE of a trigger event
ReportingDuration	6.1.6.3.2	Maximum duration of event reporting
LinearDistance	6.1.6.3.2	Minimum straight line distance moved by a UE to trigger a motion event report
LMFIdentification	6.1.6.3.2	LMF identification
EventReportCounter	6.1.6.3.2	Number of event reports received from the target UE
EventReportDuration	6.1.6.3.2	Duration of event reporting
UePositioningCapabilities	6.1.6.3.2	Indicates the positioning capabilities supported by the UE.
TimeWindow	6.1.6.3.2	Indicates the Time Window
ExternalClientType	6.1.6.3.3	Indicates types of External Clients
SupportedGADShapes	6.1.6.3.4	Indicates supported GAD shapes
ResponseTime	6.1.6.3.5	Indicates acceptable delay of location request
PositioningMethod	6.1.6.3.6	Indicates supported positioning methods
PositioningMode	6.1.6.3.7	Indicates supported modes used for positioning method
GnssId	6.1.6.3.8	Global Navigation Satellite System (GNSS) ID
Usage	6.1.6.3.9	Indicates usage made of the location measurement
LcsPriority	6.1.6.3.10	Indicates priority of the LCS client
VelocityRequested	6.1.6.3.11	Indicates velocity requirement
AccuracyFulfilmentIndicator	6.1.6.3.12	Indicates fulfilment of requested accuracy
VerticalDirection	6.1.6.3.13	Indicates direction of vertical speed
LdrType	6.1.6.3.14	Indicates LDR types
ReportingAreaType	6.1.6.3.15	Indicates type of event reporting area
OccurrenceInfo	6.1.6.3.16	Specifies occurrence of event reporting
ReportingAccessType	6.1.6.3.17	Specifies access types of event reporting

EventClass	6.1.6.3.18	Specifies event classes
ReportedEventType	6.1.6.3.19	Specifies type of event reporting
TerminationCause	6.1.6.3.20	Specifies causes of event reporting termination
LcsQosClass	6.1.6.3.21	Specifies LCS QoS class
UeLocationServiceInd	6.1.6.3.22	Specifies location service types requested by UE
IndoorOutdoorInd	6.1.6.3.23	Indoor Outdoor Indication
FixType	6.1.6.3.24	Fix Type
LosNlosMeasureInd	6.1.6.3.25	LOS/NLOS measurement indication
UpConnectionStatus	6.1.6.3.26	UP Connection Status
RangingSlResult	6.1.6.3.27	Specifies result type for ranging and sidelink positioning
RelatedUEType	6.1.6.3.28	Specifies type of related UE for ranging and sidelink positioning
LcsUpConnectionInd	6.1.6.3.29	LCS UP Connection Indication
UeUpPositioningCapabilities	6.1.6.3.30	Indicates the user plane positioning capabilities supported by the UE.

Table 6.1.6.1-2 specifies data types re-used by the Nlmf_Location service based interface protocol from other specifications, including a reference to their respective specifications and when needed, a short description of their use within the Nlmf_Location service based interface.

Table 6.1.6.1-2: Nlmf_Location re-used Data Types

Data type	Reference	Comments
Supi	3GPP TS 29.571 [8]	Subscription Permanent Identifier
Pei	3GPP TS 29.571 [8]	Permanent Equipment Identifier
Gpsi	3GPP TS 29.571 [8]	Generic Public Subscription Identifier
Ecgi	3GPP TS 29.571 [8]	E-UTRA Cell Identity
Ncgi	3GPP TS 29.571 [8]	NR Cell Identity
NfInstanceId	3GPP TS 29.571 [8]	Network Function Instance ID
Uri	3GPP TS 29.571 [8]	Uniform Resource Identifier
RefToBinaryData	3GPP TS 29.571 [8]	Reference to binary data
AccessType	3GPP TS 29.571 [8]	Access type
CmState	3GPP TS 29.518 [23]	Connection Management State
Guami	3GPP TS 29.571 [8]	GUAMI
SupportedFeatures	3GPP TS 29.571 [8]	Supported Features
RedirectResponse	3GPP TS 29.571 [8]	Redirect Response
TwapId	3GPP TS 29.571 [8]	TWAP identifier
TnapId	3GPP TS 29.571 [8]	TNAP identifier
DateTime	3GPP TS 29.571 [8]	Date and Time
DurationSec	3GPP TS 29.571 [8]	Duration Second
LpHapType	3GPP TS 29.518 [23]	Type of Low Power and/or High Accuracy Positioning
ReportingInd	3GPP TS 29.515 [27]	Reporting indication
IntegrityRequirements	3GPP TS 29.515 [27]	Integrity Requirements
UpLocRepAddrAfRm	3GPP TS 29.122 [29]	Endpoint address for location reporting over user plane
UpCumEvtRptCriteria	3GPP TS 29.515 [27]	Criteria for sending cumulative events reports over control plane

6.1.6.2 Structured data types

6.1.6.2.1 Introduction

This clause defines the structures to be used in resource representations.

6.1.6.2.2 Type: InputData

Table 6.1.6.2.2-1: Definition of type InputData

Attribute name	Data type	P	Cardinality	Description	Applicability
externalClientType	ExternalClientType	O	0..1	When present, this IE shall carry the external client type of the requester.	
correlationID	CorrelationID	O	0..1	When present, this IE shall carry the correlation ID of the request.	
amfId	NfInstanceId	O	0..1	Indicates the AMF Instance serving the UE. LMF shall use the AMF Instance to forward LCS related N1/N2 messages to the UE/RAN.	
locationQoS	LocationQoS	O	0..1	When present, this IE shall carry the QoS of the location request.	
supportedGADShapes	array(SupportedGADShapes)	O	1..N	When present, this IE shall carry the GAD shapes supported by the requester.	
supi	Supi	O	0..1	Indicates the SUPI of the target UE.	
pei	Pei	O	0..1	Indicates the PEI of the target UE.	
gpsi	Gpsi	O	0..1	Indicates the GPSI of the target UE.	
ecgi	Ecgi	O	0..1	When present, this IE shall indicate the identifier of the E-UTRAN cell serving the UE or the serving cell identifier of the Primary Cell in the Master RAN Node that is an E-UTRAN node on Dual Connectivity scenarios. (NOTE 2)	
ecgiOnSecondNode	Ecgi	O	0..1	When present, the serving cell identifier of the Primary Cell in the Secondary RAN Node that is an E-UTRAN node when available on Dual Connectivity scenarios. (NOTE 3) (NOTE 4)	
ncgi	Ncgi	O	0..1	When present, this IE shall indicate the identifier of the NR cell serving the UE or the serving cell identifier of the Primary Cell in the Master RAN Node that is a NR node on Dual Connectivity scenarios. (NOTE 2)	
ncgiOnSecondNode	Ncgi	O	0..1	When present, the serving cell identifier of the Primary Cell in the Secondary RAN Node that is a NR node when available on Dual Connectivity scenarios. (NOTE 3) (NOTE 4)	
priority	LcsPriority	O	0..1	When present, this IE shall indicate the priority of the location request.	
velocityRequested	VelocityRequested	O	0..1	When present, this IE shall indicate whether velocity is requested or not.	
ueLcsCap	UeLcsCapability	O	0..1	When present, this IE shall indicate the LCS capability supported by the UE.	
lcsServiceType	LcsServiceType	O	0..1	The LCS service type	
ldrType	LdrType	O	0..1	The type of LDR	
hgmlcCallBackURI	Uri	C	0..1	Callback URI of the H-GMLC It shall be present, if attribute LdrType is present. This IE shall also be present for location service in PNI-NPN with signalling optimisation, as specified in 3GPP TS 23.273 [42] clause 6.1.2.	
lirGmlcCallBackUri	Uri	C	0..1	This IE shall be present when the intermediateLocationInd IE is present with the value "true". When present, this IE shall contain callback URI of the GMLC to receive the intermediate location reports.	
vgmlcAddress	Uri	C	0..1	V-GMLC address that corresponds to the V-GMLC that receives Location Request It shall be present, if attribute LdrType is present and the target UE is in roaming case.	

ldrReference	LdrReference	C	0..1	LDR Reference Number It shall be present, if attribute LdrType is present. This IE shall be present for location service in PNI-NPN with signalling optimisation, as specified in 3GPP TS 23.273 [42] clause 6.1.2.	
lirReference	LirReference	C	0..1	This IE shall be present when the intermediateLocationInd IE is present with the value "true". When present, this IE shall contain the LIR Reference Number for a multiple location request	
periodicEventInfo	PeriodicEventInfo	C	0..1	Information for periodic event reporting	
areaEventInfo	AreaEventInfo	C	0..1	Information for area event reporting	
motionEventInfo	MotionEventInfo	C	0..1	Information for motion event reporting	
reportingAccessTypes	array(ReportingAccessType)	O	1..N	Allowed access types for event reporting	
ueConnectivityStates	array(UeConnectivityState)	O	1..N	When present, this IE shall indicate the UE connectivity state per access type	
ueLocationServiceInd	UeLocationServiceInd	C	0..1	If UE sends an MO-LR Request message, this IE shall be present and indicate the request type for a 5GC-MO-LR.	
moAssistanceDataTypes	LcsBroadcastAssistanceTypesData	O	0..1	When present, this IE shall indicate a list of one or more types of location assistance data that UE subscribed.	
lppMessage	RefToBinaryData	C	0..1	If UE includes the first LPP message in MO-LR Request, this IE shall be present and Indicate the binary data of LPP message. (NOTE 5)	
lppMessageExt	array(RefToBinaryData)	C	1..N	If UE includes the additional LPP messages (maximum 3) in MO-LR Request, this IE shall be present and Indicates the binary data of LPP message. (NOTE 5)	
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in clause 6.1.9 is supported.	
uePositioningCap	UePositioningCapabilities	O	0..1	When present, this IE shall indicate the positioning capabilities supported by the UE.	
tnapId	TnapId	O	0..1	When present, this IE shall contain the TNAP Identifier. This IE may be present for non-3GPP access.	
twapId	TwapId	O	0..1	When present, This IE shall contain the TWAP Identifier. This IE may be present for non-3GPP access.	
ueCountryDetInd	boolean	O	0..1	When present, This IE shall contain an indication of determining the UE geographical area identified by the country, area within a country or international area indication where UE is located for PLMN selection verification.	SAT
scheduledLocTime	DateTime	O	0..1	When present, this IE shall contain the scheduled time (in UTC) that the UE needs to be located.	
reliableLocReq	boolean	C	0..1	This IE shall be included with the value true to indicate that reliable UE location information is required, as specified in 3GPP TS 33.256 [26] clause 5.3.2. When present, this IE shall be set as following: - true: the reliable UE location information is required - false (default): the reliable UE location information is not required	

evtRptAllowedAreas	array(ReportingArea)	O	1..250	When present, this IE shall contain a list of event report allowed areas, where UE is allowed to generate and send the event report to network during the deferred 5GC-MT-LR procedure for UE power saving purpose.	
ueUnawareInd	boolean	C	0..1	UE Unaware Positioning indication. If the UE Unaware Positioning is required, as specified in 3GPP TS 23.273 [19] clause 5.12, this IE shall be included and set to true; otherwise, the IE shall be absent.	
intermediateLocationInd	boolean	C	0..1	This IE shall be included by the AMF if received from the GMLC, during a 5GC-MT-LR multiple location procedure for the regulatory location service (see clause 6.1.3 and clause 6.10.4 of 3GPP TS 23.273 [19]). When present, this IE shall indicate the acceptance of intermediate location response at the GMLC: - true: intermediate location response acceptable - false (default): intermediate location response not acceptable	
maxRespTime	DurationSec	C	0..1	This IE shall be included by the AMF if received from the GMLC. When present, this IE shall contain the maximum response time for the GMLC to receive the final location response. The AMF may overwrite the received maximum response time when passing it to the LMF, e.g., to avoid timeout of the HTTP service request.	
lpHapType	LpHapType	C	0..1	This IE shall be included and set to "LOW_POW_HIGH_ACCU_POS" to request low power and high accuracy positioning, as specified in clause 6.1.2 of 3GPP TS 23.273 [19].	
ueUpPosCaps	array(UeUpPositioning Capabilities)	O	1..N	When present, this IE shall indicate the user plane positioning capabilities supported by the UE.	
reportingInd	ReportingInd	O	0..1	This IE may be present if the evtRptAllowedAreas IE is present. When present, this IE shall indicate whether the UE is allowed to generate and send the reports inside or outside the event report allowed areas: - Inside reporting (default) - Outside reporting (see 3GPP TS 23.273 [19] clause 5.14 and 6.3.1)	
mbsrInfo	MbsrInfo	O	0..1	Indicates that serving cell of the UE belongs to a MBSR	MBSR
additionalUeInfo	AdditionalUeInfo	O	0..1	When present, this IE indicates the serving cell of the MBSR UE (i.e., IAB UE)	MBSR
integrityRequirements	IntegrityRequirements	O	0..1	When present, this IE shall indicate the integrity requirements.	
requestedRangingSlResult	array(RangingSlResult)	O	1..N	This IE shall contain the type of result requested for ranging and sidelink positioning, such as absolute locations, relative locations or distances and directions related to the UEs, etc.	
relatedUEs	array(RelatedUE)	O	1..N	This IE contains a list of the information for the related UEs for the ranging and sidelink positioning.	

upLocRepAddrAf	UpLocRepAddrAfRm	O	0..1	This IE shall be present if the request is for the location reporting over user plane.	
upCumEvtRptCriteria	UpCumEvtRptCriteria	O	0..1	This IE may be present if the upLocRepAddrAf is present.	
mappedQoSEps	MappedLocationQoSEps	C	0..1	This IE shall be present if the Multiple QoS Class is indicated in the locationQoS IE. When present, this IE shall indicate the mapped Location QoS applicable to EPS ("BEST_EFFORT" or "ASSURED") based on the Multiple Location QoS (see clause 6.19 of 3GPP TS 23.273 [19]).	
coordinateID	integer	O	0..1	This IE may be present when requestedRangingSlResult indicates "ABSOLUTE_LOCATION". When present, this IE represents a local coordinate (see clause 6.20.3 of 3GPP TS 23.273 [4]).	Ranging_SL
rangingSlCapability	RangingSlCapability	O	0..1	When present, this IE shall indicate that the UE supports Ranging/Sidelink Positioning Capability.	Ranging_SL
NOTE 1: At least one of the attributes defined in this table shall be present in the InputData structure. NOTE 2: Attribute "ecgi" and "ncgi" shall not be present at the same time. NOTE 3: Attribute "ecgiOnSecondNode" and "ncgiOnSecondNode" shall not be present at the same time. NOTE 4: Attribute "ecgiOnSecondNode" or "ncgiOnSecondNode" shall not be present if neither attribute "ecgi" nor "ncgi" is present. NOTE 5: If 3 LPP messages are received, then first LPP message shall be encoded in lppMessage IE and additional 2 LPP messages shall be encoded in lppMessageExt IE.					

6.1.6.2.3 Type: LocationData

Table 6.1.6.2.3-1: Definition of type LocationData

Attribute name	Data type	P	Cardinality	Description	Applicability
locationEstimate	GeographicArea	M	1	For a request for triggered location where location estimates are not required, the location estimate can be based on current serving cell.	
accuracyFulfilmentIndicator	AccuracyFulfilmentIndicator	O	0..1	When present, this IE shall indicate fulfilment of required accuracy.	
ageOfLocationEstimate	AgeOfLocationEstimate	O	0..1	When present, this IE shall indicate age of the location estimate.	
timestampOfLocationEstimate	DateTime	O	0..1	When present, this IE shall indicate the estimated UTC time when the location estimate corresponded to the UE location (i.e. when the location estimate and the actual UE location was the same).	
velocityEstimate	VelocityEstimate	O	0..1	When present, this IE shall indicate velocity estimate.	
civicAddress	CivicAddress	O	0..1	When present, this IE shall indicate a civic address.	
localLocationEstimate	LocalArea	O	0..1	When present, this IE shall indicate a local area in reference system.	
positioningDataList	array(PositioningMethodAndUsage)	O	1..N	When present, this IE shall include a list of data related to positioning methods.	
gnssPositioningDataList	array(GnssPositioningMethodAndUsage)	O	1..N	When present, this IE shall include a list of data related to GNSS positioning methods.	
ecgi	Ecgi	O	0..1	When present, this IE shall indicate the ID of the E-UTRAN cell serving the UE.	
ncgi	Ncgi	O	0..1	When present, this IE shall indicate the ID of the NR cell serving the UE.	
altitude	Altitude	O	0..1	Altitude of the positioning estimate. When the shape used in "locationEstimate" supports conveying the altitude parameter, this IE shall be absent.	
barometricPressure	BarometricPressure	O	0..1	If present, this IE contains the barometric pressure measurement as reported by the target UE.	
servingLMFidentification	LMFIdentification	O	0..1	When present, this IE shall indicate the identity of the serving LMF	
uePositioningCap	UePositioningCapabilities	O	0..1	When present, this IE shall indicate the positioning capabilities supported by the UE.	
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in clause 6.1.9 is supported.	

ueAreaInd	UeAreaIndication	O	0..1	When present, this IE shall contain a country, area in a country or international area indication where UE is located. If UE is outside of the area of any known country, i.e. international area, then the LMF shall provide the International Area Indication without a country.	SAT
achievedQos	MinorLocationQoS	O	0..1	When present, this IE shall contain the achieved Location QoS Accuracy of the estimated location. This IE may be present if the LCS QoS Class required in the request message is "MULTIPLE_QOS". If it's absent, LCS QoS Class required in the request message is "MULTIPLE_QOS" and AccuracyFulfilmentIndicator is "REQUESTED_ACCURACY_FULFILLED", it indicates that the location QoS in the highest priority is achieved.	MUTIQOS
directReportInd	boolean	C	0..1	When present, this IE shall be set for the following value: - true: location determination will be sent by LMF to GMLC directly - false (default): location determination will not be sent by LMF to GMLC directly	
indoorOutdoorInd	IndoorOutdoorInd	O	0..1	When present, this IE shall indicate whether the UE is indoor or outdoor.	
acceptedPeriodicEventInfo	PeriodicEventInfo	C	0..1	This IE shall be present if PeriodicEventInfo was received in the request which includes reportingAmountInf IE and/or reportingIntervalMs IE. When present, this IE shall provide the accepted periodic event reporting information.	
haGnssMetrics	HighAccuracyGnssMetrics	O	0..1	When present, this IE shall indicate the high accuracy GNSS metrics received from the device in the LPP *HA-GNSS-Metrics-r17* IE as specified in 3GPP TS 37.355 [21].	
losNlosMeasureInd	LosNlosMeasureInd	O	0..1	When present, this IE shall indicate whether LOS measurement or NLOS measurement is used.	

rangingSlCapability	RangingSlCapability	O	0..1	When present, this IE shall indicate that the UE supports Ranging/Sidelink Positioning Capability.	Ranging_SL
relatedApplicationlayerId	ApplicationlayerId	O	0..1	Identifies the application layer ID of the related UE for ranging and sidelink positioning, such as located UE, reference UE, etc.	Ranging_SL
distanceDirection	RangeDirection	O	0..1	When present, this IE identifies a distance and direction from a point A to a point B, comprising a distance from point A to point B, an azimuth direction from point A to point B and an elevation direction from point A to point B.	Ranging_SL
2dRelativeLocation	2DRelativeLocation	O	0..1	When present, this IE identifies a relative 2D location with uncertainty ellipse, characterised by a point described in 2D local co-ordinates with origin corresponding to another known point, distances r1 and r2 and an angle of orientation A.	Ranging_SL
3dRelativeLocation	3DRelativeLocation	O	0..1	When present, this IE identifies a relative 3D location with uncertainty ellipsoid, characterised by a point described in 3D local co-ordinates with origin corresponding to another known point, distances r1 (the "semi-major uncertainty"), r2 (the "semi-minor uncertainty") and r3 (the "vertical uncertainty") and an angle of orientation A (the "angle of the major axis").	Ranging_SL
relativeVelocity	VelocityEstimate	O	0..1	When present, this IE identifies UE velocity relative to the UE identified with relatedApplicationlayerId.	Ranging_SL

6.1.6.2.4 Type: GeographicalCoordinates

Table 6.1.6.2.4-1: Definition of type GeographicalCoordinates

Attribute name	Data type	P	Cardinality	Description
lon	number	M	1	Longitude (Double-precision float value): Format: double Minimum: -180 Maximum: 180
lat	number	M	1	Latitude (Double-precision float value): Format: double Minimum: -90 Maximum: 90

6.1.6.2.5 Type: GeographicArea

Table 6.1.6.2.5-1: Definition of type GeographicArea as a list of mutually exclusive alternatives

Data type	Cardinality	Discriminator property name	Discriminator mapping	Description
Point	1	shape	POINT	Geographical area consisting of a single point, represented by its longitude and latitude.
PointUncertaintyCircle	1	shape	POINT_UNCERTAINTY_CIRCLE	Geographical area consisting of a point and an uncertainty value.
PointUncertaintyEllipse	1	shape	POINT_UNCERTAINTY_ELLIPSE	Geographical area consisting of a point, plus an uncertainty ellipse and a confidence value.
Polygon	1	shape	POLYGON	Geographical area consisting of a list of points (between 3 to 15 points).
PointAltitude	1	shape	POINT_ALTITUDE	Geographical area consisting of a point and an altitude value.
PointAltitudeUncertainty	1	shape	POINT_ALTITUDE_UNCERTAINTY	Geographical area consisting of a point, an altitude value and an uncertainty value.
EllipsoidArc	1	shape	ELLIPSOID_ARC	Geographical are consisting of an ellipsoid arc.
NOTE: The "anyOf" keyword (instead of "oneOf" keyword which is normally used for mutually exclusive alternatives) is used for GeographicArea type in yaml file to avoid validation failure of OpenAPI. According to current definition, a PointUncertaintyCircle object will always pass the validation with both PointUncertaintyCircle and Point, which fails the qualification of "oneOf" keyword.				

6.1.6.2.6 Type: Point

Table 6.1.6.2.6-1: Definition of type Point

Attribute name	Data type	P	Cardinality	Description
shape	SupportedGADShapes	M	1	It shall take the value "POINT".
point	GeographicalCoordinates	M	1	Indicates a geographic point represented by its longitude and latitude.

6.1.6.2.7 Type: PointUncertaintyCircle

Table 6.1.6.2.7-1: Definition of type PointUncertaintyCircle

Attribute name	Data type	P	Cardinality	Description
shape	SupportedGADShapes	M	1	It shall take the value "POINT_UNCERTAINTY_CIRCLE".
point	GeographicalCoordinates	M	1	Indicates a geographic point represented by its longitude and latitude.
uncertainty	Uncertainty	M	1	Indicates the uncertainty value.

6.1.6.2.8 Type: PointUncertaintyEllipse

Table 6.1.6.2.8-1: Definition of type PointUncertaintyEllipse

Attribute name	Data type	P	Cardinality	Description
shape	SupportedGADShapes	M	1	It shall take the value "POINT_UNCERTAINTY_ELLIPSE".
point	GeographicalCoordinates	M	1	Indicates a geographic point represented by its longitude and latitude.
uncertaintyEllipse	UncertaintyEllipse	M	1	Indicates an uncertainty ellipse.
confidence	Confidence	M	1	Indicates the value of confidence.

6.1.6.2.9 Type: Polygon

Table 6.1.6.2.9-1: Definition of type Polygon

Attribute name	Data type	P	Cardinality	Description
shape	SupportedGADShapes	M	1	It shall take the value "POLYGON".
pointList	array(GeographicalCoordinates)	M	3..15	Array with up to15 items, where each item is a "point".

6.1.6.2.10 Type: PointAltitude

Table 6.1.6.2.10-1: Definition of type PointAltitude

Attribute name	Data type	P	Cardinality	Description
shape	SupportedGADShapes	M	1	It shall take the value "POINT_ALTITUDE".
point	GeographicalCoordinates	M	1	Indicates a geographic point represented by its longitude and latitude.
altitude	Altitude	M	1	Indicates the value of altitude.

6.1.6.2.11 Type: PointAltitudeUncertainty

Table 6.1.6.2.11-1: Definition of type PointAltitudeUncertainty

Attribute name	Data type	P	Cardinality	Description
shape	SupportedGADShapes	M	1	It shall take the value "POINT_ALTITUDE_UNCERTAINTY".
point	GeographicalCoordinates	M	1	Indicates a geographic point represented by its longitude and latitude.
altitude	Altitude	M	1	Indicates the value of altitude.
uncertaintyEllipse	UncertaintyEllipse	M	1	Indicates the uncertainty ellipse
uncertaintyAltitude	Uncertainty	M	1	Indicates the uncertainty of the altitude.
confidence	Confidence	M	1	Indicates the value of confidence. If the vConfidence IE is present, this IE shall indicate the value of horizontal confidence.
vConfidence	Confidence	O	0..1	When present, this IE shall Indicate the value of vertical confidence.

6.1.6.2.12 Type: EllipsoidArc

Table 6.1.6.2.12-1: Definition of type EllipsoidArc

Attribute name	Data type	P	Cardinality	Description
shape	SupportedGADShapes	M	1	It shall take the value "ELLIPSOID_ARC".
point	GeographicalCoordinates	M	1	Indicates a geographic point represented by its longitude and latitude.
innerRadius	InnerRadius	M	1	Indicates the value of inner radius of the Ellipsoid Arc.
uncertaintyRadius	Uncertainty	M	1	Indicates the uncertainty radius of the Ellipsoid Arc.
offsetAngle	Angle	M	1	Indicates the offset angle of the Ellipsoid Arc.
includedAngle	Angle	M	1	Indicates the included angle of the Ellipsoid Arc.
confidence	Confidence	M	1	Indicates the value of confidence.

6.1.6.2.13 Type: LocationQoS

Table 6.1.6.2.13-1: Definition of type LocationQoS

Attribute name	Data type	P	Cardinality	Description	Applicability
hAccuracy	Accuracy	O	0..1	Horizontal accuracy	
vAccuracy	Accuracy	O	0..1	Vertical accuracy	
vertRequested	boolean	O	0..1	Vertical accuracy requested (yes/no)	
responseTime	ResponseTime	O	0..1	No delay, Low delay or Delay tolerant	
minorLocQoses	array(MinorLocationQoS)	C	1..2	If present, this IE shall contain a list of MinorLocationQoS in priority order. When the lcsQosClass sets to "MULTIPLE_QOS", this IE shall be present, and when lcsQosClass sets to either "BEST_EFFORT" or "ASSURED" this IE shall be absent.	MUTIQOS
lcsQosClass	LcsQosClass	C	0..1	LCS QoS Class, see clause 4.1b of 3GPP TS 23.273 [19]. This IE shall be absent if neither hAccuracy nor vAccuracy is included.	
NOTE: If the lcsQosClass set to "MULTIPLE_QOS", at least one of attributes hAccuracy, vAccuracy shall be present.					

6.1.6.2.14 Type: CivicAddress

Table 6.1.6.2.14-1: Definition of type CivicAddress

Attribute name	Data type	P	Cardinality	Description
country	string	M	1	The two-letter ISO 3166 country code in capital ASCII letters, e.g., DE or US IETF RFC 4776 [6]
A1	string	O	0..1	National subdivisions (state, canton, region, province, prefecture) IETF RFC 4776 [6]
A2	string	O	0..1	County, parish, gun (JP), district (IN) IETF RFC 4776 [6]
A3	string	O	0..1	City, township, shi (JP) IETF RFC 4776 [6]
A4	string	O	0..1	City division, borough, city district, ward, chou (JP) IETF RFC 4776 [6]
A5	string	O	0..1	Neighbourhood, block IETF RFC 4776 [6]
A6	string	O	0..1	Group of streets below the neighbourhood level IETF RFC 4776 [6]
PRD	string	O	0..1	Leading street direction IETF RFC 4776 [6]
POD	string	O	0..1	Trailing street suffix IETF RFC 4776 [6]
STS	string	O	0..1	Street suffix or type IETF RFC 4776 [6]
HNO	string	O	0..1	House number IETF RFC 4776 [6]
HNS	string	O	0..1	House number suffix IETF RFC 4776 [6]
LMK	string	O	0..1	Landmark or vanity address IETF RFC 4776 [6]
LOC	string	O	0..1	Additional location information IETF RFC 4776 [6]
NAM	string	O	0..1	Name (residence and office occupant) IETF RFC 4776 [6]
PC	string	O	0..1	Postal/zip code IETF RFC 4776 [6]
BLD	string	O	0..1	Building (structure) IETF RFC 5139 [7]
UNIT	string	O	0..1	Unit (apartment, suite) IETF RFC 5139 [7]
FLR	string	O	0..1	Floor IETF RFC 4776 [6]
ROOM	string	O	0..1	Room IETF RFC 5139 [7]
PLC	string	O	0..1	Place-type IETF RFC 5139 [7]
PCN	string	O	0..1	Postal community name IETF RFC 5139 [7]
POBOX	string	O	0..1	Post office box (P.O. box) IETF RFC 5139 [7]
ADDCODE	string	O	0..1	Additional code IETF RFC 5139 [7]
SEAT	string	O	0..1	Seat (desk, cubicle, workstation) IETF RFC 5139 [7]
RD	string	O	0..1	Primary road or street IETF RFC 5139 [7]
RDSEC	string	O	0..1	Road clause IETF RFC 5139 [7]
RDBR	string	O	0..1	Road branch IETF RFC 5139 [7]
RDSUBBR	string	O	0..1	Road sub-branch IETF RFC 5139 [7]
PRM	string	O	0..1	Road pre-modifier IETF RFC 5139 [7]
POM	string	O	0..1	Road post-modifier IETF RFC 5139 [7]

usageRules	string	O	0..1	When present, this IE shall carry the value of "usage-rules" Element of the PIDL-LO XML document, with UTF-8 encoding. IETF RFC 4119 [25]
method	string	O	0..1	When present, this IE shall contain the method token, carried by the "method" Element of the PIDL-LO XML document. IETF RFC 4119 [25]
providedBy	string	O	0..1	When present, this IE shall carry the value of "provided-by" Element of the PIDL-LO XML document, with UTF-8 encoding. IETF RFC 4119 [25]

EXAMPLE: The above structure follows the same label naming as in the XML schema shown in IETF RFC 5139 [7]. The same example shown in XML in that RFC, in clause 5, would be equivalent to the following JSON document:

```
{
  "country": "AU",
  "A1": "NSW",
  "A3": "Wollongong",
  "A4": "North Wollongong",
  "RD": "Flinders",
  "STS": "Street",
  "RDBR": "Campbell Street",
  "LMK": "Gilligan's Island",
  "LOC": "Corner",
  "NAM": "Video Rental Store",
  "PC": "2500",
  "ROOM": "Westerns and Classics",
  "PLC": "store",
  "POBOX": "Private Box 15"
}
```

6.1.6.2.15 Type: PositioningMethodAndUsage

Table 6.1.6.2.15-1: Definition of type PositioningMethodAndUsage

Attribute name	Data type	P	Cardinality	Description
method	PositioningMethod	M	1	Indicates the related positioning method
mode	PositioningMode	M	1	Indicates the mode of the location measurement from the related positioning method.
usage	Usage	M	1	Indicates the usage of the location measurement from the related positioning method.
methodCode	integer	C	0..1	This IE shall be present when the *method* IE is with value "NETWORK_SPECIFIC". When present, this IE shall carry the code value of the network specific positioning method in decimal which encodes the binary value "10000 to 11111" (bits 8-4 of "*Positioning Method and Usage*" IE within "*Positioning Data*" parameter, as specified in clause 7.4.13 of 3GPP TS 29.171 [24].) Minimum: 16 Maximum: 31

6.1.6.2.16 Type: GnssPositioningMethodAndUsage

Table 6.1.6.2.16-1: Definition of type GnssPositioningMethodAndUsage

Attribute name	Data type	P	Cardinality	Description
mode	PositioningMode	M	1	Indicates the mode of location measurement from the related GNSS positioning method.
gnss	GnssId	M	1	Indicates the related GNSS positioning method
usage	Usage	M	1	Indicates the usage of the location measurement from related GNSS positioning method.

6.1.6.2.17 Type: VelocityEstimate

Table 6.1.6.2.17-1: Definition of type VelocityEstimate as a list of mutually exclusive alternatives

Data type	Cardinality	Description
HorizontalVelocity	1	Velocity estimate including horizontal speed and bearing.
HorizontalWithVerticalVelocity	1	Velocity estimate including horizontal speed and bearing, and also vertical speed and vertical direction.
HorizontalVelocityWithUncertainty	1	Velocity estimate including horizontal speed and bearing; it also includes an uncertainty value.
HorizontalWithVerticalVelocityAndUncertainty	1	Velocity estimate including horizontal speed and bearing, and also vertical speed and vertical direction; it also includes uncertainty value for horizontal and vertical speeds.

6.1.6.2.18 Type: HorizontalVelocity

Table 6.1.6.2.18-1: Definition of type HorizontalVelocity

Attribute name	Data type	P	Cardinality	Description
hSpeed	HorizontalSpeed	M	1	Horizontal speed in kilometres per hour.
bearing	Angle	M	1	Bearing angle in degrees, measured clockwise from North.

6.1.6.2.19 Type: HorizontalWithVerticalVelocity

Table 6.1.6.2.19-1: Definition of type HorizontalWithVerticalVelocity

Attribute name	Data type	P	Cardinality	Description
hSpeed	HorizontalSpeed	M	1	Horizontal speed in kilometres per hour.
bearing	Angle	M	1	Bearing angel in degrees, measured clockwise from North.
vSpeed	VerticalSpeed	M	1	Vertical Seed in kilometres per hour.
vDirection	VerticalDirection	M	1	Vertical Direction: upward or downward.

6.1.6.2.20 Type: HorizontalVelocityWithUncertainty

Table 6.1.6.2.20-1: Definition of type HorizontalVelocityWithUncertainty

Attribute name	Data type	P	Cardinality	Description
hSpeed	HorizontalSpeed	M	1	Speed in kilometres per hour.
bearing	Angle	M	1	Bearing angel in degrees, measured clockwise from North.
uncertainty	SpeedUncertainty	M	1	Uncertainty of horizontal speed in kilometres per hour.

6.1.6.2.21 Type: HorizontalWithVerticalVelocityAndUncertainty

Table 6.1.6.2.21-1: Definition of type HorizontalWithVerticalVelocityAndUncertainty

Attribute name	Data type	P	Cardinality	Description
hspeed	HorizontalSpeed	M	1	Speed in kilometres per hour.
bearing	Angle	M	1	Bearing angel in degrees, measured clockwise from North.
vSpeed	VerticalSpeed	M	1	Vertical Seed in kilometres per hour.
vDirection	VerticalDirection	M	1	Vertical Direction: upwards or downwards.
hUncertainty	SpeedUncertainty	M	1	Uncertainty of horizontal speed in kilometres per hour.
vUncertainty	SpeedUncertainty	M	1	Uncertainty of vertical speed in kilometres per hour.

6.1.6.2.22 Type: UncertaintyEllipse

Table 6.1.6.2.22-1: Definition of type UncertaintyEllipse

Attribute name	Data type	P	Cardinality	Description
semiMajor	Uncertainty	M	1	Indicates the semi-major axis of the uncertainty ellipse.
semiMinor	Uncertainty	M	1	Indicates the semi-minor axis of the uncertainty ellipse.
orientationMajor	Orientation	M	1	Indicates the orientation angle of the major axis.

6.1.6.2.23 Type: UeLcsCapability

Table 6.1.6.2.23-1: Definition of type UeLcsCapability

Attribute name	Data type	P	Cardinality	Description
lppSupport	boolean	O	0..1	Indicates whether the UE supports LPP or not. - true (default): LPP supported by the UE - false: LPP not supported by the UE
ciotOptimisation	boolean	O	0..1	Indicates whether the UE supports and is allowed to use Control Plane CIoT 5GS Optimisation to send an event report for periodic or triggered location or not. Refer to 3GPP TS 23.273 [19] clause 6.7 for more detail. - true: Control Plane CIoT 5GS Optimisation is supported by the UE and allowed - false (default): Control Plane CIoT 5GS Optimisation not supported by the UE or not allowed

6.1.6.2.24 Type: PeriodicEventInfo

Table 6.1.6.2.24-1: Definition of type PeriodicEventInfo

Attribute name	Data type	P	Cardinality	Description
reportingAmount	ReportingAmount	M	1	Number of event reports
reportingInterval	ReportingInterval	M	1	Interval of event reports
reportingInfiniteInd	boolean	O	0..1	When present, this IE shall be set to the value true, indicating that as many reports as possible to be generated during allowed duration (8639999 seconds). When this IE is present in a request, the reportingAmount should be set to the largest possible value (see NOTE) for backward compatibility consideration. An LMF supporting this IE shall ignore the reportingAmount IE and an LMF not supporting this IE will use reportingAmount IE to generate indicated number of reports as legacy. When this IE is present in a response, it indicates that this IE is supported and accepted by the LMF.
reportingIntervalMs	ReportingIntervalMs	O	0..1	When present, this IE shall indicate the Interval of event reports in milliseconds. When this IE is present in a request, the reportingInterval is set to 1 for backward compatible consideration. An LMF supporting this IE shall ignore the reportingInterval IE; an LMF not supporting this IE will use reportingInterval IE to generate report with minimal interval as legacy, i.e. 1 second. When this IE is present in a response, it indicates that this IE is supported by the LMF and it shall indicate the value accepted by the LMF.
NOTE: reportingAmount x reportingInterval shall not exceed 8639999 (99 days, 23 hours, 59 minutes and 59 seconds) for compatibility with OMA MLP and RLP.				

6.1.6.2.25 Type: AreaEventInfo

Table 6.1.6.2.25-1: Definition of type AreaEventInfo

Attribute name	Data type	P	Cardinality	Description
areaDefinition	array(ReportingArea)	M	1..250	One or more reporting areas
occurrenceInfo	OccurrenceInfo	O	0..1	One time only report indication
minimumInterval	MinimumInterval	C	0..1	Minimum interval between event reports. This IE shall not be included if occurrenceInfo is present and set to one time event.
maximumInterval	MaximumInterval	C	0..1	Maximum interval between event reports. This IE shall not be included if occurrenceInfo is present and set to one time event.
samplingInterval	SamplingInterval	O	0..1	Maximum time interval between consecutive evaluations by a UE of a trigger event.
reportingDuration	ReportingDuration	O	0..1	Maximum duration of event reporting.
reportingLocationReq	boolean	C	0..1	This IE shall be present and set to true if a location estimate is required for each event report. When present, it shall be set as follows: - true: location report is required. - false: location report is not required.

6.1.6.2.26 Type: ReportingArea

Table 6.1.6.2.26-1: Definition of type ReportingArea

Attribute name	Data type	P	Cardinality	Description
areaType	ReportingAreaType	M	1	Type of reporting area.
tai	Tai	C	1	TAI for EPS or 5GS. This IE shall be present if the reporting area type is EPS TAI or 5GS TAI.
ecgi	Ecgi	C	1	ECGI. This IE shall be present if the reporting area type is ECGI.
ncgi	Ncgi	C	1	NCGI. This IE shall be present if the reporting area type is NCGI.
NOTE: One of tai, ecgi or ncgi shall be included.				

6.1.6.2.27 Type: MotionEventInfo

Table 6.1.6.2.27-1: Definition of type MotionEventInfo

Attribute name	Data type	P	Cardinality	Description
linearDistance	LinearDistance	M	1	Minimum linear (straight line) distance for motion event reports.
occurrenceInfo	OccurrenceInfo	O	0..1	One time only report indication
minimumInterval	MinimumInterval	C	0..1	Minimum interval between event reports. This IE shall not be included if occurrenceInfo is present and set to one time event.
maximumInterval	MaximumInterval	C	0..1	Maximum interval between event reports. This IE shall not be included if occurrenceInfo is present and set to one time event.
samplingInterval	SamplingInterval	O	0..1	Maximum time interval between consecutive evaluations by a UE of a trigger event.
reportingDuration	ReportingDuration	O	0..1	Maximum duration of event reporting.
reportingLocationReq	boolean	C	0..1	This IE shall be present and set to true if a location estimate is required for each event report. When present, it shall be set as follows: - true: location report is required. - false: location report is not required.

6.1.6.2.28 Void

6.1.6.2.29 Type: CancelLocData

Table 6.1.6.2.29-1: Definition of type CancelLocData

Attribute name	Data type	P	Cardinality	Description
hgmlcCallBackURI	Uri	M	1	Callback URI of the H-GMLC
ldrReference	LdrReference	M	1	LDR Reference
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in clause 6.1.9 is supported.

6.1.6.2.30 Type: LocContextData

Table 6.1.6.2.30-1: Definition of type LocContextData

Attribute name	Data type	P	Cardinality	Description
amfId	NfInstanceId	M	1	Indicates the AMF Instance serving the UE. LMF shall use the AMF Instance to forward LCS related N1/N2 messages to the UE/RAN.
locationQoS	LocationQoS	C	0..1	This IE shall contain the location QoS if available.
supportedGADShapes	array(SupportedGADShapes)	C	1..N	This IE shall contain the supported GAD shapes if available.
supi	Supi	C	0..1	This IE shall contain the SUPI if available.
gpsi	Gpsi	C	0..1	This IE shall contain the GPSI if available.
ldrType	LdrType	M	1	The type of LDR
hgmlcCallBackURI	Uri	M	1	Callback URI of the H-GMLC
ldrReference	LdrReference	M	1	LDR Reference
periodicEventInfo	PeriodicEventInfo	C	0..1	Information for periodic event reporting
areaEventInfo	AreaEventInfo	C	0..1	Information for area event reporting
motionEventInfo	MotionEventInfo	C	0..1	Information for motion event reporting
eventReportMessage	EventReportMessage	M	1	Contains an embedded event report
eventReportingStatus	EventReportingStatus	O	0..1	Status of event reporting
ueLocationInfo	UELocationInfo	O	0..1	Location information for the target UE
cIoT5GSOptimisation	boolean	C	0..1	This IE shall be present if it was received from AMF. When present, it shall be set as follows: - true: Control Plane CIoT 5GS Optimisation was used and no signalling or data is currently pending for the UE at the AMF. - false (default): Control Plane CIoT 5GS Optimisation was not used or signalling or data is currently pending for the UE at the AMF.
ecgi	Ecgi	C	0..1	When present, this IE shall indicate the identifier of the E-UTRAN cell serving the UE. This IE shall be present if it was received from AMF.
ncgi	Ncgi	C	0..1	When present, this IE shall indicate the identifier of the NR cell serving the UE. This IE shall be present if it was received from AMF
guami	Guami	C	0..1	This IE shall be present if it was received from AMF. When present, it shall contain the GUAMI serving the UE.
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in clause 6.1.9 is supported.
uePositioningCap	UePositioningCapabilities	O	0..1	When present, this IE shall indicate the positioning capabilities supported by the UE.
scheduledLocTime	DateTime	O	0..1	When present, this IE shall contain the scheduled time (in UTC) that the UE needs to be located.
indoorOutdoorInd	IndoorOutdoorInd	O	0..1	When present, this IE shall indicate whether the UE is indoor or outdoor.
losNlosMeasureInd	LosNlosMeasureInd	O	0..1	When present, this IE shall indicate whether LOS measurement or NLOS measurement is used.
upCumEvtRptCriteria	UpCumEvtRptCriteria	O	0..1	When present, this IE shall include the cumulative event report timer or the maximum number of location reporting over user plane or both.
NOTE: At least one of periodicEventInfo, areaEventInfo or motionEventInfo shall be present in the LocContextData structure.				

6.1.6.2.31 Type: EventReportMessage

Table 6.1.6.2.31-1: Definition of type EventReportMessage

Attribute name	Data type	P	Cardinality	Description
eventClass	EventClass	M	1	This IE shall contain the event class for the message content specified in eventContent.
eventContent	RefToBinaryData	M	1	This IE shall reference the event report binary data corresponding to the eventClass.

6.1.6.2.32 Type: EventReportingStatus

Table 6.1.6.2.32-1: Definition of type EventReportingStatus

Attribute name	Data type	P	Cardinality	Description
eventReportCounter	EventReportCounter	O	0..1	This IE shall contain a count of event reports.
eventReportDuration	EventReportDuration	O	0..1	This IE shall contain the duration of event reporting.

6.1.6.2.33 Type: UELocationInfo

Table 6.1.6.2.33-1: Definition of type UELocationInfo

Attribute name	Data type	P	Cardinality	Description
locationEstimate	GeographicArea	O	0..1	Previous location estimate for the target UE.
ageOfLocationEstimate	AgeOfLocationEstimate	O	0..1	Age of previous location estimate.
timestampOfLocationEstimate	DateTime	O	0..1	When present, this IE shall indicate the estimated UTC time when the location estimate corresponded to the UE location (i.e. when the location estimate and the actual UE location was the same).
velocityEstimate	VelocityEstimate	O	0..1	Previous velocity estimate for the target UE.
ageOfVelocityEstimate	AgeOfLocationEstimate	O	0..1	Age of previous velocity estimate.
timestampOfVelocityEstimate	DateTime	O	0..1	When present, this IE shall indicate the estimated UTC time when the velocity estimate corresponded to the UE velocity (i.e. when the velocity estimate and the actual UE velocity was the same).

6.1.6.2.34 Type: EventNotifyData

Table 6.1.6.2.34-1: Definition of type EventNotifyData

Attribute name	Data type	P	Cardinality	Description	Applicability
reportedEventType	ReportedEventType	M	1	This IE shall contain the type of event being reported.	
supi	Supi	C	0..1	This IE shall contain the SUPI if available.	
gpsi	Gpsi	C	0..1	This IE shall contain the GPSI if available.	
hgmlcCallBackURI	Uri	C	0..1	Callback URI of the H-GMLC (NOTE 1)	
ldrReference	LdrReference	M	1	LDR Reference When the ReportedEventType is "INTERMEDIATE_EVENT", the LMF shall set this IE to the value "NULL" and shall be ignored by the receiver.	
lirReference	LirRefernece	C	0..1	This IE shall be present when the ReportedEventType is set to the value "INTERMEDIATE_EVENT". When present, this IE shall include the LIR Reference number received in the 5GC-MR-LR multiple location request.	
locationEstimate	GeographicArea	O	0..1	If present, this IE shall contain an estimate of the location of the UE in universal coordinates and the accuracy of the estimate.	
ageOfLocationEstimate	AgeOfLocationEstimate	O	0..1	If present, this IE shall contain an indication of how long ago the location estimate was obtained.	
timestampOfLocationEstimate	DateTime	O	0..1	When present, this IE shall indicate the estimated UTC time when the location estimate corresponded to the UE location (i.e. when the location estimate and the actual UE location was the same).	
civicAddress	CivicAddress	O	0..1	If present, this IE shall contain a civic address.	
localLocationEstimate	LocalArea	O	0..1	When present, this IE shall indicate a local area in reference system.	
positioningDataList	array(PositioningMethodAndUsage)	O	1..N	If present, this IE shall indicate the usage of each non-GANSS positioning method that was attempted to determine the location estimate, either successfully or unsuccessfully.	
gnssPositioningDataList	array(GnssPositioningMethodAndUsage)	O	1..N	If present, this IE shall indicate the usage of each GANSS positioning method that was attempted to determine the location estimate, either successfully or unsuccessfully.	
servingLMFIdentification	LMFIdentification	C	0..1	This IE shall be included to identify an LMF which acts as a serving LMF if a serving LMF is used.	
terminationCause	TerminationCause	C	0..1	This IE shall be included if event reporting has been terminated	
velocityEstimate	VelocityEstimate	O	0..1	If present, this IE shall contain an estimate of the velocity of the target UE, composed by horizontal speed, vertical speed, and their respective uncertainty.	

altitude	Altitude	O	0..1	If present, this IE indicates the altitude of the positioning estimate. When the shape used in "locationEstimate" supports conveying the altitude parameter, this IE shall be absent.	
achievedQos	MinorLocationQoS	O	0..1	When present, this IE shall contain the achieved Location QoS Accuracy of the estimated location. This IE may be present if the required LCS QoS Class in the location request procedure is "MULTIPLE_QOS". If it's absent, the required LCS QoS Class in the location request procedure is "MULTIPLE_QOS" and AccuracyFulfilmentIndicator is "REQUESTED_ACCURACY_FULFILLED", it indicates that the location QoS in the highest priority is achieved.	MUTIQOS
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in clause 6.1.9 is supported.	
indoorOutdoorInd	IndoorOutdoorInd	O	0..1	When present, this IE shall indicate whether the UE is indoor or outdoor.	
haGnssMetrics	HighAccuracyGnssMetrics	O	0..1	When present, this IE shall indicate the high accuracy GNSS metrics received from the device in the LPP *HA-GNSS-Metrics-r17* IE as specified in 3GPP TS 37.355 [21].	
losNlosMeasureInd	LosNlosMeasureInd	O	0..1	When present, this IE shall indicate whether LOS measurement or NLOS measurement is used.	
upLocRepStatAf	integer	O	0..1	When present, this IE contains the number of event reports have transferred over user plane. If the culumative event report has been sent previously, this IE contains the number of event reports have transferred over user plane since the last cumulative event report was sent	
relatedApplicationlayerId	ApplicationlayerId	O	0..1	Identifies the application layer ID of the related UE for ranging and sidelink positioning, such as located UE, reference UE, etc.	Ranging_SL
distanceDirection	RangeDirection	O	0..1	When present, this IE identifies a distance and direction from a point A to a point B, comprising a distance from point A to point B, an azimuth direction from point A to point B and an elevation direction from point A to point B.	Ranging_SL
2dRelativeLocation	2DRelativeLocation	O	0..1	When present, this IE identifies a relative 2D location with uncertainty ellipse, characterised by a point described in 2D local co-ordinates with origin corresponding to another known point, distances r1 and r2 and an angle of orientation A.	Ranging_SL

3dRelativeLocation	3DRelativeLocation	O	0..1	When present, this IE identifies a relative 3D location with uncertainty ellipsoid, characterised by a point described in 3D local co-ordinates with origin corresponding to another known point, distances r1 (the "semi-major uncertainty"), r2 (the "semi-minor uncertainty") and r3 (the "vertical uncertainty") and an angle of orientation A (the "angle of the major axis").	Ranging_SL
relativeVelocity	VelocityEstimate	O	0..1	When present, this IE identifies UE velocity relative to the UE identified with relatedApplicationlayerId.	Ranging_SL
NOTE 1: If the reportedEventType is not "INTERMEDIATE_EVENT", the hgmlcCallBackURI shall be included when the consumer NF is not the H-GMLC.					

6.1.6.2.35 Type: UeConnectivityState

Table 6.1.6.2.35-1: Definition of type UeConnectivityState

Attribute name	Data type	P	Cardinality	Description
accessType	AccessType	M	1	Shall indicate the access type of the UE.
connectivitystate	CmState	O	0..1	When present, it shall indicate the UE connectivity state in the indicated access type.

6.1.6.2.36 Type: LocalOrigin

Table 6.1.6.2.36-1: Definition of type LocalOrigin

Attribute name	Data type	P	Cardinality	Description
coordinateId	string	M	1	This IE defines a known reference point which configured by the PLMN operator
point	GeographicalCoordinates	O	0..1	Indicates a geographic point represented by its longitude and latitude.

6.1.6.2.37 Type: RelativeCartesianLocation

Table 6.1.6.2.37-1: Definition of type RelativeCartesianLocation

Attribute name	Data type	P	Cardinality	Description
x	Float	M	1	Indicates the value (in the unit of meters) on x-axis of the relative location in the cartesian system. Positive value represents easting from reference point (origin).
y	Float	M	1	Indicates the value (in the unit of meters) on y-axis of the relative location in the cartesian system. Positive value represents northing from reference point (origin).
z	Float	O	0..1	Indicates the value (in the unit of meters) on z-axis of the relative location in the cartesian system for a 3D-Point. Positive value represents height above reference point (origin).

6.1.6.2.38 Type: Local2dPointUncertaintyEllipse

Table 6.1.6.2.38-1: Definition of type Local2dPointUncertaintyEllipse

Attribute name	Data type	P	Cardinality	Description
shape	SupportedGADShapes	M	1	It shall take the value "LOCAL_2D_POINT_UNCERTAINTY_ELLIPSE".
localOrigin	LocalOrigin	M	1	Indicates the local origin in the local Cartesian co-ordinates system configured by the PLMN operator.
point	RelativeCartesianLocation	M	1	Indicates a 2D-point (specified by "x" and "y" coordinates) relative to origin in refenrece system.
uncertaintyEllipse	UncertaintyEllipse	M	1	Indicates an uncertainty ellipse.
confidence	Confidence	M	1	Indicates the value of confidence.

6.1.6.2.39 Type: Local3dPointUncertaintyEllipsoid

Table 6.1.6.2.39-1: Definition of type Local3dPointUncertaintyEllipsoid

Attribute name	Data type	P	Cardinality	Description
shape	SupportedGADShapes	M	1	It shall take the value "LOCAL_3D_POINT_UNCERTAINTY_ELLIPSOID".
localOrigin	LocalOrigin	M	1	Indicates the local origin in the local Cartesian co-ordinates system configured by the PLMN operator.
point	RelativeCartesianLocation	M	1	Indicates a 3D-point (specified by "x", "y" and "z" coordinates) relative to origin in refenrece system.
uncertaintyEllipsoid	UncertaintyEllipsoid	M	1	Indicates the uncertainty ellipsoid
confidence	Confidence	M	1	Indicates the value of confidence.

6.1.6.2.40 Type: UncertaintyEllipsoid

Table 6.1.6.2.40-1: Definition of type UncertaintyEllipsoid

Attribute name	Data type	P	Cardinality	Description
semiMajor	Uncertainty	M	1	Indicates the semi-major axis of the uncertainty ellipsoid.
semiMinor	Uncertainty	M	1	Indicates the semi-minor axis of the uncertainty ellipsoid.
vertical	Uncertainty	M	1	Indicates the vertical axis of the uncertainty ellipsoid.
orientationMajor	Orientation	M	1	Indicates the orientation angle of the major axis.

6.1.6.2.41 Type: LocalArea

Table 6.1.6.2.41-1: Definition of type LocalArea as a list of mutually exclusive alternatives

Data type	Cardinality	Discriminator property name	Discriminator mapping	Description
Local2dPointUncertaintyEllipse	1	shape	LOCAL_2D_POINT_UNCERTAINTY_ELLIPSE	Local area consisting of a point described in 2D local co-ordinates relative to an origin in a reference system, plus an uncertainty ellipse and a confidence value.
Local3dPointUncertaintyEllipsoid	1	shape	LOCAL_3D_POINT_UNCERTAINTY_ELLIPSOID	Local area consisting of a point described in 3D local co-ordinates relative to an origin in a reference system, distances r1 (the "semi-major uncertainty"), r2 (the "semi-minor uncertainty") and r3 (the "vertical uncertainty") and an angle of orientation A (the "angle of the major axis").

6.1.6.2.42 Type: UeAreaIndication

Table 6.1.6.2.42-1: Definition of type UeAreaIndication

Attribute name	Data type	P	Cardinality	Description
country	string	C	0..1	This IE shall be present if the country or the area of country where the UE is located is determined. When present, this IE contains two-letter ISO 3166 country code in capital ASCII letters, e.g., DE or US IETF RFC 4776 [6]
internationalAreaInd	boolean	C	0..1	Indicates international area When present, it shall be set as follows: - true: UE is located in international area. - false (default): UE is not located in international area.
NOTE: Either country or internationalAreaInd shall be present.				

6.1.6.2.43 Type: MinorLocationQoS

Table 6.1.6.2.43-1: Definition of type MinorLocationQoS

Attribute name	Data type	P	Cardinality	Description
hAccuracy	Accuracy	O	0..1	Horizontal accuracy
vAccuracy	Accuracy	O	0..1	Vertical accuracy

6.1.6.2.44 Type: MbsrInfo

Table 6.1.6.2.44-1: Definition of type MbsrInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
ecgi	Ecgi	O	0..1	E-UTRA Cell Identity	
ncgi	Ncgi	O	0..1	NR Cell Identity	

6.1.6.2.45 Type: LocMeasurementReq

Table 6.1.6.2.45-1: Definition of type LocMeasurementReq

Attribute name	Data type	P	Cardinality	Description
ecgi	Ecgi	O	0..1	E-UTRA Cell Identity (NOTE)
ncgi	Ncgi	O	0..1	NR Cell Identity (NOTE)
preCalcuLocEstimate	GeographicArea	O	0..1	Pre-calculated location estimate of target UE
timestampOfPreCalcuLocEstimate	DateTime	O	0..1	Timestamp (in UTC) of pre-calculated location estimate of target UE
timeWindows	array(TimeWindow)	C	1..N	Time windows for scheduling of PRU measurements.
NOTE: Either the "ecgi" attribute or the "ncgi" attribute shall be included.				

6.1.6.2.46 Type: LocMeasurementResp

Table 6.1.6.2.46-1: Definition of type LocMeasurementResp

Attribute name	Data type	P	Cardinality	Description
locMeasurements	LocMeasurements	M	1	PRU Location Measurements
locationEstimate	GeographicArea	M	1	For a request for triggered location where location estimates are not required, the location estimate can be based on current serving cell.
ageOfLocationEstimate	AgeOfLocationEstimate	O	0..1	When present, this IE shall indicate age of the location estimate.
timestampOfLocationEstimate	DateTime	O	0..1	When present, this IE shall indicate the estimated UTC time when the location estimate corresponded to the UE location (i.e. when the location estimate and the actual UE location was the same).
velocityEstimate	VelocityEstimate	O	0..1	When present, this IE shall indicate velocity estimate.
localLocationEstimate	LocalArea	O	0..1	When present, this IE shall indicate a local area in reference system.

6.1.6.2.47 Type: LocMeasurements

Table 6.1.6.2.47-1: Definition of type LocMeasurements

Attribute name	Data type	P	Cardinality	Description
rstd	Integer	O	0..1	Reference Signal Time Difference (RSTD), as specified in 3GPP TS 38.305 [3]

Editor's note: The details of LocMeasurements are based on Stage2's details and referred to TS 23.273 and TS 38.305.

6.1.6.2.48 Type: HighAccuracyGnssMetrics

Table 6.1.6.2.48-1: Definition of type HighAccuracyGnssMetrics

Attribute name	Data type	P	Cardinality	Description
nrOfUsedSatellites	integer	M	1	Indicates the number of satellites used for the high accuracy GNSS positioning method. Minimum: 0. Maximum: 64.
hdopi	Integer	O	0..1	When present, this IE shall indicate the horizontal dilution of precision for the location estimate, scale factor 0.1. Minimum: 1. Maximum: 256.
pdopi	integer	O	0..1	When present, this IE shall indicate the 3D position dilution of precision, scale factor 0.1. Minimum: 1. Maximum: 256.
age	integer	O	0..1	When present, this IE shall indicate the age of the most recent used assistance data for high accuracy GNSS, scale factor 0.1 second. Minimum: 0. Maximum: 99.
fixType	FixType	O	0..1	When present, this IE shall indicate the the positioning fix type.

6.1.6.2.49 Type: UpNotifyData

Table 6.1.6.2.49-1: Definition of type UpNotifyData

Attribute name	Data type	P	Cardinality	Description
notifCorrelationId	CorrelationID	M	1	Notification correlation ID.
upConnectionStatus	UpConnectionStatus	M	1	UP Connection Status
targetLMFId	LMFIdentification	C	0..1	This IE shall be present if the UpConnectionStatus is set to “MOVE”. When present, this IE shall indicate the Target LMF identifier.

6.1.6.2.50 Type: UpSubscription

Table 6.1.6.2.50-1: Definition of type UpSubscription

Attribute name	Data type	P	Cardinality	Description
upNotifyCallBackUri	Uri	M	1	Callback URI of the NF Service Consumer
notifCorrelationId	CorrelationID	M	1	Notification correlation ID.
supi	Supi	M	1	SUPI
gpsi	Gpsi	C	0..1	GPSI shall be included if available.

6.1.6.2.51 Type: RelatedUE

Table 6.1.6.2.51-1: Definition of type RelatedUE

Attribute name	Data type	P	Cardinality	Description
applicationlayerId	ApplicationlayerId	M	1	The application layer identification of the UE
relatedUEType	RelatedUEType	M	1	The type of the related UE for ranging and sidelink positioning, such as located UE, reference UE, etc.

6.1.6.2.52 Type: UpConfig

Table 6.1.6.2.52-1: Definition of type UpConfig

Attribute name	Data type	P	Cardinality	Description
upNotifyCallBackUri	Uri	M	1	Callback URI of the NF Service Consumer
notifCorrelationId	CorrelationID	M	1	Notification correlation ID.
supi	Supi	C	0..1	SUPI (NOTE)
gpsi	Gpsi	C	0..1	GPSI (NOTE)
amfReallocationInd	boolean	O	0..1	Indicates AMF reallocation indication. When present, it shall be set as follows: - true: AMF reallocated. - false (default): AMF not reallocated.
lcsUpConnectionInd	LcsUpConnectionInd	O	0..1	LCS-UP connection indication
targetLMFId	LMFIdentification	O	0..1	Target LMF identifier.
NOTE: At least one of the supi or gpsi shall be present in the UpConfig structure.				

6.1.6.2.53 Type: RangeDirection

Table 6.1.6.2.53-1: Definition of type RangeDirection

Attribute name	Data type	P	Cardinality	Description	Applicability
distance	number	O	0..1	Identifies the distance from point A to point B.	
azimuthDirection	Angle	O	0..1	Indentifies the azimuth direction from point A to point B.	
elevationDirection	Angle	O	0..1	Indentifies the elevation direction from point A to point B.	

6.1.6.2.54 Type: 2DRelativeLocation

Table 6.1.6.2.54-1: Definition of type 2DRelativeLocation

Attribute name	Data type	P	Cardinality	Description	Applicability
semiMinor	Uncertainty	M	1	Indicates the semi-major axis of the uncertainty ellipse.	
semiMajor	Uncertainty	M	1	Indicates the semi-minor axis of the uncertainty ellipse.	
orientationAngle	Angle	M	1	Indentifies the angle of orientation A.	

6.1.6.2.55 Type: 3DRelativeLocation

Table 6.1.6.2.55-1: Definition of type 3DRelativeLocation

Attribute name	Data type	P	Cardinality	Description	Applicability
semiMinor	Uncertainty	M	1	Indicates the semi-major axis of the uncertainty ellipse.	
semiMajor	Uncertainty	M	1	Indicates the semi-minor axis of the uncertainty ellipse.	
verticalUncertainty	Uncertainty	M	1	Indicates the vertical uncertainty.	
orientationAngle	Angle	M	1	Indentifies the angle of orientation A.	

6.1.6.2.56 Type: AddLocationDatas

Table 6.1.6.2.56-1: Definition of type AddLocationDatas

Attribute name	Data type	P	Cardinality	Description	Applicability
addLocationDatas	array(LocationData)	O	1..N	Contains one or more LocationData.	

6.1.6.2.57 Type: AddEventNotifyDatas

Table 6.1.6.2.57-1: Definition of type AddEventNotifyDatas

Attribute name	Data type	P	Cardinality	Description	Applicability
addEventNotifyDatas	array(LocationData)	O	1..N	Contains one or more EventNotifyData.	

6.1.6.2.58 Type: LocationDataExt

Table 6.1.6.2.58-1: Definition of type LocationDataExt as a list of data types to be combined

Data type	Cardinality	Description	Applicability
LocationData	1	Location Data	
AddLocationDatas	1	Additional Location Data	

6.1.6.2.59 Type: EventNotifyDataExt

Table 6.1.6.2.59-1: Definition of type EventNotifyDataExt as a list of data types to be combined

Data type	Cardinality	Description	Applicability
EventNotifyData	1	Positioning event notify	
AddEventNotifyDatas	1	Additional positioning event(s) notify	

6.1.6.2.60 Type: MappedLocationQoSEps

Table 6.1.6.2.60-1: Definition of type MappedLocationQoSEps

Attribute name	Data type	P	Cardinality	Description	Applicability
hAccuracy	Accuracy	M	1	Mapped Horizontal accuracy for EPS	
vAccuracy	Accuracy	O	0..1	Mapped Vertical accuracy for EPS	

6.1.6.2.61 Type: AdditionalUeInfo

Table 6.1.6.2.61-1: Definition of type AdditionalUeInfo

Attribute name	Data type	P	Cardinality	Description	Applicability
ecgi	Ecgi	O	0..1	E-UTRA Cell Identity of MBSR UE (i.e., IAB UE)	
ncgi	Ncgi	O	0..1	NR Cell Identity of MBSR UE (i.e., IAB UE)	

6.1.6.3 Simple data types and enumerations

6.1.6.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses.

6.1.6.3.2 Simple data types

The simple data types defined in table 6.1.6.3.2-1 shall be supported.

Table 6.1.6.3.2-1: Simple data types

Type Name	Type Definition	Description
Altitude	number	Double-precision float value of the altitude, expressed in meters. Minimum: -32767. Maximum: 32767. Format: double.
Angle	integer	Integer value of the angle, expressed in degrees. Minimum: 0. Maximum: 360.
Uncertainty	number	Float value of uncertainty, expressed in meters. Minimum: 0 Format: float.
Orientation	integer	Integer value of the orientation angle, expressed in degrees. Minimum: 0. Maximum: 180.
Confidence	integer	Integer value of the confidence, expressed in percentage value. Minimum: 0. Maximum: 100.
Accuracy	number	Float value of accuracy, expressed in meters. Minimum: 0 Format: float.
InnerRadius	integer	Integer value of the inner radius, expressed in meters. Minimum: 0. Maximum: 327675. Format: int32.
CorrelationID	string	LCS Correlation ID. The correlation ID shall be of a minimum length of 1 character and maximum length of 255 characters.
AgeOfLocationEstimate	integer	Integer value of the age of the location estimate, expressed in minutes. Minimum: 0. Maximum: 32767.
HorizontalSpeed	number	Float value of horizontal speed, expressed in kilometres per hour. Minimum: 0. Maximum: 2047. Format: float.
VerticalSpeed	number	Float value of horizontal speed, expressed in kilometres per hour. Minimum: 0. Maximum: 255. Format: float.
SpeedUncertainty	number	Float value of speed uncertainty, expressed in kilometres per hour. Minimum: 0. Maximum: 255. Format: float.
BarometricPressure	integer	This IE specifies the measured uncompensated atmospheric pressure in units of Pascal (Pa). Minimum: 30000. Maximum: 115000.
LcsServiceType	integer	The LCS service type as defined in 3GPP TS 22.071 [17] and clause 17.7.8 of 3GPP TS 29.002 [18]. Minimum: 0. Maximum: 127.
LdrReference	string	LDR Reference encoded as a string of hexadecimal characters. The LdrReference shall be of a minimum length of 2 characters and maximum length of 510 characters.
LirReference	string	LIR Reference encoded as a string of hexadecimal characters. The LdrReference shall be of a minimum length of 2 characters and maximum length of 510 characters.
ReportingAmount	integer	Number of required periodic event reports. Minimum: 1. Maximum: 8639999.

ReportingInterval	integer	Event reporting periodic interval in seconds. Minimum: 1. Maximum: 8639999. ReportingInterval x ReportingAmount shall not exceed 8639999.
ReportingIntervalMs	integer	Event reporting periodic interval in milliseconds. Minimum: 1. Maximum: 999.
MinimumInterval	integer	Minimum interval between event reports in seconds. Minimum: 1. Maximum: 32767.
MaximumInterval	integer	Maximum interval between event reports in seconds. Minimum: 1. Maximum: 86400.
SamplingInterval	integer	Maximum time interval between consecutive evaluations by a UE of a trigger event, in seconds. Minimum: 1. Maximum: 3600
ReportingDuration	integer	Maximum duration of event reporting, in seconds. Minimum: 1. Maximum: 8640000.
LinearDistance	integer	The minimum straight line distance moved by a UE to trigger a motion event report, in meters. Minimum: 1. Maximum: 10000.
LMFIdentification	string	The serving LMF identification as defined in 3GPP TS 23.273 [19], encoded as a string of hexadecimal characters.
EventReportCounter	integer	Number of event reports received from the target UE. Minimum: 1. Maximum: 8640000. Note: the current event report is included in the count.
EventReportDuration	integer	Duration of event reporting, in seconds. Minimum: 0. Maximum: 8640000. Note: the duration starts when event reporting is activated in the UE and extends to the current time.
UePositioningCapabilities	Bytes	Positioning capabilities supported by the UE. String with format "byte" as defined in OpenAPI Initiative [14], i.e. base64-encoded characters, encoding the "ProvideCapabilities-r9-IEs" IE as specified in clause 6.3 of 3GPP TS 37.355 [21] (start from octet 1).
TimeWindow	Bytes	Time window(s) of the targe UE. String with format "byte" as defined in OpenAPI Initiative [14], i.e. base64-encoded characters, encoding the "NR-DL-PRS-MeasurementTimeWindowsConfig-r18" IE as specified in clause 6.4.3 of 3GPP TS 37.355 [21] (start from octet 1).

RangingSlCapability	Bytes	Ranging/Sidelink Positioning Capability supported by the UE. String with format "byte" as defined in OpenAPI Initiative [14], i.e. base64-encoded characters, encoding the "ProvideCapabilities" IE as specified in clause 6.2.2 of 3GPP TS 38.355 [30] (start from octet 1).

6.1.6.3.3 Enumeration: ExternalClientType

The enumeration ExternalClientType represents the different types of clients of the location service.

Table 6.1.6.3.3-1: Enumeration ExternalClientType

Enumeration value	Description
"EMERGENCY_SERVICES"	External client for emergency services
"VALUE_ADDED_SERVICES"	External client for value added services
"PLMN_OPERATOR_SERVICES"	External client for PLMN operator services
"LAWFUL_INTERCEPT_SERVICES"	External client for Lawful Intercept services
"PLMN_OPERATOR_BROADCAST_SERVICES"	External client for PLMN Operator Broadcast services
"PLMN_OPERATOR_OM"	External client for PLMN Operator O&M
"PLMN_OPERATOR_ANONYMOUS_STATISTICS"	External client for PLMN Operator anonymous statistics
"PLMN_OPERATOR_TARGET_MS_SERVICE_SUPPORT"	External client for PLMN Operator target MS service support
"SL_POS"	External client for ranging and sidelink positioning

6.1.6.3.4 Enumeration: SupportedGADShapes

The enumeration SupportedGADShapes represents the different types, or shapes, of geographic areas supported by the system.

Table 6.1.6.3.4-1: Enumeration SupportedGADShapes

Enumeration value	Description
"POINT"	Ellipsoid Point
"POINT_UNCERTAINTY_CIRCLE"	Ellipsoid point with uncertainty circle
"POINT_UNCERTAINTY_ELLIPSE"	Ellipsoid point with uncertainty ellipse
"POLYGON"	Polygon
"POINT_ALTITUDE"	Ellipsoid point with altitude
"POINT_ALTITUDE_UNCERTAINTY"	Ellipsoid point with altitude and uncertainty ellipsoid
"ELLIPSOID_ARC"	Ellipsoid Arc
"LOCAL_2D_POINT_UNCERTAINTY_ELLIPSE"	Local 2D point with uncertainty ellipse
"LOCAL_3D_POINT_UNCERTAINTY_ELLIPSOID"	Local 3D point with uncertainty ellipsoid
"DISTANCE_DIRECTION"	Distance and direction from a point A to a point B, comprising a distance from point A to point B, an azimuth direction from point A to point B and an elevation direction from point A to point B
"RELATIVE_2D_LOCATION_UNCERTAINTY_ELLIPSE"	Relative 2D location with uncertainty ellipse, characterised by a point described in 2D local co-ordinates with origin corresponding to another known point, distances r1 and r2 and an angle of orientation A.
"RELATIVE_3D_LOCATION_UNCERTAINTY_ELLIPSOID"	Relative 3D location with uncertainty ellipsoid, characterised by a point described in 3D local co-ordinates with origin corresponding to another known point, distances r1 (the "semi-major uncertainty"), r2 (the "semi-minor uncertainty") and r3 (the "vertical uncertainty") and an angle of orientation A (the "angle of the major axis").

6.1.6.3.5 Enumeration: ResponseTime

The enumeration ResponseTime represents the acceptable delay in the determination of the location of the UE.

Table 6.1.6.3.5-1: Enumeration ResponseTime

Enumeration value	Description
"LOW_DELAY"	Location request is expected with low delay level.
"DELAY_TOLERANT"	Location request is delay tolerant.
"NO_DELAY "	Location request is expected with no delay (NOTE)
NOTE: The value is only used in the interface between GMLC and AF/LCS client via NEF, not further delivered to other NFs in the network. After receiving the enumeration value, the GMLC shall immediately return any location estimate, local location or civic location that it currently has. The GMLC shall return either the Initial or Last Known Location of the Target UE. If no location estimate or Dispatchable Location is available, the GLMC shall return the failure indication and may optionally initiate procedures to obtain a location estimate or Dispatchable Location (e.g. to be available for a later request).	

6.1.6.3.6 Enumeration: PositioningMethod

The enumeration PositioningMethod represents the method used to determine the location of the UE.

Table 6.1.6.3.6-1: Enumeration PositioningMethod

Enumeration value	Description
"CELLID"	Cell ID positioning method
"ECID"	Enhanced cell ID methods based on LTE signals
"OTDOA"	Observed time difference of arrival positioning based on LTE signals
"BAROMETRIC_PRESSURE"	Positioning method based on barometric Pressure Sensor
"WLAN"	WLAN positioning
"BLUETOOTH"	Bluetooth positioning
"MBS"	Terrestrial Beacon System (TBS) positioning based on MBS signals
"MOTION_SENSOR"	Positioning method based on motion Sensor
"DL_TDOA"	Downlink Time Difference of Arrival (DL-TDOA) based on NR signals
"DL_AOD"	Downlink Angle-of-Departure (DL-AoD) based on NR signals
"MULTI-RTT"	Multi-Round Trip Time Positioning (Multi-RTT based on NR signals).
"NR_ECID"	NR enhanced cell ID methods (NR E-CID) based on NR signals.
"UL_TDOA"	Uplink Time Difference of Arrival (UL-TDOA) based on NR signals
"UL_AOA"	Uplink Angle of Arrival (UL-AoA), including the Azimuth of Arrival (A-AoA) and the Zenith of Arrival (Z-AoA) based on NR signals.
"NETWORK_SPECIFIC"	Network specific position methods.
"SL_TDOA"	Sidelink Time Difference of Arrival (TDOA) based on Sidelink NR PC5 radio signals
"SL_TOA"	Sidelink Time Of Arrival based on NR PC5 radio signals
"SL_AOA"	Sidelink Angle-of-Arrival based on NR PC5 radio signals
"SL_RT"	Sidelink Round Trip based on NR PC5 radio signals

6.1.6.3.7 Enumeration: PositioningMode

The enumeration PositioningMode represents the mode used to determine the location of the UE when a certain positioning method is used.

Table 6.1.6.3.7-1: Enumeration PositioningMode

Enumeration value	Description
"UE_BASED"	UE-based mode
"UE_ASSISTED"	UE-assisted mode
"CONVENTIONAL"	Conventional mode

6.1.6.3.8 Enumeration: GnssId

The enumeration GnssId represents the different GNSS systems.

Table 6.1.6.3.8-1: Enumeration GnssId

Enumeration value	Description
"GPS"	GPS
"GALILEO"	Galileo
"SBAS"	Space Based Augmentation Systems
"MODERNIZED_GPS"	Modernized GPS
"QZSS"	Quasi Zenith Satellite System
"GLONASS"	Global Navigation Satellite System
"BDS"	BeiDou Navigation Satellite System
"NAVIC"	Navigation with Indian Constellation

6.1.6.3.9 Enumeration: Usage

The enumeration Usage represents the type of usage made of the location measurement from the UE.

Table 6.1.6.3.9-1: Enumeration Usage

Enumeration value	Description
"UNSUCCESS"	Not successful
"SUCCESS_RESULTS_NOT_USED"	Successful result not used
"SUCCESS_RESULTS_USED_TO_VERIFY_LOCATION"	Successful result used to verify the location estimate
"SUCCESS_RESULTS_USED_TO_GENERATE_LOCATION"	Successful result used to generate the location estimate
"SUCCESS_METHOD_NOT_DETERMINED"	Successful method not determined

6.1.6.3.10 Enumeration: LcsPriority

The enumeration LcsPriority represents the priority of the LCS client.

Table 6.1.6.3.10-1: Enumeration LcsPriority

Enumeration value	Description
"HIGHEST_PRIORITY"	LCS client with highest priority
"NORMAL_PRIORITY"	LCS client with normal priority

6.1.6.3.11 Enumeration: VelocityRequested

The enumeration VelocityRequested represents the indication of velocity requirement.

Table 6.1.6.3.11-1: Enumeration VelocityRequested

Enumeration value	Description
"VELOCITY_IS_NOT_REQUESTED"	velocity estimate is required
"VELOCITY_IS_REQUESTED"	velocity estimate is not required

6.1.6.3.12 Enumeration: AccuracyFulfilmentIndicator

The enumeration AccuracyFulfilmentIndicator represents whether the requested accuracy was fulfilled or not.

Table 6.1.6.3.12-1: Enumeration AccuracyFulfilmentIndicator

Enumeration value	Description
"REQUESTED_ACCURACY_FULFILLED"	requested accuracy is fulfilled
"REQUESTED_ACCURACY_NOT_FULFILLED"	requested accuracy is not fulfilled

6.1.6.3.13 Enumeration: VerticalDirection

The enumeration VerticalDirection represents the direction (upward/downward) of the vertical speed.

Table 6.1.6.3.13-1: Enumeration VerticalDirection

Enumeration value	Description
"UPWARD"	Vertical speed is upward
"DOWNWARD"	Vertical speed is downward

6.1.6.3.14 Enumeration: LdrType

Table 6.1.6.3.14-1: Enumeration LdrType

Enumeration value	Description
"UE_AVAILABLE"	UE available event
"PERIODIC"	Periodic event
"ENTERING_INTO_AREA"	Entering area event
"LEAVING_FROM_AREA"	Leaving area event
"BEING_INSIDE_AREA"	Being inside area event
"MOTION"	Motion event

6.1.6.3.15 Enumeration: ReportingAreaType

The enumeration ReportingAreaType indicates the type of a reporting area.

Table 6.1.6.3.15-1: Enumeration ReportingAreaType

Enumeration value	Description
"EPS_TRACKING_AREA_IDENTITY"	EPS TAI
"E-UTRAN_CELL_GLOBAL_IDENTIFICATION"	ECGI
"5GS_TRACKING_AREA_IDENTITY"	5GS TAI
"NR_CELL_GLOBAL_IDENTITY"	NCGI

6.1.6.3.16 Enumeration: OccurrenceInfo

The enumeration OccurrenceInfo indicates whether event reporting is one time.

Table 6.1.6.3.16-1: Enumeration AreaType

Enumeration value	Description
"ONE_TIME_EVENT"	Event to be reported one-time only
"MULTIPLE_TIME_EVENT"	Event to be reported multiple times

6.1.6.3.17 Enumeration: ReportingAccessType

The enumeration ReportingAccessType indicates an allowed access type for event reporting.

Table 6.1.6.3.17-1: Enumeration ReportingAccessType

Enumeration value	Description
"NR"	NG Radio access
"EUTRA_CONNECTED_TO_5GC"	E-URTAN access connected to 5GC
"NON_3GPP_CONNECTED_TO_5GC"	Non-3GPP access connected to 5GC
"NR_LEO"	NR (LEO) satellite access
"NR_MEO"	NR (MEO) satellite access
"NR_GEO"	NR (GEO) satellite access
"NR_OTHER_SAT"	NR (OTHERSAT) satellite access
"EUTRA_CONNECTED_TO_EPC"	E-URTAN access connected to EPC

6.1.6.3.18 Enumeration: EventClass

Table 6.1.6.3.18-1: Enumeration EventClass

Enumeration value	Description
"SUPPLEMENTARY_SERVICES"	A supplementary services message containing an argument for an lcs-EventReport operation as defined in 3GPP TS 24.080 [20].

6.1.6.3.19 Enumeration: ReportedEventType

Table 6.1.6.3.19-1: Enumeration ReportedEventType

Enumeration value	Description
"PERIODIC_EVENT"	Periodic reporting event
"ENTERING_AREA_EVENT"	Entering area reporting event
"LEAVING_AREA_EVENT"	Leaving area reporting event
"BEING_INSIDE_AREA_EVENT"	Being inside area reporting event
"MOTION_EVENT"	Motion reporting event
"MAXIMUM_INTERVAL_EXPIRATION_EVENT"	Expiration of maximum reporting interval event
"LOCATION_CANCELLATION_EVENT"	Cancellation of location reporting event
"INTERMEDIATE_EVENT"	Intermediate location reporting event
"DIRECT_REPORT_EVENT"	Direct location reporting event
"CUMULATIVE_EVENT_REPORT"	Cumulative event report for events reported

6.1.6.3.20 Enumeration: TerminationCause

Table 6.1.6.3.20-1: Enumeration TerminationCause

Enumeration value	Description
"TERMINATION_BY_UE"	Event reporting terminated by UE
"TERMINATION_BY_NETWORK"	Event reporting terminated by Network
"NORMAL_TERMINATION"	Normal Termination

6.1.6.3.21 Enumeration: LcsQosClass

Table 6.1.6.3.21-1: Enumeration LcsQosClass

Enumeration value	Description
"BEST_EFFORT"	Best Effort Class
"ASSURED"	Assured Class
"MULTIPLE_QOS"	Multiple QoS Class

MUTIQOS

6.1.6.3.22 Enumeration: UeLocationServiceInd

Table 6.1.6.3.22-1: Enumeration UeLocationServiceInd

Enumeration value	Description
"LOCATION_ESTIMATE"	Request location estimate
"LOCATION_ASSISTANCE_DATA"	Request location assistance data

6.1.6.3.23 Enumeration: IndoorOutdoorInd

Table 6.1.6.3.23-1: Enumeration IndoorOutdoorInd

Enumeration value	Description
"INDOOR"	UE indoor.
"OUTDOOR"	UE outdoor.

6.1.6.3.24 Enumeration: FixType

Table 6.1.6.3.24-1: Enumeration FixType

Enumeration value	Description
"CARRIER_PHASE_FLOAT"	Converging carrier phase floating point ambiguity resolution
"CARRIER_PHASE_FIX"	Converged carrier phase integer ambiguity resolution

6.1.6.3.25 Enumeration: LosNlosMeasureInd

Table 6.1.6.3.25-1: Enumeration LosNlosMeasureInd

Enumeration value	Description
"LOS"	LOS measurement.
"NLOS"	NLOS measurement.

6.1.6.3.26 Enumeration: UpConnectionStatus

The enumeration UpConnectionStatus indicates the UP Connection Status.

Table 6.1.6.3.26-1: Enumeration UpConnectionStatus

Enumeration value	Description
"ESTABLISHED"	UP Connection Established
"RELEASED"	UP Connection Released
"MOVE"	UP Connection Move Indication

6.1.6.3.27 Enumeration: RangingSlResult

The enumeration RangingSlResult represents the type of result requested for ranging and sidelink positioning.

Table 6.1.6.3.27-1: Enumeration RangingSlResult

Enumeration value	Description
"ABSOLUTE_LOCATION"	This value indicates that the absolute location of the target UE is required.
"RELATIVE_LOCATION"	This value indicates that the position of the target UE relative to other UEs is required.
"RANGING_DIRECTION"	This value indicates that the distance between two UEs or more UEs and the direction of one UE (i.e. Target UE) from another UE (i.e. Reference UE) is required.
"RANGING"	This value indicates that the distance between two UEs or more UEs is required.
"DIRECTION"	This value indicates that the direction of one UE (i.e. Target UE) from another UE (i.e. Reference UE) is required.
"VELOCITY"	This value indicates that the velocities of the target UE is required.
"RELATIVE_VELOCITY"	This value indicates that the velocities of the target UE relative to other UEs is required.

6.1.6.3.28 Enumeration: RelatedUEType

The enumeration RelatedUEType represents the different roles of UE for ranging and sidelink positioning service.

Table 6.1.6.3.28-1: Enumeration RelatedUEType

Enumeration value	Description
"LOCATED_UE"	UE as located UE for the ranging and sidelink positioning service
"REFERENCE_UE"	UE as reference UE for the ranging and sidelink positioning service

6.1.6.3.29 Enumeration: LcsUpConnectionInd

The enumeration LcsUpConnectionInd indicates the LCS UP Connection Indication.

Table 6.1.6.3.29-1: Enumeration LcsUpConnectionInd

Enumeration value	Description
"TERMINATION"	LCS-UP connection termination indication
"SETUP"	LCS-UP connection set up request indication

6.1.6.3.30 Enumeration: UeUpPositioningCapabilities

The enumeration UeUpPositioningCapabilities represents the user plane positioning capabilities supported by the UE.

Table 6.1.6.3.30-1: UeUpPositioningCapabilities

Enumeration value	Description
"LCS-UPP"	Indicates the capability to support LCS-UPP user plane positioning
"SUPL"	Indicates the capability to support SUPL user plane positioning

6.1.6.4 Binary data

6.1.6.4.1 Introduction

This clause defines the binary data that shall be supported in a binary body part in an HTTP multipart message (see clauses 6.1.2.2.2 and 6.1.2.4).

6.1.6.4.2 LPP Message

LPP Message shall encode a LPP message as specified in 3GPP TS 37.355 [21], using the vnd.3gpp.lpp content-type.

6.1.7 Error Handling

6.1.7.1 General

HTTP error handling shall be supported as specified in clause 5.2.4 of 3GPP TS 29.500 [4].

6.1.7.2 Protocol Errors

Protocol errors handling shall be supported as specified in clause 5.2.7 of 3GPP TS 29.500 [4].

6.1.7.3 Application Errors

The application errors defined for the Nlmf_Location service are listed in Table 6.1.7.3-1.

Table 6.1.7.3-1: Application errors

Application Error	HTTP status code	Description
POSITIONING_DENIED	403 Forbidden	The positioning procedure was denied.
UNSPECIFIED	403 Forbidden	The request is rejected due to unspecified reasons.
UNSUPPORTED_BY_UE	403 Forbidden	A request for periodic or triggered location is not supported by the UE.
PAGING_NOT_ALLOWED	403 Forbidden	The UE cannot be paged during the UE Unaware Positioning procedure.
LOCATION_SESSION_UNKNOWN	403 Forbidden	The location context was not found.
LOCATION_TRANSFER_NOT_SUPPORTED	403 Forbidden	Transfer of a location context is not supported
INSUFFICIENT_RESOURCES	403 Forbidden	Insufficient resources for location context transfer
EVENT_REPORT_UNRECOGNIZED	403 Forbidden	The event report is unrecognized or cannot be parsed.
LOCATION_MEASUREMENT_UNKNOWN	403 Forbidden	The location measurements were not found.
POSITIONING_FAILED	500 Internal Server Error	The positioning procedure failed.
UNREACHABLE_USER	504 Gateway Timeout	The user could not be reached in order to perform positioning procedure.

6.1.8 Security

As indicated in 3GPP TS 33.501 [9], the access to the Nlmf_Location API may be authorized by means of the OAuth2 protocol (see IETF RFC 6749 [10]), using the "Client Credentials" authorization grant, where the NRF (see 3GPP TS 29.510 [11]) plays the role of the authorization server.

If Oauth2 authorization is used, an NF Service Consumer, prior to consuming services offered by the Nlmf_Location API, shall obtain a "token" from the authorization server, by invoking the Access Token Request service, as described in 3GPP TS 29.510 [11], clause 5.4.2.2.

NOTE: When multiple NRFs are deployed in a network, the NRF used as authorization server is the same NRF that the NF Service Consumer used for discovering the Nlmf_Location service.

The Nlmf_Location API defines the following scopes for OAuth2 authorization as specified in 3GPP TS 33.501 [9]:

Table 6.1.8-1: OAuth2 scopes defined in Nlmf_Location API

Scope	Description
"nlmf-loc"	Access to the Nlmf_Location API.
"nlmf-loc:determine-location:invoke"	Access to invoke Determine Location
"nlmf-loc:cancel-location:invoke"	Access to invoke Cancel Location
"nlmf-loc:location-context-transfer:invoke"	Access to invoke Location Context
"nlmf-loc:measure-location:invoke"	Access to invoke Location Measurement
"nlmf-loc:up-subscription:invoke"	Access to invoke UP Subscription
"nlmf-loc:configure-up:invoke"	Access to invoke UP Config

6.1.9 Feature Negotiation

The optional features in table 6.1.9-1 are defined for the Nlmf_Location API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

Table 6.1.9-1: Supported Features

Feature number	Feature Name	M/O	Description
1	ES3XX	M	Extended Support of HTTP 307/308 redirection An NF Service Consumer (e.g. AMF) that supports this feature shall support handling of HTTP 307/308 redirection for any service operation of the Location service. An NF Service Consumer that does not support this feature does only support HTTP redirection as specified for 3GPP Release 15.
2	SAT	O	Satellite Access Support of this feature implies the LMF shall be able to determine the geographical area identified by a country, area of a country or International area where UE is located for PLMN selection verification.
3	MUTIQOS	O	Support of Mlutiple Location QoSes. This feature bit indicates whether the LMF support that more than one Location QoSes during consuming location service are required.
4	MBSR	O	Support of Mobile Base Station Relay. This feature indicates whether the LMF support that location service capability for MBSR.
5	Ranging_SL	O	This feature supports the enhanced location exposure service (e.g. location information for ranging and sidelink positioning), and requires the support of eLCS feature. The feature is not applicable to pre-5G (e.g. 4G).

6.1.10 HTTP redirection

An HTTP request may be redirected to a different LMF service instance, within the same LMF or a different LMF of an LMF set, e.g. when an LMF service instance is part of an LMF (service) set or when using indirect communications (see 3GPP TS 29.500 [4]). See also the ES3XX feature in clause 6.1.9.

An SCP that reselects a different LMF producer instance will return the NF Instance ID of the new LMF producer instance in the 3gpp-Sbi-Producer-Id header, as specified in clause 6.10.3.4 of 3GPP TS 29.500 [4].

If an LMF within an LMF set redirects a service request to a different LMF of the set using an 307 Temporary Redirect or 308 Permanent Redirect status code, the identity of the new LMF towards which the service request is redirected shall be indicated in the 3gpp-Sbi-Target-Nf-Id header of the 307 Temporary Redirect or 308 Permanent Redirect response as specified in clause 6.10.9.1 of 3GPP TS 29.500 [4].

6.2 Nlmf_Broadcast Service API

6.2.1 API URI

The Nlmf_Broadcast service shall use the Nlmf_Broadcast API.

The API URI of the Nlmf_Broadcast API shall be:

{apiRoot}/<apiName>/<apiVersion>

The request URI used in HTTP requests from the NF service consumer towards the NF service producer shall have the Resource URI structure defined in clause 4.4.1 of 3GPP TS 29.501 [5], i.e.:

{apiRoot}/<apiName>/<apiVersion>/<apiSpecificResourceUriPart>

with the following components:

- The {apiRoot} shall be set as described in 3GPP TS 29.501 [5].
- The <apiName> shall be "nlmf-broadcast".
- The <apiVersion> shall be "v1".
- The <apiSpecificResourceUriPart> shall be set as described in clause 6.2.3.

6.2.2 Usage of HTTP

6.2.2.1 General

HTTP/2, as defined in IETF RFC 9113 [12], shall be used as specified in clause 5 of 3GPP TS 29.500 [4].

HTTP/2 shall be transported as specified in clause 5.3 of 3GPP TS 29.500 [4].

HTTP messages and bodies for the Nlmf_Location service shall comply with the OpenAPI [14] specification contained in Annex A.

6.2.2.2 HTTP Standard Headers

6.2.2.2.1 General

6.2.2.2.2 Content type

The following content types shall be supported:

- JSON, as defined in IETF RFC 8259 [13], shall be used as content type of the HTTP bodies specified in the present specification as indicated in clause 5.4 of 3GPP TS 29.500 [4].
- The Problem Details JSON Object (IETF RFC 9457 [15]). The use of the Problem Details JSON object in a HTTP response body shall be signalled by the content type "application/problem+json".

6.2.2.3 HTTP custom headers

6.2.2.3.1 General

The following HTTP custom headers shall be supported:

- 3gpp-Sbi-Message-Priority: See 3GPP TS 29.500 [4], clause 5.2.3.2.2.

This API does not define any new HTTP custom headers.

6.2.3 Resources

6.2.3.1 Overview

The structure of the Resource URIs of the Nlmf_Broadcast service is shown in figure 6.2.3.1-1.

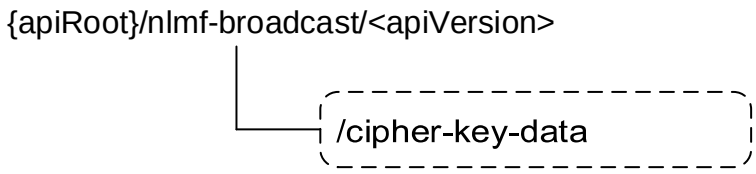

Figure 6.2.3.1-1: Resource URI structure of the Nlmf_Broadcast API

6.2.4 Custom Operations without associated resources

6.2.4.1 Overview

The URI structure for Custom Operations without associated resources is included as part of the Figure 6.2.3.1-1

Table 6.2.4.1-1: Custom operations without associated resources

Operation Name	Custom operation URI	Mapped HTTP method	Description
cipher-key-data	/cipher-key-data	POST	Ciphering Key Data

6.2.4.4 Operation: cipher-key-data

6.2.4.4.1 Description

This clause describes the custom operation and what it is used for.

6.2.4.4.2 Operation Definition

This operation shall support the request and response data structures and response codes specified in table 6.2.4.4.2-1 and table 6.2.4.4.2-2.

Table 6.2.4.4.2-1: Data structures supported by the POST Request Body on this resource

Data type	P	Cardinality	Description
CipherRequestData	M	1	Input parameters to the "Ciphering Key Data" operation

Table 6.2.4.4.2-2: Data structures supported by the POST Response Body on this resource

Data type	P	Cardinality	Response codes	Description
CipherResponseData	M	1	200 OK	This case represents a successful request for ciphering key data. Upon success, a response body is returned indicating whether the LMF has ciphering key data. The ciphering key data is returned separately in a CipheringKeyData notification.
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
ProblemDetails	O	0..1	403 Forbidden	The "cause" attribute may be set to one of the following application errors: - UNSPECIFIED - BROADCAST_CIPHERING_KEYS_NOT_SUPPORTED See table 6.2.7.3-1 for the description of this error.
NOTE 1: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] other than those specified in the table above also apply, with a ProblemDetails data type (see clause 5.2.7 of 3GPP TS 29.500 [4]). NOTE 2: RedirectResponse may be inserted by an SCP, see clause 6.10.9.1 of 3GPP TS 29.500 [4].				

Table 6.2.4.4.2-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set. For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected

Table 6.2.4.4.2-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	An alternative URI of the resource located on an alternative service instance within the same LMF or LMF (service) set. For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the request is redirected

6.2.5 Notifications

6.2.5.1 CipheringKeyData

6.2.5.1.1 Description

The CipheringKeyData operation is used to notify the occurrence of new ciphering key information to a consumer NF (e.g. AMF).

6.2.5.1.2 Notification Definition

Callback URI: {amfCallBackURI}

See clause 5.3.2.2.2 for the description of how the LMF obtains the Callback URI of the NF Service Consumer (i.e. AMF).

6.2.5.1.3 Notification Standard Methods

6.2.5.1.3.1 POST

This method sends a ciphering key data notify to the NF Service Consumer.

This method shall support the request and response data structures and response codes specified in table 6.2.5.1.3.1-1 and table 6.2.5.1.3.1-2.

Table 6.2.5.1.3.1-1: Data structures supported by the POST Request Body

Data type	P	Cardinality	Description
CipheringKeyInfo	M	1	Input parameters to the "Ciphering Key Data" operation

Table 6.2.5.1.3.1-2: Data structures supported by the POST Response Body

Data type	P	Cardinality	Response codes	Description
CipheringKeyResponse	M	1	200 OK	This case represents successful or partially successful storage of ciphering key information by the service consumer NF. A response body is returned containing the following parameters: - List of Ciphering Set IDs successfully stored - List of Ciphering Set IDs not successfully stored
RedirectResponse	O	0..1	307 Temporary Redirect	Temporary redirection. (NOTE 2)
RedirectResponse	O	0..1	308 Permanent Redirect	Permanent redirection. (NOTE 2)
ProblemDetails	O	0..1	403 Forbidden	The "cause" attribute may be set to one of the following application errors: - UNSPECIFIED - UNABLE_TO_STORE_CIPHERING_KEY_DATA See table 6.2.7.3-1 for the description of this error.
NOTE 1: The mandatory HTTP error status codes for the POST method listed in Table 5.2.7.1-1 of 3GPP TS 29.500 [4] other than those specified in the table above also apply, with a ProblemDetails data type (see clause 5.2.7 of 3GPP TS 29.500 [4]). NOTE 2: RedirectResponse may be inserted by an SCP, see clause 6.10.9.1 of 3GPP TS 29.500 [4].				

Table 6.2.5.1.3.1-3: Headers supported by the 307 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	A URI pointing to the endpoint of NF service consumer to which the notification should be sent. For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the notification is redirected

Table 6.2.5.1.3.1-4: Headers supported by the 308 Response Code on this resource

Name	Data type	P	Cardinality	Description
Location	string	M	1	A URI pointing to the endpoint of NF service consumer to which the notification should be sent. For the case when a request is redirected to the same target resource via a different SCP, see clause 6.10.9.1 in 3GPP TS 29.500 [4].
3gpp-Sbi-Target-Nf-Id	string	O	0..1	Identifier of the target NF (service) instance ID towards which the notification is redirected

6.2.6 Data Model

6.2.6.1 General

This clause specifies the application data model supported by the API.

Table 6.2.6.1-1 specifies the data types defined for the Nlmf_Broadcast service based interface protocol.

Table 6.2.6.1-1: Nlmf_Broadcast specific Data Types

Data type	Clause defined	Description
CipheringKeyInfo	6.2.6.2.2	Information within Ciphering Key Data Notification request
CipheringKeyResponse	6.2.6.2.3	Information within Ciphering Key Data Notification Response
CipheringDataSet	6.2.6.2.4	Represents a Ciphering Data Set
CipheringSetReport	6.2.6.2.5	Represents a report of Ciphering Data Set storage
CipherRequestData	6.2.6.2.6	Information within Ciphering Key Data request
CipherResponseData	6.2.6.2.7	Information within Ciphering Key Data Response
CipheringSetID	6.2.6.3.2	Ciphering Data Set ID
CipheringKey	6.2.6.3.2	Ciphering Key
C0	6.2.6.3.2	First component of the initial ciphering counter
ValidityDuration	6.2.6.3.2	Validity Duration of the Ciphering Data Set
StorageOutcome	6.2.6.3.3	Indicates the result of Ciphering Data Set storage
DataAvailability	6.2.6.3.4	Indicates availability of ciphering key data at an LMF

Table 6.2.6.1-2 specifies data types re-used by the Nlmf_Broadcast service based interface protocol from other specifications, including a reference to their respective specifications and when needed, a short description of their use within the Nlmf_Broadcast service based interface.

Table 6.2.6.1-2: Nlmf_Broadcast re-used Data Types

Data type	Reference	Comments
Bytes	3GPP TS 29.571 [8]	Binary data encoded as a base64 character string
DateTime	3GPP TS 29.571 [8]	Date and Time
Uri	3GPP TS 29.571 [8]	Uniform Resource Identifier
SupportedFeatures	3GPP TS 29.571 [8]	Supported Features
RedirectResponse	3GPP TS 29.571 [8]	Redirect Response

6.2.6.2 Structured data types

6.2.6.2.1 Introduction

This clause defines the structures to be used in resource representations.

6.2.6.2.2 Type: CipheringKeyInfo

Table 6.2.6.2.2-1: Definition of type CipheringKeyInfo

Attribute name	Data type	P	Cardinality	Description
cipheringData	array(CipheringDataSet)	M	1..N	This IE contains one or more ciphering data sets, where each ciphering data set contains information for one ciphering key.
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in clause 6.2.9 is supported.

6.2.6.2.3 Type: CipheringKeyResponse

Table 6.2.6.2.3-1: Definition of type CipheringKeyResponse

Attribute name	Data type	P	Cardinality	Description
cipheringDataReport	Array(CipheringSetReport)	O	1..N	This IE indicates the ciphering data sets which were successfully stored or not stored. The absence of this IE indicates that all ciphering data sets were successfully stored.

6.2.6.2.4 Type: CipheringDataSet

Table 6.2.6.2.4-1: Definition of type CipheringDataSet

Attribute name	Data type	P	Cardinality	Description
cipheringSetID	CipheringSetID	M	1	Identification of a ciphering data set
cipheringKey	CipheringKey	M	1	A ciphering key value
c0	C0	M	1	First component of the initial ciphering counter as defined in clause 7.4.2 of 3GPP TS 37.355 [21]

ltePosSibTypes	Bytes	O	0..1	This IE contains a bitmap indicating the LTE positioning SIB types for which the ciphering data set is applicable: - a bit set to 0 indicates that the ciphering data set is not applicable to the corresponding LTE positioning SIB type - a bit set to 1 indicates that the ciphering data set is applicable to the corresponding LTE positioning SIB type The mapping of the bits to the LTE positioning SIB types is as follows: -- bit 8 in the first octet maps to positioning SIB Type 1-1 -- bit 7 in the first octet maps to positioning SIB Type 1-2 -- bit 6 in the first octet maps to positioning SIB Type 1-3 -- bit 5 in the first octet maps to positioning SIB Type 1-4 -- bit 4 in the first octet maps to positioning SIB Type 1-5 -- bit 3 in the first octet maps to positioning SIB Type 1-6 -- bit 2 in the first octet maps to positioning SIB Type 1-7 -- bit 1 in the first octet maps to positioning SIB Type 1-8 -- bit 8 in the second octet maps to positioning SIB Type 2-1 -- bit 7 in the second octet maps to positioning SIB Type 2-2 -- bit 6 in the second octet maps to positioning SIB Type 2-3 -- bit 5 in the second octet maps to positioning SIB Type 2-4 -- bit 4 in the second octet maps to positioning SIB Type 2-5 -- bit 3 in the second octet maps to positioning SIB Type 2-6 -- bit 2 in the second octet maps to positioning SIB Type 2-7 -- bit 1 in the second octet maps to positioning SIB Type 2-8 -- bit 8 in the third octet maps to positioning SIB Type 2-9 -- bit 7 in the third octet maps to positioning SIB Type 2-10 -- bit 6 in the third octet maps to positioning SIB Type 2-11 -- bit 5 in the third octet maps to positioning SIB Type 2-12 -- bit 4 in the third octet maps to positioning SIB Type 2-13 -- bit 3 in the third octet maps to positioning SIB Type 2-14 -- bit 2 in the third octet maps to positioning SIB Type 2-15 -- bit 1 in the third octet maps to positioning SIB Type 2-16 -- bit 8 in the fourth octet maps to

				positioning SIB Type 2-17 -- bit 7 in the fourth octet maps to positioning SIB Type 2-18 -- bit 6 in the fourth octet maps to positioning SIB Type 2-19 -- bit 5 in the fourth octet maps to positioning SIB Type 2-20 -- bit 4 in the fourth octet maps to positioning SIB Type 2-21 -- bit 3 in the fourth octet maps to positioning SIB Type 2-22 -- bit 2 in the fourth octet maps to positioning SIB Type 2-23 -- bit 1 in the fourth octet maps to positioning SIB Type 2-24 -- bit 8 in the fifth octet maps to positioning SIB Type 2-25 -- bit 7 in the fifth octet maps to positioning SIB Type 3-1 -- bit 6 in the fifth octet maps to positioning SIB Type 4-1 -- bit 5 in the fifth octet maps to positioning SIB Type 5-1 Any unassigned bits are spare and shall be coded as zero. Non-included bits shall be treated as being coded as zero. (NOTE 1)

nrPosSibTypes	Bytes	O	0..1	This IE contains a bitmap indicating the NR positioning SIB types for which the ciphering data set is applicable: - a bit set to 0 indicates that the ciphering data set is not applicable to the corresponding NR positioning SIB type - a bit set to 1 indicates that the ciphering data set is applicable to the corresponding NR positioning SIB type The mapping of the bits to the NR positioning SIB types is as follows: -- bit 8 in the first octet maps to positioning SIB Type 1-1 -- bit 7 in the first octet maps to positioning SIB Type 1-2 -- bit 6 in the first octet maps to positioning SIB Type 1-3 -- bit 5 in the first octet maps to positioning SIB Type 1-4 -- bit 4 in the first octet maps to positioning SIB Type 1-5 -- bit 3 in the first octet maps to positioning SIB Type 1-6 -- bit 2 in the first octet maps to positioning SIB Type 1-7 -- bit 1 in the first octet maps to positioning SIB Type 1-8 -- bit 8 in the second octet maps to positioning SIB Type 2-1 -- bit 7 in the second octet maps to positioning SIB Type 2-2 -- bit 6 in the second octet maps to positioning SIB Type 2-3 -- bit 5 in the second octet maps to positioning SIB Type 2-4 -- bit 4 in the second octet maps to positioning SIB Type 2-5 -- bit 3 in the second octet maps to positioning SIB Type 2-6 -- bit 2 in the second octet maps to positioning SIB Type 2-7 -- bit 1 in the second octet maps to positioning SIB Type 2-8 -- bit 8 in the third octet maps to positioning SIB Type 2-9 -- bit 7 in the third octet maps to positioning SIB Type 2-10 -- bit 6 in the third octet maps to positioning SIB Type 2-11 -- bit 5 in the third octet maps to positioning SIB Type 2-12 -- bit 4 in the third octet maps to positioning SIB Type 2-13 -- bit 3 in the third octet maps to positioning SIB Type 2-14 -- bit 2 in the third octet maps to positioning SIB Type 2-15 -- bit 1 in the third octet maps to positioning SIB Type 2-16 -- bit 8 in the fourth octet maps to positioning SIB Type 2-17

				-- bit 7 in the fourth octet maps to positioning SIB Type 2-18 -- bit 6 in the fourth octet maps to positioning SIB Type 2-19 -- bit 5 in the fourth octet maps to positioning SIB Type 2-20 -- bit 4 in the fourth octet maps to positioning SIB Type 2-21 -- bit 3 in the fourth octet maps to positioning SIB Type 2-22 -- bit 2 in the fourth octet maps to positioning SIB Type 2-23 -- bit 1 in the fourth octet maps to positioning SIB Type 3-1 -- bit 8 in the fifth octet maps to positioning SIB Type 4-1 -- bit 7 in the fifth octet maps to positioning SIB Type 5-1 -- bit 6 in the fifth octet maps to positioning SIB Type 6-1 -- bit 5 in the fifth octet maps to positioning SIB Type 6-2 -- bit 4 in the fifth octet maps to positioning SIB Type 6-3 Any unassigned bits are spare and shall be coded as zero. Non-included bits shall be treated as being coded as zero. (NOTE 1)
validityStartTime	DateTime	M	1	This IE contains the UTC time when the ciphering data set becomes valid.
validityDuration	ValidityDuration	M	1	The validity duration of the ciphering data set.
taiList	Bytes	O	0..1	This IE contains the TAIs of the tracking areas for which the ciphering data set is applicable. It is encoded as octets 2 to n of the 5GS tracking area identity list IE specified in clause 9.11.3.9 of 3GPP TS 24.501 [22]. If this IE is omitted, the ciphering data set is valid in the entire PLMN.
NOTE 1: At least one of ltesibTypes IE and nrsibTypes IE shall be included.				

6.2.6.2.5 Type: CipheringSetReport

Table 6.2.6.2.5-1: Definition of CipheringSetReport

Attribute name	Data type	P	Cardinality	Description
cipheringSetID	CipheringSetID	M	1	Identification of a ciphering data set
storageOutcome	StorageOutcome	M	1	Indication of whether the ciphering data set was successfully stored or was not stored.

6.2.6.2.6 Type: CipherRequestData

Table 6.2.6.2.6-1: Definition of CipherRequestData

Attribute name	Data type	P	Cardinality	Description
amfCallBackURI	Uri	M	1	Callback URI of the NF Service Consumer
supportedFeatures	SupportedFeatures	C	0..1	This IE shall be present if at least one optional feature defined in clause 6.2.9 is supported.

6.2.6.2.7 Type: CipherResponseData

Table 6.2.6.2.7-1: Definition of CipherResponseData

Attribute name	Data type	P	Cardinality	Description
dataAvailability	DataAvailability	M	1	An indication of whether the LMF currently has ciphering key data applicable to the NF Service Consumer

6.2.6.3 Simple data types and enumerations

6.2.6.3.1 Introduction

This clause defines simple data types and enumerations that can be referenced from data structures defined in the previous clauses.

6.2.6.3.2 Simple data types

The simple data types defined in table 6.2.6.3.2-1 shall be supported.

Table 6.2.6.3.2-1: Simple data types

Type Name	Type Definition	Description
CipheringSetID	integer	The ciphering set ID Minimum = 0. Maximum = 65535
CipheringKey	Bytes	A 128 bit ciphering key encoded as a base64 character string
C0	Bytes	A 128 bit value for C0 encoded as a base64 character string
ValidityDuration	integer	The validity duration in minutes. Minimum = 1. Maximum = 65535

6.2.6.3.3 Enumeration: StorageOutcome

The enumeration StorageOutcome represents the outcome of cipher set data storage at the service consumer NF.

Table 6.2.6.3.3-1: Enumeration StorageOutcome

Enumeration value	Description
"STORAGE_SUCCESSFUL"	Indicates storage of Ciphering Data Set is successful
"STORAGE_FAILED"	Indicates storage of Ciphering Data Set is not successful

6.2.6.3.4 Enumeration: DataAvailability

The enumeration DataAvailability represents the availability of ciphering key data at an LMF.

Table 6.2.6.3.4-1: Enumeration DataAvailability

Enumeration value	Description
"CIPHERING_KEY_DATA_AVAILABLE"	Indicates Ciphering Data Set is available in LMF
CIPHERING_KEY_DATA_NOT_AVAILABLE"	Indicates Ciphering Data Set is not available in LMF

6.2.7 Error Handling

6.2.7.1 General

HTTP error handling shall be supported as specified in clause 5.2.4 of 3GPP TS 29.500 [4].

6.2.7.2 Protocol Errors

Protocol errors handling shall be supported as specified in clause 5.2.7 of 3GPP TS 29.500 [4].

6.2.7.3 Application Errors

The application errors defined for the Nlmf_Broadcast service are listed in table 6.2.7.3-1.

Table 6.2.7.3-1: Application errors

Application Error	HTTP status code	Description
UNSPECIFIED	403 Forbidden	The request is rejected due to unspecified reasons.
UNABLE_TO_STORE_CIPHERING_KEY_DATA	403 Forbidden	The service consumer NF was unable to store ciphering key data.
BROADCAST_CIPHERING_KEYS_NOT_SUPPORTED	403 Forbidden	Ciphering keys for broadcast are not supported.

6.2.8 Security

The Nlmf_Broadcast API does not define service operations for which additional security is needed in this version of the specification.

6.2.9 Feature Negotiation

The optional features in table 6.2.9-1 are defined for the Nlmf_Broadcast API. They shall be negotiated using the extensibility mechanism defined in clause 6.6 of 3GPP TS 29.500 [4].

Table 6.2.9-1: Supported Features

Feature number	Feature Name	M/O	Description
1	ES3XX	M	Extended Support of HTTP 307/308 redirection An NF Service Consumer (e.g. AMF) that supports this feature shall support handling of HTTP 307/308 redirection for any service operation of the Broadcast service. An NF Service Consumer that does not support this feature does only support HTTP redirection as specified for 3GPP Release 15.

6.2.10 HTTP redirection

An HTTP request may be redirected to a different LMF service instance, within the same LMF or a different LMF of an LMF set, e.g. when an LMF service instance is part of an LMF (service) set or when using indirect communications (see 3GPP TS 29.500 [4]). See also the ES3XX feature in clause 6.2.9.

An SCP that reselects a different LMF producer instance will return the NF Instance ID of the new LMF producer instance in the 3gpp-Sbi-Producer-Id header, as specified in clause 6.10.3.4 of 3GPP TS 29.500 [4].

If an LMF within an LMF set redirects a service request to a different LMF of the set using an 307 Temporary Redirect or 308 Permanent Redirect status code, the identity of the new LMF towards which the service request is redirected shall be indicated in the 3gpp-Sbi-Target-Nf-Id header of the 307 Temporary Redirect or 308 Permanent Redirect response as specified in clause 6.10.9.1 of 3GPP TS 29.500 [4].

Annex A (normative): OpenAPI specification

A.1 General

This Annex specifies the formal definition of the Nlmf Service APIs. It consists of an OpenAPI 3.0.0 specification, in YAML format.

This Annex takes precedence when being discrepant to other parts of the specification with respect to the encoding of information elements and methods within the API(s).

NOTE: The semantics and procedures, as well as conditions, e.g. for the applicability and allowed combinations of attributes or values, not expressed in the OpenAPI definitions but defined in other parts of the specification also apply.

Informative copies of the OpenAPI specification files contained in this 3GPP Technical Specification are available on a Git-based repository, that uses the GitLab software version control system (see 3GPP TS 29.501 [5] clause 5.3.1 and 3GPP TR 21.900 [7] clause 5B).

A.2 Nlmf_Location API

```
openapi: 3.0.0

info:
  version: '1.3.0-alpha.6'
  title: 'LMF Location'
  description: |
    LMF Location Service.
    © 2024, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: 3GPP TS 29.572 V18.5.0; 5G System; Location Management Services; Stage 3
  url: 'https://www.3gpp.org/ftp/Specs/archive/29_series/29.572/'

servers:
  - url: '{apiRoot}/nlmf-loc/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501

security:
  - {}
  - oAuth2ClientCredentials:
      - nlmf-loc

paths:
  /determine-location:
    post:
      summary: Determine Location of an UE
      operationId: DetermineLocation
      tags:
        - Determine Location
      security:
        - {}
        - oAuth2ClientCredentials:
          - nlmf-loc
        - oAuth2ClientCredentials:
          - nlmf-loc
          - nlmf-loc:determine-location:invoke
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/InputData'
          multipart/related:  # message with binary body part(s)
```

```
        schema:
          type: object
          properties: # Request parts
            jsonData:
              $ref: '#/components/schemas/InputData'
            binaryDataLppMessage:
              type: string
              format: binary
        encoding:
          jsonData:
            contentType:  application/json
          binaryDataLppMessage:
            contentType:  application/vnd.3gpp.lpp
            headers:
              Content-Id:
                schema:
                  type: string
          binaryDataLppMessageExt1:
            contentType:  application/vnd.3gpp.lpp
            headers:
              Content-Id:
                schema:
                  type: string
          binaryDataLppMessageExt2:
            contentType:  application/vnd.3gpp.lpp
            headers:
              Content-Id:
                schema:
                  type: string
    required: true
  responses:
    '200':
      description: Expected response to a valid request
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/LocationDataExt'
    '204':
      description: Expected response for MO-LR requesting location assistance data.
    '307':
      $ref: 'TS29571_CommonData.yaml#/components/responses/307'
    '308':
      $ref: 'TS29571_CommonData.yaml#/components/responses/308'
    '400':
      $ref: 'TS29571_CommonData.yaml#/components/responses/400'
    '401':
      $ref: 'TS29571_CommonData.yaml#/components/responses/401'
    '403':
      $ref: 'TS29571_CommonData.yaml#/components/responses/403'
    '404':
      $ref: 'TS29571_CommonData.yaml#/components/responses/404'
    '411':
      $ref: 'TS29571_CommonData.yaml#/components/responses/411'
    '413':
      $ref: 'TS29571_CommonData.yaml#/components/responses/413'
    '415':
      $ref: 'TS29571_CommonData.yaml#/components/responses/415'
    '429':
      $ref: 'TS29571_CommonData.yaml#/components/responses/429'
    '500':
      $ref: 'TS29571_CommonData.yaml#/components/responses/500'
    '502':
      $ref: 'TS29571_CommonData.yaml#/components/responses/502'
    '503':
      $ref: 'TS29571_CommonData.yaml#/components/responses/503'
    '504':
      $ref: 'TS29571_CommonData.yaml#/components/responses/504'
    default:
      $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  callbacks:
    EventNotify:
      '{$request.body#/hgmlcCallBackURI}':
        post:
          requestBody:
            description: UE Event Notification
            content:
              application/json:
                schema:
```

```
                $ref: '#/components/schemas/EventNotifyDataExt'
            responses:
              '204':
                description: Expected response to a valid notification
              '307':
                $ref: 'TS29571_CommonData.yaml#/components/responses/307'
              '308':
                $ref: 'TS29571_CommonData.yaml#/components/responses/308'
              '400':
                $ref: 'TS29571_CommonData.yaml#/components/responses/400'
              '401':
                $ref: 'TS29571_CommonData.yaml#/components/responses/401'
              '403':
                $ref: 'TS29571_CommonData.yaml#/components/responses/403'
              '404':
                $ref: 'TS29571_CommonData.yaml#/components/responses/404'
              '411':
                $ref: 'TS29571_CommonData.yaml#/components/responses/411'
              '413':
                $ref: 'TS29571_CommonData.yaml#/components/responses/413'
              '415':
                $ref: 'TS29571_CommonData.yaml#/components/responses/415'
              '429':
                $ref: 'TS29571_CommonData.yaml#/components/responses/429'
              '500':
                $ref: 'TS29571_CommonData.yaml#/components/responses/500'
              '502':
                $ref: 'TS29571_CommonData.yaml#/components/responses/502'
              '503':
                $ref: 'TS29571_CommonData.yaml#/components/responses/503'
              '504':
                $ref: 'TS29571_CommonData.yaml#/components/responses/504'
              default:
                $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  /up-subscriptions:
    post:
      summary: subscribe about status of a secure LCS-UP connection for a target UE
      operationId: UpSubscriptions
      tags:
        - UP Subscribe
      security:
        - {}
        - oAuth2ClientCredentials:
          - nlmf-loc
        - oAuth2ClientCredentials:
          - nlmf-loc
          - nlmf-loc:up-subscription:invoke
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/UpSubscription'
        required: true
      responses:
        '201':
          description: Expected response to successful UP Subscription
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/UpSubscription'
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29571_CommonData.yaml#/components/responses/415'
```

```
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '502':
        $ref: 'TS29571_CommonData.yaml#/components/responses/502'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      '504':
        $ref: 'TS29571_CommonData.yaml#/components/responses/504'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'
    callbacks:
      UPNotify:
        '{$request.body#/upNotifyCallBackUri}':
          post:
            requestBody:
              description: UP Connection Status Notification
              content:
                application/json:
                  schema:
                    $ref: '#/components/schemas/UpNotifyData'
            responses:
              '204':
                description: Expected response to a valid notification
              '307':
                $ref: 'TS29571_CommonData.yaml#/components/responses/307'
              '308':
                $ref: 'TS29571_CommonData.yaml#/components/responses/308'
              '400':
                $ref: 'TS29571_CommonData.yaml#/components/responses/400'
              '401':
                $ref: 'TS29571_CommonData.yaml#/components/responses/401'
              '403':
                $ref: 'TS29571_CommonData.yaml#/components/responses/403'
              '404':
                $ref: 'TS29571_CommonData.yaml#/components/responses/404'
              '411':
                $ref: 'TS29571_CommonData.yaml#/components/responses/411'
              '413':
                $ref: 'TS29571_CommonData.yaml#/components/responses/413'
              '415':
                $ref: 'TS29571_CommonData.yaml#/components/responses/415'
              '429':
                $ref: 'TS29571_CommonData.yaml#/components/responses/429'
              '500':
                $ref: 'TS29571_CommonData.yaml#/components/responses/500'
              '502':
                $ref: 'TS29571_CommonData.yaml#/components/responses/502'
              '503':
                $ref: 'TS29571_CommonData.yaml#/components/responses/503'
              '504':
                $ref: 'TS29571_CommonData.yaml#/components/responses/504'
              default:
                $ref: 'TS29571_CommonData.yaml#/components/responses/default'

  /up-subscriptions/{subscriptionId}:
    delete:
      summary: Deletes a subscription
      operationId: DeleteSubscription
      tags:
        - UP Unsubscribe
      parameters:
        - name: subscriptionId
          in: path
          required: true
          description: Unique subscription Id
          schema:
            type: string
      responses:
        '204':
          description: Expected response to a successful subscription removal
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
```

```
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '411':
        $ref: 'TS29571_CommonData.yaml#/components/responses/411'
      '413':
        $ref: 'TS29571_CommonData.yaml#/components/responses/413'
      '415':
        $ref: 'TS29571_CommonData.yaml#/components/responses/415'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '501':
        $ref: 'TS29571_CommonData.yaml#/components/responses/501'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'


/cancel-location:
  post:
    summary: request cancellation of periodic or triggered location
    operationId: CancelLocation
    tags:
      - Cancel Location
    security:
      - {}
      - oAuth2ClientCredentials:
        - nlmf-loc
      - oAuth2ClientCredentials:
        - nlmf-loc
        - nlmf-loc:cancel-location:invoke
    requestBody:
      content:
        application/json:
          schema:
            $ref: '#/components/schemas/CancelLocData'
      required: true
    responses:
      '204':
        description: Expected response to a successful cancellation
      '307':
        $ref: 'TS29571_CommonData.yaml#/components/responses/307'
      '308':
        $ref: 'TS29571_CommonData.yaml#/components/responses/308'
      '400':
        $ref: 'TS29571_CommonData.yaml#/components/responses/400'
      '401':
        $ref: 'TS29571_CommonData.yaml#/components/responses/401'
      '403':
        $ref: 'TS29571_CommonData.yaml#/components/responses/403'
      '404':
        $ref: 'TS29571_CommonData.yaml#/components/responses/404'
      '411':
        $ref: 'TS29571_CommonData.yaml#/components/responses/411'
      '413':
        $ref: 'TS29571_CommonData.yaml#/components/responses/413'
      '415':
        $ref: 'TS29571_CommonData.yaml#/components/responses/415'
      '429':
        $ref: 'TS29571_CommonData.yaml#/components/responses/429'
      '500':
        $ref: 'TS29571_CommonData.yaml#/components/responses/500'
      '502':
        $ref: 'TS29571_CommonData.yaml#/components/responses/502'
      '503':
        $ref: 'TS29571_CommonData.yaml#/components/responses/503'
      '504':
        $ref: 'TS29571_CommonData.yaml#/components/responses/504'
      default:
        $ref: 'TS29571_CommonData.yaml#/components/responses/default'
/location-context-transfer:
  post:
```

```
      summary: transfer context information for periodic or triggered location
      operationId: LocationContextTransfer
      tags:
        - Location Context Transfer
      security:
        - {}
        - oAuth2ClientCredentials:
          - nlmf-loc
        - oAuth2ClientCredentials:
          - nlmf-loc
          - nlmf-loc:location-context-transfer:invoke
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/LocContextData'
        required: true
      responses:
        '204':
          description: Expected response to successful location context transfer
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29571_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        '504':
          $ref: 'TS29571_CommonData.yaml#/components/responses/504'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'
  /measure-location:
    post:
      summary: PRU location measurement
      operationId: LocationMeasure
      tags:
        - Location Measure
      security:
        - {}
        - oAuth2ClientCredentials:
          - nlmf-loc
        - oAuth2ClientCredentials:
          - nlmf-loc
          - nlmf-loc:measure-location:invoke
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/LocMeasurementReq'
        required: true
      responses:
        '200':
          description: Expected response to a valid request
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/LocMeasurementResp'
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
```

```
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29571_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        '504':
          $ref: 'TS29571_CommonData.yaml#/components/responses/504'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'

  /configure-up:
    post:
      summary: set up, modify or terminate a secure LCS-UP connection for a target UE
      operationId: UpConfig
      tags:
        - UP Configure
      security:
        - {}
        - oAuth2ClientCredentials:
          - nlmf-loc
        - oAuth2ClientCredentials:
          - nlmf-loc
          - nlmf-loc:configure-up:invoke
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/UpConfig'
        required: true
      responses:
        '204':
          description: Expected response to successful set up, modify or terminate LCS-UP
connection.
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29571_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
```

```
        '504':
          $ref: 'TS29571_CommonData.yaml#/components/responses/504'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'

components:
  securitySchemes:
    oAuth2ClientCredentials:
      type: oauth2
      flows:
        clientCredentials:
          tokenUrl: '{nrfApiRoot}/oauth2/token'
          scopes:
            nlmf-loc: Access to the Nlmf_Location API
            nlmf-loc:determine-location:invoke: Access to invoke Determine Location
            nlmf-loc:cancel-location:invoke: Access to invoke Cancel Location
            nlmf-loc:location-context-transfer:invoke: Access to invoke Location Context
            nlmf-loc:measure-location:invoke: Access to invoke Location Measurement
            nlmf-loc:up-subscriptions:invoke: Access to invoke UP Subscription
            nlmf-loc:configure-up:invoke: Access to invoke UP Config

  schemas:
#
# COMPLEX TYPES
#
    InputData:
      description: Information within Determine Location Request.
      type: object
      not:
        required: [ ecgi, ncgi ]
      properties:
        externalClientType:
          $ref: '#/components/schemas/ExternalClientType'
        correlationID:
          $ref: '#/components/schemas/CorrelationID'
        amfId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
        locationQoS:
          $ref: '#/components/schemas/LocationQoS'
        supportedGADShapes:
          type: array
          items:
            $ref: '#/components/schemas/SupportedGADShapes'
          minItems: 1
        supi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
        pei:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Pei'
        gpsi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
        requestedRangingSlResult:
          type: array
          items:
            $ref: '#/components/schemas/RangingSlResult'
          minItems: 1
        relatedUEs:
          type: array
          items:
            $ref: '#/components/schemas/RelatedUE'
          minItems: 1
        ecgi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Ecgi'
        ecgiOnSecondNode:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Ecgi'
        ncgi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Ncgi'
        ncgiOnSecondNode:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Ncgi'
        priority:
          $ref: '#/components/schemas/LcsPriority'
        velocityRequested:
          $ref: '#/components/schemas/VelocityRequested'
        ueLcsCap:
          $ref: '#/components/schemas/UeLcsCapability'
        lcsServiceType:
          $ref: '#/components/schemas/LcsServiceType'
        ldrType:
          $ref: '#/components/schemas/LdrType'
```

```
    hgmlcCallBackURI:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
    lirGmlcCallBackUri:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
    vgmlcAddress:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
    ldrReference:
      $ref: '#/components/schemas/LdrReference'
    lirReference:
      $ref: '#/components/schemas/LirReference'
    periodicEventInfo:
      $ref: '#/components/schemas/PeriodicEventInfo'
    areaEventInfo:
      $ref: '#/components/schemas/AreaEventInfo'
    motionEventInfo:
      $ref: '#/components/schemas/MotionEventInfo'
    reportingAccessTypes:
      type: array
      items:
        $ref: '#/components/schemas/ReportingAccessType'
      minItems: 1
    ueConnectivityStates:
      $ref: '#/components/schemas/UeConnectivityState'
    ueLocationServiceInd:
      $ref: '#/components/schemas/UeLocationServiceInd'
    moAssistanceDataTypes:
      $ref: 'TS29503_Nudm_SDM.yaml#/components/schemas/LcsBroadcastAssistanceTypesData'
    lppMessage:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/RefToBinaryData'
    lppMessageExt:
      description: Indicates the lpp message extension.
      type: array
      items:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/RefToBinaryData'
      minItems: 1
    supportedFeatures:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
    uePositioningCap:
      $ref: '#/components/schemas/UePositioningCapabilities'
    tnapId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/TnapId'
    twapId:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/TwapId'
    ueCountryDetInd:
      type: boolean
    scheduledLocTime:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
    reliableLocReq:
      type: boolean
      default: false
    evtRptAllowedAreas:
      type: array
      items:
        $ref: '#/components/schemas/ReportingArea'
      minItems: 1
      maxItems: 250
    ueUnawareInd:
      type: boolean
      enum:
        - true
    intermediateLocationInd:
      type: boolean
      default: false
    maxRespTime:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/DurationSec'
    lpHapType:
      $ref: 'TS29518_Namf_Location.yaml#/components/schemas/LpHapType'
    ueUpPosCaps:
      type: array
      items:
        $ref: '#/components/schemas/UeUpPositioningCapabilities'
      minItems: 1
    reportingInd:
      allOf:
        - $ref: 'TS29515_Ngmlc_Location.yaml#/components/schemas/ReportingInd'
      default: INSIDE_REPORTING
    mbsrInfo:
      $ref: '#/components/schemas/MbsrInfo'
```

```
      integrityRequirements:
        $ref: 'TS29515_Ngmlc_Location.yaml#/components/schemas/IntegrityRequirements'
      upLocRepAddrAf:
        $ref: 'TS29122_MonitoringEvent.yaml#/components/schemas/UpLocRepAddrAfRm'
      upCumEvtRptCriteria:
        $ref: 'TS29515_Ngmlc_Location.yaml#/components/schemas/UpCumEvtRptCriteria'
      mappedQoSEps:
        $ref: '#/components/schemas/MappedLocationQoSEps'
      additionalUeInfo:
        $ref: '#/components/schemas/AdditionalUeInfo'
      coordinateID:
        type: integer
      rangingSlCapability:
        $ref: '#/components/schemas/RangingSlCapability'

  LocationDataExt:
    description: Extended Location Data for UEs
    allOf:
      - $ref: '#/components/schemas/LocationData'
      - $ref: '#/components/schemas/AddLocationDatas'

  LocationData:
    description: Information within Determine Location Response.
    type: object
    required:
      - locationEstimate
    properties:
      locationEstimate:
        $ref: '#/components/schemas/GeographicArea'
      accuracyFulfilmentIndicator:
        $ref: '#/components/schemas/AccuracyFulfilmentIndicator'
      ageOfLocationEstimate:
        $ref: '#/components/schemas/AgeOfLocationEstimate'
      timestampOfLocationEstimate:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      velocityEstimate:
        $ref: '#/components/schemas/VelocityEstimate'
      civicAddress:
        $ref: '#/components/schemas/CivicAddress'
      localLocationEstimate:
        $ref: '#/components/schemas/LocalArea'
      positioningDataList:
        type: array
        items:
          $ref: '#/components/schemas/PositioningMethodAndUsage'
        minItems: 1
      gnssPositioningDataList:
        type: array
        items:
          $ref: '#/components/schemas/GnssPositioningMethodAndUsage'
        minItems: 1
      ecgi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Ecgi'
      ncgi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Ncgi'
      altitude:
        $ref: '#/components/schemas/Altitude'
      barometricPressure:
        $ref: '#/components/schemas/BarometricPressure'
      servingLMFIdentification:
        $ref: '#/components/schemas/LMFIdentification'
      uePositioningCap:
        $ref: '#/components/schemas/UePositioningCapabilities'
      ueAreaInd:
        $ref: '#/components/schemas/UeAreaIndication'
      supportedFeatures:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
      achievedQos:
        $ref: '#/components/schemas/MinorLocationQoS'
      directReportInd:
        type: boolean
        default: false
      indoorOutdoorInd:
        $ref: '#/components/schemas/IndoorOutdoorInd'
      acceptedPeriodicEventInfo:
        $ref: '#/components/schemas/PeriodicEventInfo'
      haGnssMetrics:
        $ref: '#/components/schemas/HighAccuracyGnssMetrics'
```

```
        losNlosMeasureInd:
          $ref: '#/components/schemas/LosNlosMeasureInd'
        relatedApplicationlayerId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationlayerId'
        distanceDirection:
          $ref: '#/components/schemas/RangeDirection'
        2dRelativeLocation:
          $ref: '#/components/schemas/2DRelativeLocation'
        3dRelativeLocation:
          $ref: '#/components/schemas/3DRelativeLocation'
        relativeVelocity:
          $ref: '#/components/schemas/VelocityEstimate'
        rangingSlCapability:
          $ref: '#/components/schemas/RangingSlCapability'


    GeographicArea:
      description: Geographic area specified by different shape.
      anyOf:
        - $ref: '#/components/schemas/Point'
        - $ref: '#/components/schemas/PointUncertaintyCircle'
        - $ref: '#/components/schemas/PointUncertaintyEllipse'
        - $ref: '#/components/schemas/Polygon'
        - $ref: '#/components/schemas/PointAltitude'
        - $ref: '#/components/schemas/PointAltitudeUncertainty'
        - $ref: '#/components/schemas/EllipsoidArc'

    GADShape:
      description: Common base type for GAD shapes.
      type: object
      required:
        - shape
      properties:
        shape:
          $ref: '#/components/schemas/SupportedGADShapes'
      discriminator:
        propertyName: shape
        mapping:
          POINT: '#/components/schemas/Point'
          POINT_UNCERTAINTY_CIRCLE: '#/components/schemas/PointUncertaintyCircle'
          POINT_UNCERTAINTY_ELLIPSE: '#/components/schemas/PointUncertaintyEllipse'
          POLYGON: '#/components/schemas/Polygon'
          POINT_ALTITUDE: '#/components/schemas/PointAltitude'
          POINT_ALTITUDE_UNCERTAINTY: '#/components/schemas/PointAltitudeUncertainty'
          ELLIPSOID_ARC: '#/components/schemas/EllipsoidArc'
          LOCAL_2D_POINT_UNCERTAINTY_ELLIPSE: '#/components/schemas/Local2dPointUncertaintyEllipse'
          LOCAL_3D_POINT_UNCERTAINTY_ELLIPSOID:
'#/components/schemas/Local3dPointUncertaintyEllipsoid'

    Point:
      description: Ellipsoid Point.
      allOf:
        - $ref: '#/components/schemas/GADShape'
        - type: object
          required:
            - point
          properties:
            point:
              $ref: '#/components/schemas/GeographicalCoordinates'

    PointUncertaintyCircle:
      description: Ellipsoid point with uncertainty circle.
      allOf:
        - $ref: '#/components/schemas/GADShape'
        - type: object
          required:
            - point
            - uncertainty
          properties:
            point:
              $ref: '#/components/schemas/GeographicalCoordinates'
            uncertainty:
              $ref: '#/components/schemas/Uncertainty'

    PointUncertaintyEllipse:
      description: Ellipsoid point with uncertainty ellipse.
      allOf:
        - $ref: '#/components/schemas/GADShape'
```

```
      - type: object
        required:
          - point
          - uncertaintyEllipse
          - confidence
        properties:
          point:
            $ref: '#/components/schemas/GeographicalCoordinates'
          uncertaintyEllipse:
            $ref: '#/components/schemas/UncertaintyEllipse'
          confidence:
            $ref: '#/components/schemas/Confidence'

    Polygon:
      description: Polygon.
      allOf:
        - $ref: '#/components/schemas/GADShape'
        - type: object
          required:
            - pointList
          properties:
            pointList:
              $ref: '#/components/schemas/PointList'

    PointAltitude:
      description: Ellipsoid point with altitude.
      allOf:
        - $ref: '#/components/schemas/GADShape'
        - type: object
          required:
            - point
            - altitude
          properties:
            point:
              $ref: '#/components/schemas/GeographicalCoordinates'
            altitude:
              $ref: '#/components/schemas/Altitude'

    PointAltitudeUncertainty:
      description: Ellipsoid point with altitude and uncertainty ellipsoid.
      allOf:
        - $ref: '#/components/schemas/GADShape'
        - type: object
          required:
            - point
            - altitude
            - uncertaintyEllipse
            - uncertaintyAltitude
            - confidence
          properties:
            point:
              $ref: '#/components/schemas/GeographicalCoordinates'
            altitude:
              $ref: '#/components/schemas/Altitude'
            uncertaintyEllipse:
              $ref: '#/components/schemas/UncertaintyEllipse'
            uncertaintyAltitude:
              $ref: '#/components/schemas/Uncertainty'
            confidence:
              $ref: '#/components/schemas/Confidence'
            vConfidence:
              $ref: '#/components/schemas/Confidence'

    EllipsoidArc:
      description: Ellipsoid Arc.
      allOf:
        - $ref: '#/components/schemas/GADShape'
        - type: object
          required:
            - point
            - innerRadius
            - uncertaintyRadius
            - offsetAngle
            - includedAngle
            - confidence
          properties:
            point:
              $ref: '#/components/schemas/GeographicalCoordinates'
```

```
            innerRadius:
              $ref: '#/components/schemas/InnerRadius'
            uncertaintyRadius:
              $ref: '#/components/schemas/Uncertainty'
            offsetAngle:
              $ref: '#/components/schemas/Angle'
            includedAngle:
              $ref: '#/components/schemas/Angle'
            confidence:
              $ref: '#/components/schemas/Confidence'

    LocalOrigin:
      description: Indicates a Local origin in a reference system
      type: object
      properties:
        coordinateId:
          type: string
        point:
          $ref: '#/components/schemas/GeographicalCoordinates'

    RelativeCartesianLocation:
      description: Relative Cartesian Location
      type: object
      required:
        - x
        - y
      properties:
        x:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Float'
        y:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Float'
        z:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Float'


    LocalArea:
      description: Local area specified by different shape
      oneOf:
        - $ref: '#/components/schemas/Local2dPointUncertaintyEllipse'
        - $ref: '#/components/schemas/Local3dPointUncertaintyEllipsoid'

    UeAreaIndication:
      description: Indicates area (country, area in a country or international area) where UE is
located
      type: object
      oneOf:
        - required:
          - country
        - required:
          - internationalAreaInd
      properties:
        country:
          description: Indicates country or area in a country where UE is located
          type: string
        internationalAreaInd:
          description: Indicates international area indication if UE is located in international
area
          type: boolean
          default: false

    Local2dPointUncertaintyEllipse:
      description: Local 2D point with uncertainty ellipse
      allOf:
        - $ref: '#/components/schemas/GADShape'
        - type: object
          required:
            - localOrigin
            - point
            - uncertaintyEllipse
            - confidence
          properties:
            localOrigin:
              $ref: '#/components/schemas/LocalOrigin'
            point:
              $ref: '#/components/schemas/RelativeCartesianLocation'
            uncertaintyEllipse:
              $ref: '#/components/schemas/UncertaintyEllipse'
            confidence:
```

```
          $ref: '#/components/schemas/Confidence'

    Local3dPointUncertaintyEllipsoid:
      description: Local 3D point with uncertainty ellipsoid
      allOf:
        - $ref: '#/components/schemas/GADShape'
        - type: object
          required:
            - localOrigin
            - point
            - uncertaintyEllipsoid
            - confidence
          properties:
            localOrigin:
              $ref: '#/components/schemas/LocalOrigin'
            point:
              $ref: '#/components/schemas/RelativeCartesianLocation'
            uncertaintyEllipsoid:
              $ref: '#/components/schemas/UncertaintyEllipsoid'
            confidence:
              $ref: '#/components/schemas/Confidence'

    GeographicalCoordinates:
      description: Geographical coordinates.
      type: object
      required:
        - lon
        - lat
      properties:
        lon:
          type: number
          format: double
          minimum: -180
          maximum: 180
        lat:
          type: number
          format: double
          minimum: -90
          maximum: 90

    UncertaintyEllipse:
      description: Ellipse with uncertainty.
      type: object
      required:
        - semiMajor
        - semiMinor
        - orientationMajor
      properties:
        semiMajor:
          $ref: '#/components/schemas/Uncertainty'
        semiMinor:
          $ref: '#/components/schemas/Uncertainty'
        orientationMajor:
          $ref: '#/components/schemas/Orientation'

    UncertaintyEllipsoid:
      description: Ellipsoid with uncertainty
      type: object
      required:
        - semiMajor
        - semiMinor
        - vertical
        - orientationMajor
      properties:
        semiMajor:
          $ref: '#/components/schemas/Uncertainty'
        semiMinor:
          $ref: '#/components/schemas/Uncertainty'
        vertical:
          $ref: '#/components/schemas/Uncertainty'
        orientationMajor:
          $ref: '#/components/schemas/Orientation'

    PointList:
      description: List of points.
      type: array
      items:
        $ref: '#/components/schemas/GeographicalCoordinates'
```

```
      minItems: 3
      maxItems: 15

    LocationQoS:
      description: QoS of Location request.
      type: object
      properties:
        hAccuracy:
          $ref: '#/components/schemas/Accuracy'
        vAccuracy:
          $ref: '#/components/schemas/Accuracy'
        verticalRequested:
          type: boolean
        responseTime:
          $ref: '#/components/schemas/ResponseTime'
        minorLocQoses:
          type: array
          items:
            $ref: '#/components/schemas/MinorLocationQoS'
          minItems: 1
          maxItems: 2
        lcsQosClass:
          $ref: '#/components/schemas/LcsQosClass'

    PositioningMethodAndUsage:
      description: Indicates the usage of a positioning method.
      type: object
      required:
        - method
        - mode
        - usage
      properties:
        method:
          $ref: '#/components/schemas/PositioningMethod'
        mode:
          $ref: '#/components/schemas/PositioningMode'
        usage:
          $ref: '#/components/schemas/Usage'
        methodCode:
          type: integer
          minimum: 16
          maximum: 31

    GnssPositioningMethodAndUsage:
      description: Indicates the usage of a Global Navigation Satellite System (GNSS) positioning
method.
      type: object
      required:
        - mode
        - gnss
        - usage
      properties:
        mode:
          $ref: '#/components/schemas/PositioningMode'
        gnss:
          $ref: '#/components/schemas/GnssId'
        usage:
          $ref: '#/components/schemas/Usage'

    CivicAddress:
      description: Indicates a Civic address.
      type: object
      properties:
        country:
          type: string
        A1:
          type: string
        A2:
          type: string
        A3:
          type: string
        A4:
          type: string
        A5:
          type: string
        A6:
          type: string
        PRD:
```

```
        type: string
      POD:
        type: string
      STS:
        type: string
      HNO:
        type: string
      HNS:
        type: string
      LMK:
        type: string
      LOC:
        type: string
      NAM:
        type: string
      PC:
        type: string
      BLD:
        type: string
      UNIT:
        type: string
      FLR:
        type: string
      ROOM:
        type: string
      PLC:
        type: string
      PCN:
        type: string
      POBOX:
        type: string
      ADDCODE:
        type: string
      SEAT:
        type: string
      RD:
        type: string
      RDSEC:
        type: string
      RDBR:
        type: string
      RDSUBBR:
        type: string
      PRM:
        type: string
      POM:
        type: string
      usageRules:
        type: string
      method:
        type: string
      providedBy:
        type: string

  VelocityEstimate:
    description: Velocity estimate.
    oneOf:
      - $ref: '#/components/schemas/HorizontalVelocity'
      - $ref: '#/components/schemas/HorizontalWithVerticalVelocity'
      - $ref: '#/components/schemas/HorizontalVelocityWithUncertainty'
      - $ref: '#/components/schemas/HorizontalWithVerticalVelocityAndUncertainty'

  HorizontalVelocity:
    description: Horizontal velocity.
    type: object
    required:
      - hSpeed
      - bearing
    properties:
      hSpeed:
        $ref: '#/components/schemas/HorizontalSpeed'
      bearing:
        $ref: '#/components/schemas/Angle'

  HorizontalWithVerticalVelocity:
    description: Horizontal and vertical velocity.
    type: object
    required:
```

```
      - hSpeed
      - bearing
      - vSpeed
      - vDirection
    properties:
      hSpeed:
        $ref: '#/components/schemas/HorizontalSpeed'
      bearing:
        $ref: '#/components/schemas/Angle'
      vSpeed:
        $ref: '#/components/schemas/VerticalSpeed'
      vDirection:
        $ref: '#/components/schemas/VerticalDirection'

  HorizontalVelocityWithUncertainty:
    description: Horizontal velocity with speed uncertainty.
    type: object
    required:
      - hSpeed
      - bearing
      - hUncertainty
    properties:
      hSpeed:
        $ref: '#/components/schemas/HorizontalSpeed'
      bearing:
        $ref: '#/components/schemas/Angle'
      hUncertainty:
        $ref: '#/components/schemas/SpeedUncertainty'

  HorizontalWithVerticalVelocityAndUncertainty:
    description: Horizontal and vertical velocity with speed uncertainty.
    type: object
    required:
      - hSpeed
      - bearing
      - vSpeed
      - vDirection
      - hUncertainty
      - vUncertainty
    properties:
      hSpeed:
        $ref: '#/components/schemas/HorizontalSpeed'
      bearing:
        $ref: '#/components/schemas/Angle'
      vSpeed:
        $ref: '#/components/schemas/VerticalSpeed'
      vDirection:
        $ref: '#/components/schemas/VerticalDirection'
      hUncertainty:
        $ref: '#/components/schemas/SpeedUncertainty'
      vUncertainty:
        $ref: '#/components/schemas/SpeedUncertainty'

  UeLcsCapability:
    description: Indicates the LCS capability supported by the UE..
    type: object
    properties:
      lppSupport:
        type: boolean
        default: true
      ciotOptimisation:
        type: boolean
        default: false

  PeriodicEventInfo:
    description: Indicates the information of periodic event reporting.
    type: object
    required:
      - reportingAmount
      - reportingInterval
    properties:
      reportingAmount:
        $ref: '#/components/schemas/ReportingAmount'
      reportingInterval:
        $ref: '#/components/schemas/ReportingInterval'
      reportingInfiniteInd:
        type: boolean
        enum:
```

```
        - true
    reportingIntervalMs:
      $ref: '#/components/schemas/ReportingIntervalMs'

AreaEventInfo:
  description: Indicates the information of area based event reporting.
  type: object
  required:
    - areaDefinition
  properties:
    areaDefinition:
      type: array
      items:
        $ref: '#/components/schemas/ReportingArea'
      minItems: 1
      maxItems: 250
    occurrenceInfo:
      $ref: '#/components/schemas/OccurrenceInfo'
    minimumInterval:
      $ref: '#/components/schemas/MinimumInterval'
    maximumInterval:
      $ref: '#/components/schemas/MaximumInterval'
    samplingInterval:
      $ref: '#/components/schemas/SamplingInterval'
    reportingDuration:
      $ref: '#/components/schemas/ReportingDuration'
    reportingLocationReq:
      type: boolean
      default: true

ReportingArea:
  description: Indicates an area for event reporting.
  type: object
  required:
    - areaType
  properties:
    areaType:
      $ref: '#/components/schemas/ReportingAreaType'
    tai:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Tai'
    ecgi:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Ecgi'
    ncgi:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Ncgi'

MotionEventInfo:
  description: Indicates the information of motion based event reporting.
  type: object
  required:
    - linearDistance
  properties:
    linearDistance:
      $ref: '#/components/schemas/LinearDistance'
    occurrenceInfo:
      $ref: '#/components/schemas/OccurrenceInfo'
    minimumInterval:
      $ref: '#/components/schemas/MinimumInterval'
    maximumInterval:
      $ref: '#/components/schemas/MaximumInterval'
    samplingInterval:
      $ref: '#/components/schemas/SamplingInterval'
    reportingDuration:
      $ref: '#/components/schemas/ReportingDuration'
    reportingLocationReq:
      type: boolean
      default: true

CancelLocData:
  description: Information within Cancel Location Request.
  type: object
  required:
    - hgmlcCallBackURI
    - ldrReference
  properties:
    hgmlcCallBackURI:
      $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
    ldrReference:
      $ref: '#/components/schemas/LdrReference'
```

```
      supportedFeatures:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'

  LocContextData:
    description: Information within Transfer Location Context Request.
    type: object
    required:
      - amfId
      - ldrType
      - hgmlcCallBackURI
      - ldrReference
      - eventReportMessage
    properties:
      amfId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/NfInstanceId'
      locationQoS:
        $ref: '#/components/schemas/LocationQoS'
      supportedGADShapes:
        type: array
        items:
          $ref: '#/components/schemas/SupportedGADShapes'
        minItems: 1
      supi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
      gpsi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
      ldrType:
        $ref: '#/components/schemas/LdrType'
      hgmlcCallBackURI:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
      ldrReference:
        $ref: '#/components/schemas/LdrReference'
      periodicEventInfo:
        $ref: '#/components/schemas/PeriodicEventInfo'
      areaEventInfo:
        $ref: '#/components/schemas/AreaEventInfo'
      motionEventInfo:
        $ref: '#/components/schemas/MotionEventInfo'
      eventReportMessage:
        $ref: '#/components/schemas/EventReportMessage'
      eventReportingStatus:
        $ref: '#/components/schemas/EventReportingStatus'
      ueLocationInfo:
        $ref: '#/components/schemas/UELocationInfo'
      cIoT5GSOptimisation:
        type: boolean
        default: false
      ecgi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Ecgi'
      ncgi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Ncgi'
      guami:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Guami'
      supportedFeatures:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
      uePositioningCap:
        $ref: '#/components/schemas/UePositioningCapabilities'
      scheduledLocTime:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      indoorOutdoorInd:
        $ref: '#/components/schemas/IndoorOutdoorInd'
      losNlosMeasureInd:
        $ref: '#/components/schemas/LosNlosMeasureInd'
      upCumEvtRptCriteria:
        $ref: 'TS29515_Ngmlc_Location.yaml#/components/schemas/UpCumEvtRptCriteria'

  EventReportMessage:
    description: Indicates an event report message.
    type: object
    required:
      - eventClass
      - eventContent
    properties:
      eventClass:
        $ref: '#/components/schemas/EventClass'
      eventContent:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/RefToBinaryData'
```

```
    EventReportingStatus:
      description: Indicates the status of event reporting.
      type: object
      properties:
        eventReportCounter:
          $ref: '#/components/schemas/EventReportCounter'
        eventReportDuration:
          $ref: '#/components/schemas/EventReportDuration'

    UELocationInfo:
      description: Indicates location information of a UE.
      type: object
      properties:
        locationEstimate:
          $ref: '#/components/schemas/GeographicArea'
        ageOfLocationEstimate:
          $ref: '#/components/schemas/AgeOfLocationEstimate'
        timestampOfLocationEstimate:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        velocityEstimate:
          $ref: '#/components/schemas/VelocityEstimate'
        ageOfVelocityEstimate:
          $ref: '#/components/schemas/AgeOfLocationEstimate'
        timestampOfVelocityEstimate:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'

    EventNotifyDataExt:
      description: Extended Event Notify Data for UEs
      allOf:
        - $ref: '#/components/schemas/EventNotifyData'
        - $ref: '#/components/schemas/AddEventNotifyDatas'

    EventNotifyData:
      description: Information within Event Notify Request.
      type: object
      required:
        - reportedEventType
        - ldrReference
      properties:
        reportedEventType:
          $ref: '#/components/schemas/ReportedEventType'
        supi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
        gpsi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
        hgmlcCallBackURI:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        ldrReference:
          $ref: '#/components/schemas/LdrReference'
        lirReference:
          $ref: 'TS29572_Nlmf_Location.yaml#/components/schemas/LirReference'
        locationEstimate:
          $ref: '#/components/schemas/GeographicArea'
        ageOfLocationEstimate:
          $ref: '#/components/schemas/AgeOfLocationEstimate'
        timestampOfLocationEstimate:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        civicAddress:
          $ref: '#/components/schemas/CivicAddress'
        localLocationEstimate:
          $ref: '#/components/schemas/LocalArea'
        positioningDataList:
          type: array
          items:
            $ref: '#/components/schemas/PositioningMethodAndUsage'
          minItems: 1
        gnssPositioningDataList:
          type: array
          items:
            $ref: '#/components/schemas/GnssPositioningMethodAndUsage'
          minItems: 1
        servingLMFidentification:
          $ref: '#/components/schemas/LMFIdentification'
        terminationCause:
          $ref: '#/components/schemas/TerminationCause'
        velocityEstimate:
          $ref: '#/components/schemas/VelocityEstimate'
        altitude:
```

```
        $ref: '#/components/schemas/Altitude'
      achievedQos:
        $ref: '#/components/schemas/MinorLocationQoS'
      supportedFeatures:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'
      indoorOutdoorInd:
        $ref: '#/components/schemas/IndoorOutdoorInd'
      haGnssMetrics:
        $ref: '#/components/schemas/HighAccuracyGnssMetrics'
      losNlosMeasureInd:
        $ref: '#/components/schemas/LosNlosMeasureInd'
      upLocRepStatAf:
        type: integer
      relatedApplicationlayerId:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationlayerId'
      distanceDirection:
        $ref: '#/components/schemas/RangeDirection'
      2dRelativeLocation:
        $ref: '#/components/schemas/2DRelativeLocation'
      3dRelativeLocation:
        $ref: '#/components/schemas/3DRelativeLocation'
      relativeVelocity:
        $ref: '#/components/schemas/VelocityEstimate'


  UeConnectivityState:
    description: Indicates the connectivity state of a UE.
    type: object
    required:
      - accessType
    properties:
      accessType:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/AccessType'
      connectivitystate:
        $ref: 'TS29518_Namf_EventExposure.yaml#/components/schemas/CmState'

  MinorLocationQoS:
    description: Contain Minor Location QoS.
    type: object
    properties:
      hAccuracy:
        $ref: '#/components/schemas/Accuracy'
      vAccuracy:
        $ref: '#/components/schemas/Accuracy'

  MbsrInfo:
    description: MBSR Information
    type: object
    properties:
      ncgi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Ncgi'
      ecgi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Ecgi'


  LocMeasurementReq:
    description: Location Measurement Request.
    type: object
    properties:
      ncgi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Ncgi'
      ecgi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Ecgi'
      preCalcuLocEstimate:
        $ref: '#/components/schemas/GeographicArea'
      timestampOfPreCalcuLocEstimate:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      timeWindows:
        type: array
        items:
          $ref: '#/components/schemas/TimeWindow'
        minItems: 1

  LocMeasurementResp:
    description: Location Measurement Response.
    type: object
    required:
      - locMeasurements
```

```
      - locationEstimate
    properties:
      locMeasurements:
        $ref: '#/components/schemas/LocMeasurements'
      locationEstimate:
        $ref: '#/components/schemas/GeographicArea'
      ageOfLocationEstimate:
        $ref: '#/components/schemas/AgeOfLocationEstimate'
      timestampOfLocationEstimate:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
      velocityEstimate:
        $ref: '#/components/schemas/VelocityEstimate'
      localLocationEstimate:
        $ref: '#/components/schemas/LocalArea'

  LocMeasurements:
    description: PRU Location Measurements.
    type: object
    properties:
      rstd:
        type: integer

  HighAccuracyGnssMetrics:
    description: High Accuracy GNSS Positioning Metrics.
    type: object
    properties:
      nrOfUsedSatellites:
        type: integer
        minimum: 0
        maximum: 64
      hdopi:
        type: integer
        minimum: 1
        maximum: 256
      pdopi:
        type: integer
        minimum: 1
        maximum: 256
      age:
        type: integer
        minimum: 0
        maximum: 99
      fixType:
        $ref: '#/components/schemas/FixType'

  UpNotifyData:
    description: UP Subscription
    type: object
    required:
      - notifCorrelationId
      - upConnectionStatus
    properties:
      notifCorrelationId:
        $ref: '#/components/schemas/CorrelationID'
      upConnectionStatus:
        $ref: '#/components/schemas/UpConnectionStatus'
      targetLMFId:
        $ref: '#/components/schemas/LMFIdentification'

  UpSubscription:
    description: UP Subscription
    type: object
    required:
      - upNotifyCallBackUri
      - notifCorrelationId
      - supi
    properties:
      upNotifyCallBackUri:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
      notifCorrelationId:
        $ref: '#/components/schemas/CorrelationID'
      supi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
      gpsi:
        $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'

  RelatedUE:
    description: Related UE Information
```

```
      type: object
      required:
        - applicationlayerId
        - relatedUEType
      properties:
        applicationlayerId:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/ApplicationlayerId'
        relatedUEType:
          $ref: '#/components/schemas/RelatedUEType'

    UpConfig:
      description: UP Config
      type: object
      required:
        - upNotifyCallBackUri
        - notifCorrelationId
      properties:
        upNotifyCallBackUri:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        notifCorrelationId:
          $ref: '#/components/schemas/CorrelationID'
        supi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Supi'
        gpsi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Gpsi'
        amfReallocationInd:
          type: boolean
          default: false
        lcsUpConnectionInd:
          $ref: '#/components/schemas/LcsUpConnectionInd'
        targetLMFId:
          $ref: '#/components/schemas/LMFIdentification'

    RangeDirection:
      description: Represents a distance and direction from a point A to a point B.
      type: object
      properties:
        distance:
          type: number
        azimuthDirection:
          $ref: '#/components/schemas/Angle'
        elevationDirection:
          $ref: '#/components/schemas/Angle'

    2DRelativeLocation:
      description: Represents a relative 2D location with uncertainty ellipse.
      type: object
      properties:
        semiMinor:
          $ref: '#/components/schemas/Uncertainty'
        semiMajor:
          $ref: '#/components/schemas/Uncertainty'
        orientationAngle:
          $ref: '#/components/schemas/Angle'

    3DRelativeLocation:
      description: Represents a relative 3D location with uncertainty ellipsoid.
      type: object
      properties:
        semiMinor:
          $ref: '#/components/schemas/Uncertainty'
        semiMajor:
          $ref: '#/components/schemas/Uncertainty'
        verticalUncertainty:
          $ref: '#/components/schemas/Uncertainty'
        orientationAngle:
          $ref: '#/components/schemas/Angle'

    AddLocationDatas:
      type: object
      properties:
        addLocationDatas:
          type: array
          items:
            $ref: '#/components/schemas/LocationData'
          minItems: 1

    AddEventNotifyDatas:
```

```
      type: object
      properties:
        addEventNotifyDatas:
          type: array
          items:
            $ref: '#/components/schemas/EventNotifyData'
          minItems: 1

    MappedLocationQoSEps:
      description: Mapped Location QoS for EPS.
      type: object
      required:
        - hAccuracy
      properties:
        hAccuracy:
          $ref: '#/components/schemas/Accuracy'
        vAccuracy:
          $ref: '#/components/schemas/Accuracy'

    AdditionalUeInfo:
      description: MBSR UE Information
      type: object
      properties:
        ncgi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Ncgi'
        ecgi:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Ecgi'


#
#
# SIMPLE TYPES
#
    Altitude:
      description: Indicates value of altitude.
      type: number
      format: double
      minimum: -32767
      maximum: 32767

    Angle:
      description: Indicates value of angle.
      type: integer
      minimum: 0
      maximum: 360

    Uncertainty:
      description: Indicates value of uncertainty.
      type: number
      format: float
      minimum: 0

    Orientation:
      description: Indicates value of orientation angle.
      type: integer
      minimum: 0
      maximum: 180

    Confidence:
      description: Indicates value of confidence.
      type: integer
      minimum: 0
      maximum: 100

    Accuracy:
      description: Indicates value of accuracy.
      type: number
      format: float
      minimum: 0

    InnerRadius:
      description: Indicates value of the inner radius.
      type: integer
      format: int32
      minimum: 0
      maximum: 327675

    CorrelationID:
```

```
    description: LCS Correlation ID.
    type: string
    minLength: 1
    maxLength: 255

  AgeOfLocationEstimate:
    description: Indicates value of the age of the location estimate.
    type: integer
    minimum: 0
    maximum: 32767

  HorizontalSpeed:
    description: Indicates value of horizontal speed.
    type: number
    format: float
    minimum: 0
    maximum: 2047

  VerticalSpeed:
    description: Indicates value of vertical speed.
    type: number
    format: float
    minimum: 0
    maximum: 255

  SpeedUncertainty:
    description: Indicates value of speed uncertainty.
    type: number
    format: float
    minimum: 0
    maximum: 255

  BarometricPressure:
    description: Specifies the measured uncompensated atmospheric pressure.
    type: integer
    minimum: 30000
    maximum: 115000

  LcsServiceType:
    description: LCS service type.
    type: integer
    minimum: 0
    maximum: 127

  LdrReference:
    description: LDR Reference.
    type: string
    minLength: 2
    maxLength: 510

  LirReference:
    description: LIR Reference.
    type: string
    minLength: 2
    maxLength: 510

  ReportingAmount:
    description: Number of required periodic event reports.
    type: integer
    minimum: 1
    maximum: 8639999

  ReportingInterval:
    description: Event reporting periodic interval in seconds.
    type: integer
    minimum: 1
    maximum: 8639999

  ReportingIntervalMs:
    description: Event reporting periodic interval in milliseconds.
    type: integer
    minimum: 1
    maximum: 999

  MinimumInterval:
    description: Minimum interval between event reports.
    type: integer
    minimum: 1
```

```
      maximum: 32767

    MaximumInterval:
      description: Maximum interval between event reports.
      type: integer
      minimum: 1
      maximum: 86400

    SamplingInterval:
      description: Maximum time interval between consecutive evaluations by a UE of a trigger event.
      type: integer
      minimum: 1
      maximum: 3600

    ReportingDuration:
      description: Maximum duration of event reporting.
      type: integer
      minimum: 1
      maximum: 8640000

    LinearDistance:
      description: Minimum straight line distance moved by a UE to trigger a motion event report.
      type: integer
      minimum: 1
      maximum: 10000

    LMFIdentification:
      description: LMF identification.
      type: string

    EventReportCounter:
      description: Number of event reports received from the target UE.
      type: integer
      minimum: 1
      maximum: 8640000

    EventReportDuration:
      description: Duration of event reporting.
      type: integer
      minimum: 1
      maximum: 8640000

    UePositioningCapabilities:
      description: Positioning capabilities supported by the UE. A string encoding the
"ProvideCapabilities-r9-IEs" IE as specified in clause 6.3 of 3GPP TS 37.355 (start from octet 1).
      type: string
      format: byte

    TimeWindow:
      description: Time Window.
      type: string
      format: byte

    RangingSlCapability:
      description: Ranging/Sidelink Positioning Positioning capabilities supported by the UE.
      type: string
      format: byte

#
# ENUMS
#
    ExternalClientType:
      description: Indicates types of External Clients.
      anyOf:
        - type: string
          enum:
            - EMERGENCY_SERVICES
            - VALUE_ADDED_SERVICES
            - PLMN_OPERATOR_SERVICES
            - LAWFUL_INTERCEPT_SERVICES
            - PLMN_OPERATOR_BROADCAST_SERVICES
            - PLMN_OPERATOR_OM
            - PLMN_OPERATOR_ANONYMOUS_STATISTICS
            - PLMN_OPERATOR_TARGET_MS_SERVICE_SUPPORT
            - SL_POS
        - type: string

    SupportedGADShapes:
```

```
      description: Indicates supported GAD shapes.
      anyOf:
        - type: string
          enum:
            - POINT
            - POINT_UNCERTAINTY_CIRCLE
            - POINT_UNCERTAINTY_ELLIPSE
            - POLYGON
            - POINT_ALTITUDE
            - POINT_ALTITUDE_UNCERTAINTY
            - ELLIPSOID_ARC
            - LOCAL_2D_POINT_UNCERTAINTY_ELLIPSE
            - LOCAL_3D_POINT_UNCERTAINTY_ELLIPSOID
            - DISTANCE_DIRECTION
            - RELATIVE_2D_LOCATION_UNCERTAINTY_ELLIPSE
            - RELATIVE_3D_LOCATION_UNCERTAINTY_ELLIPSOID
        - type: string

    ResponseTime:
      description: Indicates acceptable delay of location request.
      anyOf:
        - type: string
          enum:
            - LOW_DELAY
            - DELAY_TOLERANT
            - NO_DELAY
        - type: string

    PositioningMethod:
      description: Indicates supported positioning methods.
      anyOf:
        - type: string
          enum:
            - CELLID
            - ECID
            - OTDOA
            - BAROMETRIC_PRESSURE
            - WLAN
            - BLUETOOTH
            - MBS
            - MOTION_SENSOR
            - DL_TDOA
            - DL_AOD
            - MULTI-RTT
            - NR_ECID
            - UL_TDOA
            - UL_AOA
            - NETWORK_SPECIFIC
            - SL_TDOA
            - SL_TOA
            - SL_AoA
            - SL_RT
        - type: string

    PositioningMode:
      description: Indicates supported modes used for positioning method.
      anyOf:
        - type: string
          enum:
            - UE_BASED
            - UE_ASSISTED
            - CONVENTIONAL
        - type: string

    GnssId:
      description: Global Navigation Satellite System (GNSS) ID.
      anyOf:
        - type: string
          enum:
            - GPS
            - GALILEO
            - SBAS
            - MODERNIZED_GPS
            - QZSS
            - GLONASS
            - BDS
            - NAVIC
        - type: string
```

```
    Usage:
      description: Indicates usage made of the location measurement.
      anyOf:
        - type: string
          enum:
            - UNSUCCESS
            - SUCCESS_RESULTS_NOT_USED
            - SUCCESS_RESULTS_USED_TO_VERIFY_LOCATION
            - SUCCESS_RESULTS_USED_TO_GENERATE_LOCATION
            - SUCCESS_METHOD_NOT_DETERMINED
        - type: string

    LcsPriority:
      description: Indicates priority of the LCS client.
      anyOf:
        - type: string
          enum:
            - HIGHEST_PRIORITY
            - NORMAL_PRIORITY
        - type: string

    VelocityRequested:
      description: Indicates velocity requirement.
      anyOf:
        - type: string
          enum:
            - VELOCITY_IS_NOT_REQUESTED
            - VELOCITY_IS_REQUESTED
        - type: string

    AccuracyFulfilmentIndicator:
      description: Indicates fulfilment of requested accuracy.
      anyOf:
        - type: string
          enum:
            - REQUESTED_ACCURACY_FULFILLED
            - REQUESTED_ACCURACY_NOT_FULFILLED
        - type: string

    VerticalDirection:
      description: Indicates direction of vertical speed.
      type: string
      enum:
        - UPWARD
        - DOWNWARD

    LdrType:
      description: Indicates LDR types.
      anyOf:
        - type: string
          enum:
            - UE_AVAILABLE
            - PERIODIC
            - ENTERING_INTO_AREA
            - LEAVING_FROM_AREA
            - BEING_INSIDE_AREA
            - MOTION
        - type: string

    ReportingAreaType:
      description: Indicates type of event reporting area.
      anyOf:
        - type: string
          enum:
            - EPS_TRACKING_AREA_IDENTITY
            - E-UTRAN_CELL_GLOBAL_IDENTIFICATION
            - 5GS_TRACKING_AREA_IDENTITY
            - NR_CELL_GLOBAL_IDENTITY
        - type: string

    OccurrenceInfo:
      description: Specifies occurrence of event reporting.
      anyOf:
        - type: string
          enum:
            - ONE_TIME_EVENT
            - MULTIPLE_TIME_EVENT
```

```
      - type: string

    ReportingAccessType:
      description: Specifies access types of event reporting.
      anyOf:
        - type: string
          enum:
            - NR
            - EUTRA_CONNECTED_TO_5GC
            - NON_3GPP_CONNECTED_TO_5GC
            - NR_LEO
            - NR_MEO
            - NR_GEO
            - NR_OTHER_SAT
            - EUTRA_CONNECTED_TO_EPC
        - type: string

    EventClass:
      description: Specifies event classes.
      anyOf:
        - type: string
          enum:
            - SUPPLEMENTARY_SERVICES
        - type: string

    ReportedEventType:
      description: Specifies type of event reporting.
      anyOf:
        - type: string
          enum:
            - PERIODIC_EVENT
            - ENTERING_AREA_EVENT
            - LEAVING_AREA_EVENT
            - BEING_INSIDE_AREA_EVENT
            - MOTION_EVENT
            - MAXIMUM_INTERVAL_EXPIRATION_EVENT
            - LOCATION_CANCELLATION_EVENT
            - INTERMEDIATE_EVENT
            - DIRECT_REPORT_EVENT
            - CUMULATIVE_EVENT_REPORT
        - type: string

    TerminationCause:
      description: Specifies causes of event reporting termination.
      anyOf:
        - type: string
          enum:
            - TERMINATION_BY_UE
            - TERMINATION_BY_NETWORK
            - NORMAL_TERMINATION
        - type: string

    LcsQosClass:
      description: Specifies LCS QoS class.
      anyOf:
        - type: string
          enum:
            - BEST_EFFORT
            - ASSURED
            - MULTIPLE_QOS
        - type: string

    UeLocationServiceInd:
      description: Specifies location service types requested by UE.
      anyOf:
        - type: string
          enum:
            - LOCATION_ESTIMATE
            - LOCATION_ASSISTANCE_DATA
        - type: string

    IndoorOutdoorInd:
      description: Specifies UE location indoor or outdoor.
      anyOf:
        - type: string
          enum:
            - INDOOR
            - OUTDOOR
```

```
      - type: string

    FixType:
      description: Specifies the positioning fix type.
      anyOf:
        - type: string
          enum:
            - CARRIER_PHASE_FLOAT
            - CARRIER_PHASE_FIX
        - type: string

    LosNlosMeasureInd:
      description: Specifies LOS measurement or NLOS measurement.
      anyOf:
        - type: string
          enum:
            - LOS
            - NLOS
        - type: string

    UpConnectionStatus:
      description: UP Connection Status.
      anyOf:
        - type: string
          enum:
            - ESTABLISHED
            - RELEASED
            - MOVE
        - type: string

    RangingSlResult:
      description: Specifies the type of result requested for ranging and sidelink positioning.
      anyOf:
        - type: string
          enum:
            - ABSOLUTE_LOCATION
            - RELATIVE_LOCATION
            - RANGING_DIRECTION
            - RANGING
            - DIRECTION
            - VELOCITY
            - RELATIVE_VELOCITY
        - type: string

    RelatedUEType:
      description: Specifies the different roles of UE for ranging and sidelink positioning service.
      anyOf:
        - type: string
          enum:
            - LOCATED_UE
            - REFERENCE_UE
        - type: string

    LcsUpConnectionInd:
      description: LCS UP Connection Indication.
      anyOf:
        - type: string
          enum:
            - TERMINATION
            - SETUP
        - type: string

    UeUpPositioningCapabilities:
      description: User plane positioning capabilities supported by the UE.
      anyOf:
        - type: string
          enum:
            - LCS-UPP
            - SUPL
        - type: string
```

A.3 Nlmf_Broadcast API

```
openapi: 3.0.0

info:
  version: '1.2.0-alpha.1'
  title: 'LMF Broadcast'
  description: |
    LMF Broadcast Service.
    © 2022, 3GPP Organizational Partners (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC).
    All rights reserved.

externalDocs:
  description: 3GPP TS 29.572 V18.0.0; 5G System; Location Management Services; Stage 3
  url: 'https://www.3gpp.org/ftp/Specs/archive/29_series/29.572/'

servers:
  - url: '{apiRoot}/nlmf-broadcast/v1'
    variables:
      apiRoot:
        default: https://example.com
        description: apiRoot as defined in clause 4.4 of 3GPP TS 29.501

paths:
  /cipher-key-data:
    post:
      summary: Request ciphering key data
      operationId: CipheringKeyData
      tags:
        - Request Ciphering Key Data
      requestBody:
        content:
          application/json:
            schema:
              $ref: '#/components/schemas/CipherRequestData'
        required: true
      responses:
        '200':
          description: Expected response to a valid request
          content:
            application/json:
              schema:
                $ref: '#/components/schemas/CipherResponseData'
        '307':
          $ref: 'TS29571_CommonData.yaml#/components/responses/307'
        '308':
          $ref: 'TS29571_CommonData.yaml#/components/responses/308'
        '400':
          $ref: 'TS29571_CommonData.yaml#/components/responses/400'
        '401':
          $ref: 'TS29571_CommonData.yaml#/components/responses/401'
        '403':
          $ref: 'TS29571_CommonData.yaml#/components/responses/403'
        '404':
          $ref: 'TS29571_CommonData.yaml#/components/responses/404'
        '411':
          $ref: 'TS29571_CommonData.yaml#/components/responses/411'
        '413':
          $ref: 'TS29571_CommonData.yaml#/components/responses/413'
        '415':
          $ref: 'TS29571_CommonData.yaml#/components/responses/415'
        '429':
          $ref: 'TS29571_CommonData.yaml#/components/responses/429'
        '500':
          $ref: 'TS29571_CommonData.yaml#/components/responses/500'
        '502':
          $ref: 'TS29571_CommonData.yaml#/components/responses/502'
        '503':
          $ref: 'TS29571_CommonData.yaml#/components/responses/503'
        '504':
          $ref: 'TS29571_CommonData.yaml#/components/responses/504'
        default:
          $ref: 'TS29571_CommonData.yaml#/components/responses/default'
      callbacks:
        CipheringKeyData:
          '{$request.body#/amfCallBackURI}':
            post:
```

```
              requestBody:
                description: Ciphering Key Data Notification
                content:
                  application/json:
                    schema:
                      $ref: '#/components/schemas/CipheringKeyInfo'
              responses:
                '200':
                  description: Expected response to a valid request
                  content:
                    application/json:
                      schema:
                        $ref: '#/components/schemas/CipheringKeyResponse'
                '307':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/307'
                '308':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/308'
                '400':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/400'
                '401':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/401'
                '403':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/403'
                '404':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/404'
                '411':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/411'
                '413':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/413'
                '415':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/415'
                '429':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/429'
                '500':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/500'
                '502':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/502'
                '503':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/503'
                '504':
                  $ref: 'TS29571_CommonData.yaml#/components/responses/504'
                default:
                  $ref: 'TS29571_CommonData.yaml#/components/responses/default'

components:
  schemas:
#
# COMPLEX TYPES
#
    CipheringKeyInfo:
      description: Information within Ciphering Key Data Notification request.
      type: object
      required:
        - cipheringData
      properties:
        cipheringData:
          type: array
          items:
            $ref: '#/components/schemas/CipheringDataSet'
          minItems: 1
        supportedFeatures:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'

    CipheringKeyResponse:
      description: Information within Ciphering Key Data Notification Response.
      type: object
      properties:
        cipheringDataReport:
          type: array
          items:
            $ref: '#/components/schemas/CipheringSetReport'
          minItems: 1

    CipheringDataSet:
      description: Represents a Ciphering Data Set.
      type: object
      required:
        - cipheringSetID
```

```
        - cipheringKey
        - c0
        - validityStartTime
        - validityDuration
      properties:
        cipheringSetID:
          $ref: '#/components/schemas/CipheringSetID'
        cipheringKey:
          $ref: '#/components/schemas/CipheringKey'
        c0:
          $ref: '#/components/schemas/C0'
        ltePosSibTypes:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Bytes'
        nrPosSibTypes:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Bytes'
        validityStartTime:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/DateTime'
        validityDuration:
          $ref: '#/components/schemas/ValidityDuration'
        taiList:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Bytes'

    CipheringSetReport:
      description: Represents a report of Ciphering Data Set storage.
      type: object
      required:
        - cipheringSetID
        - storageOutcome
      properties:
        cipheringSetID:
          $ref: '#/components/schemas/CipheringSetID'
        storageOutcome:
          $ref: '#/components/schemas/StorageOutcome'

    CipherRequestData:
      description: Information within Ciphering Key Data request.
      type: object
      required:
        - amfCallBackURI
      properties:
        amfCallBackURI:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/Uri'
        supportedFeatures:
          $ref: 'TS29571_CommonData.yaml#/components/schemas/SupportedFeatures'

    CipherResponseData:
      description: Information within Ciphering Key Data Response.
      type: object
      required:
        - dataAvailability
      properties:
        dataAvailability:
          $ref: '#/components/schemas/DataAvailability'
#
#
# SIMPLE TYPES
#
    CipheringSetID:
      description: Ciphering Data Set Identifier.
      type: integer
      minimum: 0
      maximum: 65535

    CipheringKey:
      description: Ciphering Key.
      format: byte
      type: string

    C0:
      description: First component of the initial ciphering counter.
      format: byte
      type: string

    ValidityDuration:
      description: Validity Duration of the Ciphering Data Set.
      type: integer
      minimum: 1
      maximum: 65535
```

```
#
# ENUMS
#
    StorageOutcome:
      description: Indicates the result of Ciphering Data Set storage.
      anyOf:
        - type: string
          enum:
            - STORAGE_SUCCESSFUL
            - STORAGE_FAILED

    DataAvailability:
      description: Indicates availability of ciphering key data at an LMF.
      anyOf:
        - type: string
          enum:
            - CIPHERING_KEY_DATA_AVAILABLE
            - CIPHERING_KEY_DATA_NOT_AVAILABLE
```

Annex B (informative): Change history

Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2018-01	CT4#82					TS Skeleton agreed in CT4#82	0.0.0
2018-01	CT4#82	C4-181398				Initial draft (C4-181119) Incorporation of agreed pCRs from CT4#82: C4-181121, C4-181233, C4-181234	0.1.0
2018-03	CT4#83	C4-182444				Incorporation of agreed pCRs from CT4#83: C4-182181, C4-182427	0.2.0
2018-03	CT#79	CP-180034				Presented for information	1.0.0
2018-04	CT4#84	C4-183524				Incorporation of agreed pCRs from CT4#84: C4-183184, C4-183363, C4-183510	1.1.0
2018-05	CT4#85	C4-184640				Incorporation of agreed pCRs from CT4#85: C4-184195, C4-184197, C4-184198, C4-184199, C4-184202, C4-184443, C4-184446, C4-184547	1.2.0
2018-06	CT#80	CP-181111				Presented for approval	2.0.0
2018-06	CT#80					Approved in CT#80	15.0.0
2018-09	CT#81	CP-182066	0002	2		Error Cases	15.1.0
2018-09	CT#81	CP-182066	0003	-		Custom Headers	15.1.0
2018-09	CT#81	CP-182066	0004	-		Overall Clean-up	15.1.0
2018-09	CT#81	CP-182066	0005	-		Description of Structured data types	15.1.0
2018-09	CT#81	CP-182066	0006	1		Resource structure presentation	15.1.0
2018-09	CT#81	CP-182066	0007	1		LMF servers clause in OpenAPI	15.1.0
2018-09	CT#81	CP-182066	0008	-		API Version Update	15.1.0
2018-12	CT#82	CP-183025	0010	1	F	Cardinality	15.2.0
2018-12	CT#82	CP-183025	0011	-	F	APIRoot Clarification	15.2.0
2018-12	CT#82	CP-183025	0012	-	F	AMF Id	15.2.0
2018-12	CT#82	CP-183025	0013	-	F	Barometric Pressure in Location Data	15.2.0
2018-12	CT#82	CP-183025	0014	1	F	Clarify Serving Cell in Input Data	15.2.0
2018-12	CT#82	CP-183025	0015	1	F	Oauth2 Corrections	15.2.0
2018-12	CT#82	CP-183025	0016	-	F	API Version	15.2.0
2018-12	CT#82	CP-183179	0017	-	F	ExternalDocs Update	15.2.0
2019-03	CT#83	CP-190030	0018	1	F	OpenAPI Corrections	15.3.0
2019-03	CT#83	CP-190030	0019	1	F	Application Errors	15.3.0
2019-03	CT#83	CP-190030	0020	1	F	Essential Correction to InnerRadius	15.3.0
2019-03	CT#83	CP-190030	0021	1	F	Mandatory Response Codes	15.3.0
2019-03	CT#83	CP-190030	0022	1	F	Essential correction to OpenAPI definition of GeographicArea	15.3.0
2019-03	CT#83	CP-190030	0023	-	F	API version update	15.3.0
2019-06	CT#84	CP-191042	0024	2	F	UE Capabilities	15.4.0
2019-06	CT#84	CP-191042	0025	2	F	Storage of OpenAPI specification files	15.4.0
2019-06	CT#84	CP-191042	0027	1	F	Copyright Note in OpenAPI Spec	15.4.0
2019-06	CT#84	CP-191042	0028	1	F	Major API version	15.4.0
2019-06	CT#84	CP-191042	0030	-	F	Open API Version	15.4.0
2019-09	CT#85	CP-192113	0031	1	F	Missing attribute FLR in Civic Address	16.0.0
2019-09	CT#85	CP-192192	0033	2	B	LMF service operations for a deferred 5GC-MT-LR	16.0.0
2019-09	CT#85	CP-192192	0034	1	B	LMF service operations for a commercial 5GC-MT-LR	16.0.0
2019-09	CT#85	CP-192192	0035	-	F	High Accuracy Support	16.0.0
2019-09	CT#85	CP-192113	0037	1	D	Correct type Polygon	16.0.0
2019-09	CT#85	CP-192120	0039	-	F	3GPP TS 29.572 API version update	16.0.0
2019-12	CT#86	CP-193033	0041	1	A	Motion Sensor Position Method	16.1.0
2019-12	CT#86	CP-193165	0042	3	B	Addition of the LMF Broadcast Service Operations	16.1.0
2019-12	CT#86	CP-193055	0043	1	B	LCS QoS Class	16.1.0
2019-12	CT#86	CP-193036	0045	1	F	ExternalDoc Clause	16.1.0
2019-12	CT#86	CP-193036	0046	1	F	ProblemDetails Optional in Error Response	16.1.0
2019-12	CT#86	CP-193044	0048	-	F	3GPP TS 29.572 API version update	16.1.0
2020-03	CT#87	CP-200039	0049	2	F	Add Corresponding API descriptions in clause 5.1	16.2.0
2020-03	CT#87	CP-200039	0050	2	D	Editorial corrections	16.2.0
2020-03	CT#87	CP-200039	0051	1	F	Correction - formatting consistency	16.2.0
2020-03	CT#87	CP-200018	0052		B	Connectivity state per access type	16.2.0
2020-03	CT#87	CP-200018	0053		B	Primary Cell in the Secondary RAN node	16.2.0
2020-03	CT#87	CP-200052	0055		F	3GPP TS 29.572 Rel16 API External doc update	16.2.0
2020-03	CT#87	CP-200180	0054	4	B	Request Type and embedded LPP message	16.2.0
2020-06	CT#88e	CP-201060	0056	1	F	Add a new Notifications Overview Table	16.3.0
2020-06	CT#88e	CP-201060	0057	1	F	Add custom operation Name	16.3.0
2020-06	CT#88e	CP-201032	0058		F	Location Context Transfer	16.3.0
2020-06	CT#88e	CP-201032	0059	1	B	Network Specific Positioning Methods	16.3.0
2020-06	CT#88e	CP-201032	0060		B	Positioning Methods Support	16.3.0
2020-06	CT#88e	CP-201032	0061	2	F	Storage of YAML files in ETSI Forge	16.3.0
2020-06	CT#88e	CP-201032	0062	1	F	Resolve Editor Notes	16.3.0
2020-06	CT#88e	CP-201032	0063	1	F	LDRreference	16.3.0

2020-06	CT#88e	CP-201032	0065	1	F	Resolution of EN on NR positioning SIBs	16.3.0
2020-06	CT#88e	CP-201032	0068	1	F	Adding ResponseTime enumaration value	16.3.0
2020-06	CT#88e	CP-201060	0069		F	Missing Descriptions	16.3.0
2020-06	CT#88e	CP-201073	0070		F	29.572 Rel-16 API version and External doc update	16.3.0
2020-09	CT#89e	CP-202112	0071	1	F	Optionality of ProblemDetails in TS29.572 cleanup	16.4.0
2020-09	CT#89e	CP-202112	0073	1	F	Adding missing navigation satellite systems for positioning	16.4.0
2020-09	CT#89e	CP-202112	0074	1	F	Including VGMLC address towards LMF when requesting LMF's Location service	16.4.0
2020-09	CT#89e	CP-202112	0075	1	F	Corrections on EventNotify service operation	16.4.0
2020-09	CT#89e	CP-202043	0077	1	F	Correct mismatch on GeographicArea between table and yaml	16.4.0
2020-09	CT#89e	CP-202096	0078	-	F	29.572 Rel-16 API version and External doc update	16.4.0
2020-12	CT#90e	CP-203050	0080	1	F	Essential corrections in clause 5.2.2.4 CancelLocation	16.5.0
2020-12	CT#90e	CP-203050	0081	1	F	Indication of control plane CIoT 5GS optimization in LocationContextTransfer	16.5.0
2020-12	CT#90e	CP-203035	0082	1	F	YAML files in 3GPP Forge	16.5.0
2020-12	CT#90e	CP-203036	0085	1	F	29.572 Rel-16 API version and External doc update	16.5.0
2021-03	CT#91e	CP-210041	0087	-	F	Missing PIDL-LO elements in Location Information	17.0.0
2021-03	CT#91e	CP-210037	0088	1	F	HTTP 3xx redirection	17.0.0
2021-03	CT#91e	CP-210034	0089	-	F	Reference change	17.0.0
2021-03	CT#91e	CP-210054	0091	-	F	29.572 Rel-16 API version and External doc update	17.0.0
2021-06	CT#92e	CP-211055	0092	1	F	Resolving Warning in Nlmf_BroadCast API	17.1.0
2021-06	CT#92e	CP-211055	0093		F	Resolving Warning in Nlmf_Location API	17.1.0
2021-06	CT#92e	CP-211026	0094	1	B	Add List of Assistance Data Types for MO-LR	17.1.0
2021-06	CT#92e	CP-211026	0095	3	B	Add Local Coordinates	17.1.0
2021-06	CT#92e	CP-211051	0096		F	OpenAPI Reference	17.1.0
2021-06	CT#92e	CP-211059	0098		A	3xx description correction for SCP	17.1.0
2021-06	CT#92e	CP-211059	0102	1	A	Redirect Response	17.1.0
2021-06	CT#92e	CP-211050	0103		F	29.572 Rel-17 API version and External doc update	17.1.0
2021-09	CT#93e	CP-212034	0105	1	B	Add UE Positioning Capabilities	17.2.0
2021-09	CT#93e	CP-212034	0108	2	B	Support for Area Decision of Satellite Access	17.2.0
2021-09	CT#93e	CP-212034	0109	1	B	LMF Parameters Support for non-3GPP Access	17.2.0
2021-09	CT#93e	CP-212064	0111		A	Encoding of binary attributes in JSON objects	17.2.0
2021-09	CT#93e	CP-212034	0114	1	B	Multiple QoS Class	17.2.0
2021-09	CT#93e	CP-212059	0115		F	29.572 Rel-17 API version and External doc update	17.2.0
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2021-12	CT#94e	CP-213096	0119	1	B	Higher Resolution Timestamp for Location Estimates	17.3.0
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2021-12	CT#94e	CP-213096	0121	1	B	Update allowed access type for event report	17.3.0
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2021-12	CT#94e	CP-213120	0123		F	307/308 redirection	17.3.0
2021-12	CT#94e	CP-213121	0124		F	29.572 Rel-17 API version and External doc update	17.3.0
2022-03	CT#95e	CP-220034	0128		F	Corrections on the RelativeCartesianLocation	17.4.0
2022-03	CT#95e	CP-220227	0130	1	A	Corrections on attributes	17.4.0
2022-03	CT#95e	CP-220090	0131		F	Update incorrect table number	17.4.0
2022-03	CT#95e	CP-220217	0133		F	29.572 Rel-17 API version and External doc update	17.4.0
2022-06	CT#96	CP-221022	0135	1	B	Schedule location time for LMF	17.5.0
2022-06	CT#96	CP-221022	0136		F	Update the title of RelativeCartesianLocation	17.5.0
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2022-09	CT#97	CP-222036	0140	1	F	Indication of Network Assisted Positioning method	17.6.0
2022-09	CT#97	CP-222058	0141		F	29.572 Rel-17 API version and External doc update	17.6.0
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2023-03	CT#99	CP-230032	0153	2	B	Support of Event Report Allowed Area	18.1.0
2023-03	CT#99	CP-230032	0154	2	B	Support of UE Unaware Positioning	18.1.0
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2023-06	CT#100	CP-231031	0164	2	B	NWDAF assisted LMF positioning method determination	18.2.0
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2023-06	CT#100	CP-231055	0177	1	B	Support of location service involving Mobile Base Station Relay	18.2.0
2023-06	CT#100	CP-231070	0180		F	29.572 Rel-18 API version and External doc update	18.2.0

2023-09	CT#101	CP-232035	0183	1	F	Correction on Reporting Indication	18.3.0
2023-09	CT#101	CP-232063	0185	1	A	Missed HA GNSS Metrics Support over SBI	18.3.0
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2023-09	CT#101	CP-232035	0188	2	B	Support on NLOS/LOS measurement indication	18.3.0
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2023-12	CT#102	CP-233037	0198		F	Align with the SBI template	18.4.0
2023-12	CT#102	CP-233037	0199		F	Correction on the description of scheduledLocTime	18.4.0
2023-12	CT#102	CP-233037	0201		B	Update on UpNotifyData	18.4.0
2023-12	CT#102	CP-233029	0203	1	F	HTTP RFCs obsoleted by IETF RFC 9110, 9111 and 9113	18.4.0
2023-12	CT#102	CP-233294	0204	4	B	Update on LMF service for ranging_SL	18.4.0
2023-12	CT#102	CP-233037	0205	1	F	Reporting Indication Definition Alignment to Stage 2	18.4.0
2023-12	CT#102	CP-233037	0206	2	B	Multiple QoS for Deferred Location Service Continuation from 5GS to EPS	18.4.0
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2023-12	CT#102	CP-233052	0209	1	B	Addition of additional ULI of the MBSR UE	18.4.0
2023-12	CT#102	CP-233037	0210		F	Correction on PRU Location Measurements	18.4.0
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2024-03	CT#103	CP-240140	0217	2	F	Add correlation ID to location UP service operations	18.5.0
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2024-03	CT#103	CP-240030	0232	1	B	Add time window	18.5.0
2024-03	CT#103	CP-240030	0233		F	Corrections on the URI of location-measure	18.5.0
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2024-03	CT#103	CP-240045	0239	1	F	Aligning distance and location termilogy with stage 2	18.5.0
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2024-03	CT#103	CP-240045	0241	1	B	Add Ranging/Sidelink Positioning Capability	18.5.0
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2024-03	CT#103	CP-240053	0245	2	F	Clarification on URI Path Segment Naming Conventions for Custom operations	18.5.0
2024-03	CT#103	CP-240056	0246		F	29.572 Rel-18 API version and External doc update	18.5.0

History

Document history		
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