ETSI TS 138 355 V18.3.0 (2024-10)

5G;
NR;
Sidelink Positioning Protocol (SLPP);
Protocol Specification
(3GPP TS 38.355 version 18.3.0 Release 18)

Reference
RTS/TSGR-0238355vi30

Keywords
5G

ETSI

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Contents

Foreword

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1 Scope

The present document specifies the Sidelink Positioning Protocol (SLPP) for the interface between UEs and between UE and LMF.

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 38.331: "NR; Radio Resource Control (RRC); Protocol specification".

[3] 3GPP TS 38.305: "NG Radio Access Network (NG-RAN); Stage 2 functional specification of User Equipment (UE) positioning in NG-RAN".

[4] ITU-T Recommendation X.691 (07/2002) "Information technology - ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)" (Same as the ISO/IEC International Standard 8825-2).

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

[6] 3GPP TS 38.211: "3rd Generation Partnership Project; Technical Specification Group Radio Access Network; NR; Physical channels and modulation".

[7] 3GPP TS 23.032: "Universal Geographical Area Description (GAD)".

[8] 3GPP TR 38.901: "Technical Specification Group Radio Access Network; Study on channel model for frequencies from 0.5 to 100 GHz".

[9] 3GPP TS 23.287: "Architecture enhancements for 5G System (5GS) to support Vehicle-to-Everything (V2X) services".

[10] 3GPP TS 38.101-2: "NR; User Equipment (UE) radio transmission and reception; Part 2: Range 2 Standalone".

[11] 3GPP TS 38.101-1: "NR; User Equipment (UE) radio transmission and reception; Part 1: Range 1 Standalone".

[12] 3GPP TS 23.586: "Technical Specification Group Services and System Aspects; Architectural Enhancements to support Ranging based services and Sidelink Positioning".

[13] 3GPP TS 38.133: "NR; Requirements for support of radio resource management".

[14] 3GPP TS 23.304: "Technical Specification Group Services and System Aspects; Proximity based Services (ProSe) in the 5G System (5GS)".

[15] 3GPP TS 38.321: "NR; Medium Access Control (MAC); Protocol specification".

[16] 3GPP TS 38.215: "NR; Physical layer measurements".

3 Definitions of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in 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 TR 21.905 [1].

Field: The individual contents of an information element are referred to as fields.

Ranging: Refers to the determination of the distance between two UEs or more UEs and/or the direction of one UE (i.e. Target UE) from another UE via PC5 interface.

Ranging/Sidelink Positioning: AS functionality enabling ranging-based services and sidelink positioning as specified in TS 23.586 [12].

SL Anchor UE: A UE, supporting positioning of target UE, e.g. by transmitting and/or receiving reference signals for positioning, providing positioning-related information, etc. over the Sidelink interface.

SL Server UE: A UE offering position method determination, assistance data distribution and/or location calculation functionalities for sidelink positioning and ranging based services. It interacts with other UEs over PC5 as necessary in order to determine a ranging/SL position method, distribute assistance data and calculate the location of the target UE. A Target UE or SL Anchor UE can act as SL Server UE if any of the functionalities is supported.

SL Target UE: A UE whose distance, direction and/or position is measured with the support from one or multiple SL Anchor UEs using Sidelink in the Ranging based service and Sidelink positioning.

UE-only Operation: Operation of Ranging/Sidelink Positioning in which the service request handling and result calculation are performed by UE.

3.2 Abbreviations

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

DFN	Direct Frame Number
GCS	Global Coordinate System (as defined in TR 38.901 [8])
LCS	LoCation Services
	Local Coordinate System (as defined in TR 38.901 [8])
LMF	Location Management Function
LOS	Line-of-Sight
NLOS	Non-Line-of-Sight
RTD	Relative Time Difference
SL	Sidelink
SL-AoA	Sidelink Angle-of-Arrival
SL-MO-LR	Sidelink Mobile Originating Location Request
SL-MT-LR	Sidelink Mobile Terminating Location Request
SLPP	Sidelink Positioning Protocol
SL-PRS	Sidelink Positioning Reference Signals
SL-PRS-RSRP	Sidelink Positioning Reference Signals based Reference Signal Received Power
SL-PRS-RSRPP	Sidelink Positioning Reference Signals based Reference Signal Received Path Power
SL-PRS-RSTD	Sidelink Positioning Reference Signals based Reference Signal Time Difference
SL-PRS-RTOA	Sidelink Positioning Reference Signals based Relative Time of Arrival
SL-RTT	Sidelink Round Trip Time
SL-TDOA	Sidelink Time Difference Of Arrival
SL-TOA	Sidelink Time Of Arrival
UE	User Equipment

4 Functionality of Protocol

4.1 General

4.1.1 SLPP Configuration

SLPP is used point-to-point between Endpoints, e.g. Location Server (SL Server UE or LMF) and target in order to obtain absolute position, relative position, or ranging information of target UE using sidelink measurements obtained by one or more reference sources.

Figure 4.1.1-1: Void

4.1.2 SLPP Sessions and Transactions

An SLPP session is used between UEs or a Location Server and a UE in order to obtain location related measurements based on NR PC5 radio signals, a location estimate or to transfer assistance data. A single SLPP session is used to support a single location request (e.g., for a single SL-MT-LR, or SL-MO-LR). Multiple SLPP sessions can be used between the same endpoints to support multiple location requests (as required by TS 23.273 [5]). For UE-only Operation, the instigator of an SLPP session which is the Endpoint who receives the LCS request, initiates an SLPP session by sending an SLPP message containing an assigned session ID (session identifier) to the other endpoint(s). All constituent messages within a session shall contain the same session ID. For LMF involved Operation, the session ID is assigned by target UE and contained in the SLPP messages used for communication between UEs. The session ID may be included in the SLPP message for the communication between a UE and the LMF.

Each SLPP session comprises one or more SLPP transactions, with each SLPP transaction performing a single operation (capability exchange, assistance data transfer, or location information transfer). The SLPP transactions are realized as SLPP procedures. The instigator of an SLPP session will always instigate the first SLPP transaction, but subsequent transactions may be instigated by either end. SLPP transactions within a session may occur serially or in parallel. SLPP transactions are indicated at the SLPP protocol level with a transaction ID in order to associate messages with one another (e.g., request and response).

Messages within a transaction are linked by a common transaction identifier.

4.1.3 SLPP Positioning Methods

This version of the specification defines SL-TDOA, SL-TOA, SL-AoA and SL-RTT positioning methods based on NR PC5 radio signals.

4.1.4 SLPP Messages

Each SLPP transaction involves the exchange of one or more SLPP messages between Endpoint A and Endpoint B. The general format of an SLPP message consists of a set of common fields followed by a body. The body (which may be empty) contains information specific to a particular message type. Each message type contains information specific to one or more positioning methods and/or information common to all positioning methods.

The common fields are as follows:

Field	Role
sessionID	Identify messages belonging to the same session
transactionID	Identify messages belonging to the same transaction
endTransaction	Indicate when a transaction (e.g. one with periodic responses) has ended
sequenceNumber	Enable detection of a duplicate SLPP message at a receiver
acknowledgement	Enable an acknowledgement to be requested and/or returned for any SLPP message

The following message types are defined:

- Request Capabilities;
- Provide Capabilities;
- Request Assistance Data;
- Provide Assistance Data;
- Request Location Information;
- Provide Location Information;
- Abort;
- Error.

4.2 Common SLPP Session Procedure

The purpose of this procedure is to support an SLPP session comprising a sequence of SLPP transactions. The procedure is described in Figure 4.2-1.

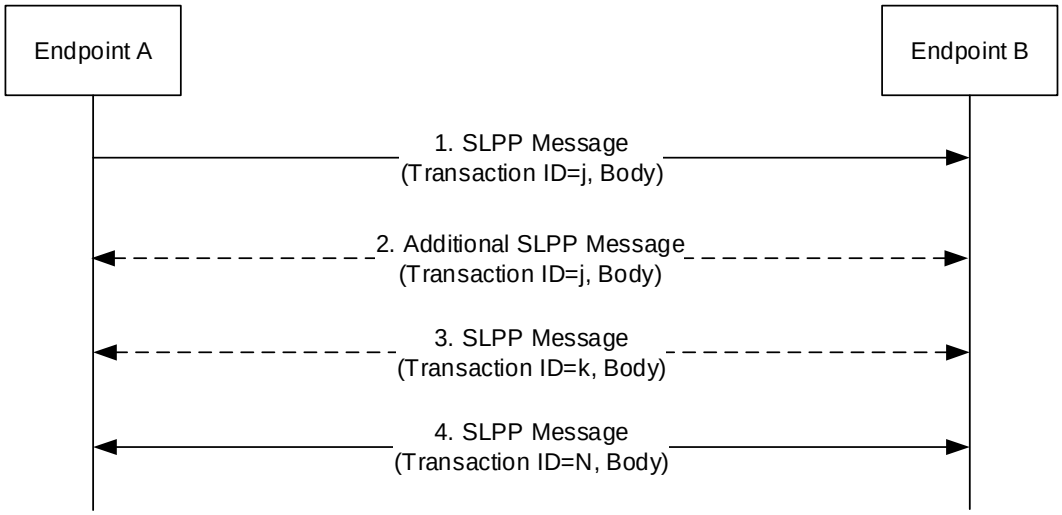

Figure 4.2-1 SLPP Session Procedure

1. Endpoint A, which is the Endpoint who receives the LCS request, initiates an SLPP session by sending an SLPP message containing an assigned session ID for an initial SLPP transaction *j* to the other endpoint B.
2. Endpoints A and B may exchange further messages to continue the transaction started in step 1.
3. Either endpoint may instigate further transactions by sending additional SLPP messages.
4. A session is terminated by a final transaction *N* in which SLPP messages will be exchanged between the two endpoints.

Within the same session, all constituent messages shall contain the same session ID and within each transaction, all constituent messages shall contain the same transaction ID. The last message sent in each transaction shall have the field *endTransaction* set to TRUE. Transactions that occur in parallel shall use different transaction IDs; transaction IDs for completed transactions may be reused at any time after the final message of the previous transaction with the same ID is known to have been received.

4.3 SLPP Transport

4.3.1 Transport Layer Requirements

SLPP requires reliable, in-sequence delivery of SLPP messages from the underlying transport layers. This clause describes the transport capabilities that are available within SLPP. A UE implementing SLPP shall support SLPP reliable transport (including all three of duplicate detection, acknowledgement, and retransmission).

4.3.2 SLPP Duplicate Detection

A sender shall include a sequence number in all SLPP messages sent for a particular location session. The sequence number shall be distinct for different SLPP messages sent by the same endpoint for the same endpoint in the same location session (e.g., may start at zero in the first SLPP message and increase monotonically in each succeeding SLPP message). Sequence numbers used in the messages transmitted from different endpoints or for different endpoints are independent (e.g., can be the same).

A receiver shall record the most recent received sequence number for each pair of endpoints of each location session. If a message is received carrying the same sequence number as that last received for the same pair of endpoints and the associated location session, it shall be discarded. Otherwise (i.e., if the sequence number is different or the sequence number is same but for different pair of endpoints), the message shall be processed.

Sending and receiving sequence numbers shall be deleted in a server when the associated location session is terminated and shall be deleted in the UE(s) when there has been no activity for a particular location session for 10 minutes.

4.3.3 SLPP Acknowledgement

4.3.3.1 General

Each SLPP message may carry an acknowledgement request and/or an acknowledgement indicator. An SLPP message including an acknowledgement request (i.e., that include the field *ackRequested* set to TRUE) shall also include a sequence number. Upon reception of an SLPP message which includes the field *ackRequested* set to TRUE, a receiver returns an SLPP message with an acknowledgement response (i.e., that includes the field *ackIndicator* set to the same sequence number of the message being acknowledged). An acknowledgement response may contain no SLPP message body (in which case only the sequence number being acknowledged is significant); alternatively, the acknowledgement may be sent in an SLPP message along with an SLPP message body. An acknowledgement is returned for each received SLPP message that requested an acknowledgement including any duplicate(s). Once a sender receives an acknowledgement for an SLPP message, and provided any included sequence number is matching, it is permitted to send the next SLPP message. No message reordering is needed at the receiver since this stop-and-wait method of sending ensures that messages normally arrive in the correct order.

When an SLPP message is transported via a NAS SL-MO-LR request, the message does not request an acknowledgement.

4.3.3.2 Procedure related to Acknowledgement

Figure 4.3.3.2-1 shows the procedure related to acknowledgement.

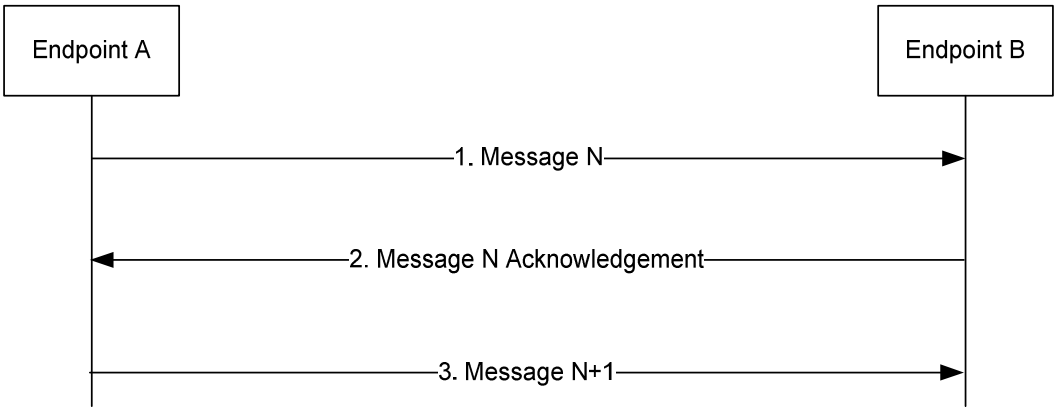

Figure 4.3.3.2-1: SLPP Acknowledgement procedure

1. Endpoint A sends an SLPP message *N* to Endpoint B which includes the field *ackRequested* set to TRUE and a sequence number.
2. If SLPP message *N* is received and Endpoint B is able to decode the *ackRequested* value and sequence number, Endpoint B shall return an acknowledgement for message *N*. The acknowledgement shall contain the field *ackIndicator* set to the same sequence number as that in message *N*.
3. When the acknowledgement for SLPP message *N* is received and provided the included field *ackIndicator* matches the sequence number sent in message *N*, Endpoint A sends the next SLPP message *N+1* to Endpoint B when this message is available.

4.3.4 SLPP Retransmission

4.3.4.1 General

This capability builds on the acknowledgement and duplicate detection capabilities. When an SLPP message which requires acknowledgement is sent and not acknowledged, it is resent by the sender following a timeout period up to three times. If still unacknowledged after that, the sender aborts all SLPP activity for this Endpoint. The timeout period is determined by the sender implementation but shall not be less than a minimum value of 250 ms.

4.3.4.2 Procedure related to Retransmission

Figure 4.3.4.2-1 shows the procedure related to retransmission when combined with acknowledgement and duplicate detection.

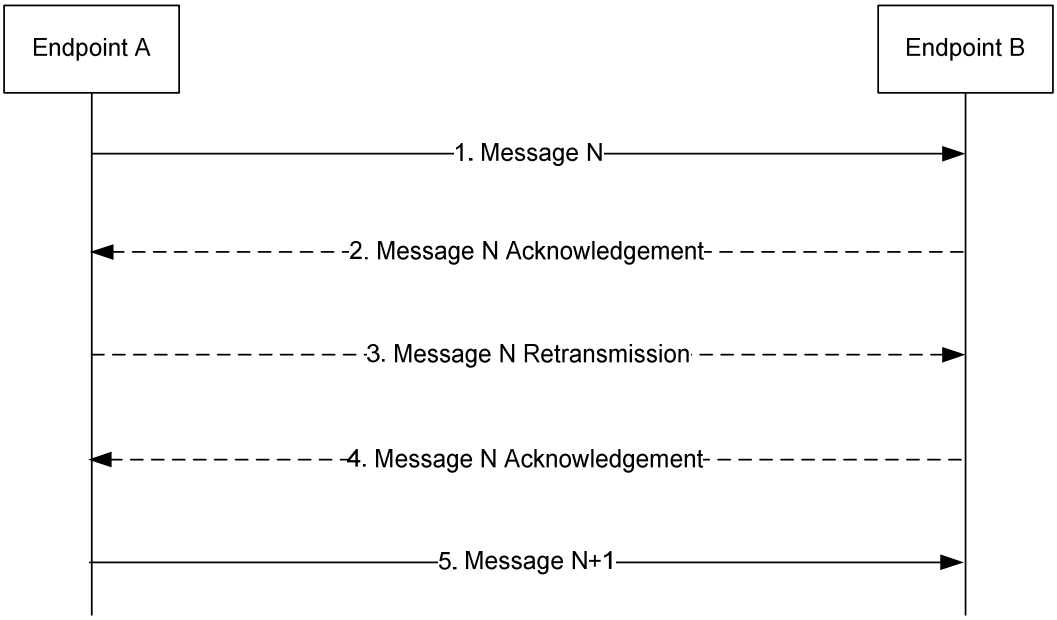

Figure 4.3.4.2-1: SLPP Retransmission procedure

1. Endpoint A sends an SLPP message *N* to Endpoint B for a particular location session and includes a request for acknowledgement along with a sequence number.
2. If SLPP message *N* is received and Endpoint B is able to decode the *ackRequested* value and sequence number (regardless of whether the message body can be correctly decoded), Endpoint B shall return an acknowledgement for message *N*. If the acknowledgement is received by Endpoint A (such that the acknowledged message can be identified and sequence numbers are matching), Endpoint A skips steps 3 and 4.
3. If the acknowledgement in step 2 is not received after a timeout period, Endpoint A shall retransmit SLPP message *N* and shall include the same sequence number as in step 1.
4. If SLPP message *N* in step 3 is received and Endpoint B is able to decode the *ackRequested* value and sequence number (regardless of whether the message body can be correctly decoded and whether or not the message is considered a duplicate), Endpoint B shall return an acknowledgement. Steps 3 may be repeated one or more times if the acknowledgement in step 4 is not received after a timeout period by Endpoint A. If the acknowledgement in step 4 is still not received after sending three retransmissions, Endpoint A shall abort all procedures and activity associated with SLPP support for this Endpoint B.
5. Once an acknowledgement in step 2 or step 4 is received, Endpoint A sends the next SLPP message *N+1* for the location session to Endpoint B when this message is available.

5 SLPP Procedures

5.1 Procedures related to capability transfer

5.1.1 General

The purpose of the procedures that are grouped together in this clause is to enable the transfer of capabilities from Endpoint A to Endpoint B. Capabilities in this context refer to positioning and protocol capabilities related to SLPP and the positioning methods supported by SLPP. These procedures instantiate the Capability Transfer procedure from TS 38.305 [3].

5.1.2 Capability Transfer procedure

The Capability Transfer procedure is shown in Figure 5.1.2-1.

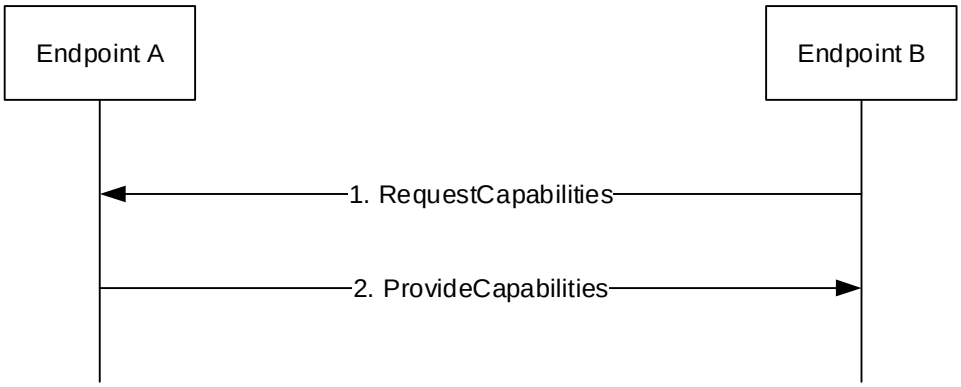

Figure 5.1.2-1: SLPP Capability Transfer procedure

1. Endpoint B sends a *RequestCapabilities* message to Endpoint A. Endpoint B may indicate the types of capability requested.
2. Endpoint A responds with a *ProvideCapabilities* message to Endpoint B. The capabilities shall correspond to the capability types specified in step 1. This message shall include the field *endTransaction* set to TRUE.

5.1.3 Capability Indication procedure

The Capability Indication procedure allows the Endpoint A to provide unsolicited capabilities to the Endpoint B and is shown in Figure 5.1.3-1.

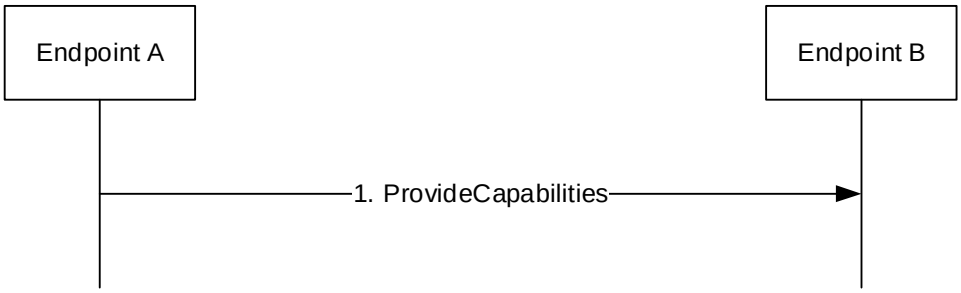

Figure 5.1.3-1: SLPP Capability Indication procedure

1. Endpoint A sends a *ProvideCapabilities* message to Endpoint B. This message shall include the field *endTransaction* set to TRUE.

5.1.4 Transmission of SLPP Request Capabilities

When triggered to transmit a *RequestCapabilities* message, Endpoint B shall:

1> set the positioning method specific *RequestCapabilities* PDUs in accordance with the information received from upper layers.

1> deliver the message to lower layers for transmission.

5.1.5 Reception of SLPP Request Capabilities

Upon receiving a *RequestCapabilities* message, Endpoint A shall generate a *ProvideCapabilities* message as a response.

Endpoint A shall:

1> for each positioning method for which a request for capabilities is included in the message:

2> if Endpoint A supports this positioning method:

3> include the capabilities of Endpoint A for that supported positioning method in the response message;

1> set the field *sessionID* in the response message to the same value as the field *sessionID* in the received message if received;

1> set the field *transactionID* in the response message to the same value as the field *transactionID* in the received message;

1> deliver the response message to lower layers for transmission.

5.1.6 Transmission of SLPP Provide Capabilities

When triggered to transmit a *ProvideCapabilities* message, Endpoint A shall:

1> for each positioning method whose capabilities are to be indicated:

2> set the corresponding fields to include Endpoint A's capabilities;

1> deliver the response to lower layers for transmission.

5.2 Procedures related to Assistance Data Transfer

5.2.1 General

The purpose of the procedures that are grouped together in this clause is to enable Endpoint A to request assistance data from Endpoint B to assist in positioning, and to enable Endpoint B to transfer assistance data to Endpoint A without a request. These procedures instantiate the Assistance Data Transfer procedure from TS 38.305 [3].

5.2.2 Assistance Data Transfer procedure

The Assistance Data Transfer procedure is shown in Figure 5.2.2-1.

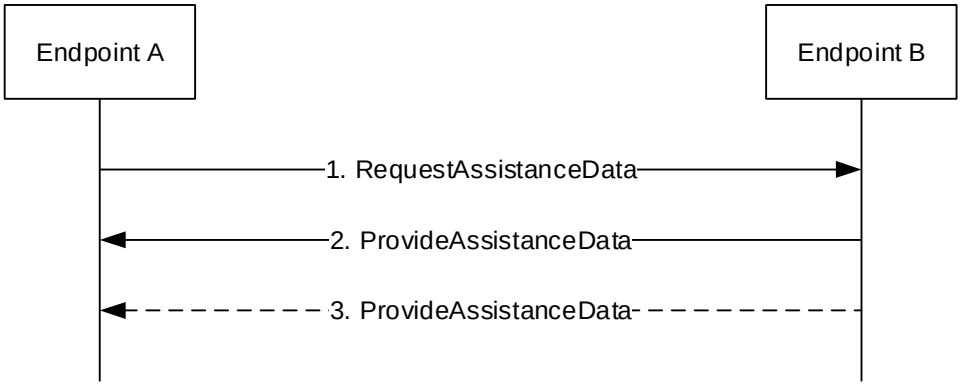

Figure 5.2.2-1: SLPP Assistance data transfer procedure

1. Endpoint A sends a *RequestAssistanceData* message to Endpoint B.

2. Endpoint B responds with a *ProvideAssistanceData* message to Endpoint A containing assistance data. The transferred assistance data should match or be a subset of the assistance data requested in step 1. Endpoint B may also provide any not requested information that it considers useful to Endpoint A. If step 3 is not expected, this message shall set the field *endTransaction* to TRUE.

3. Endpoint B may transmit one or more additional *ProvideAssistanceData* messages to Endpoint A containing further assistance data. The transferred assistance data should match or be a subset of the assistance data requested in step 1. Endpoint B may also provide any not requested information that it considers useful to Endpoint A. The last message shall include the field *endTransaction* set to TRUE.

5.2.3 Assistance Data Delivery procedure

The Assistance Data Delivery procedure allows Endpoint B to provide unsolicited assistance data to Endpoint A and is shown in Figure 5.2.3-1.

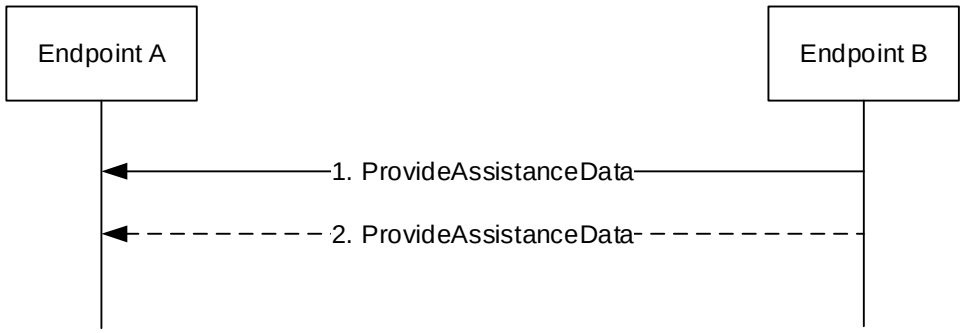

Figure 5.2.3-1: SLPP Assistance data transfer procedure

1. Endpoint B sends a *ProvideAssistanceData* message to Endpoint A containing assistance data. If step 2 is not expected, this message shall set the field *endTransaction* to TRUE.
2. Endpoint B may transmit one or more additional *ProvideAssistanceData* messages to Endpoint A containing additional assistance data. The last message shall include the field *endTransaction* set to TRUE.

5.2.4 Transmission of SLPP Request Assistance Data

When triggered to transmit a *RequestAssistanceData* message, Endpoint A shall:

1> set the positioning method specific *RequestAssistanceData* PDUs in accordance with the information received from upper layers.

1> deliver the message to lower layers for transmission.

5.2.5 Reception of SLPP Request Assistance Data

Upon receiving a *RequestAssistanceData* message, Endpoint B shall generate a *ProvideAssistanceData* message as a response.

Endpoint B shall:

1> for each positioning method for which a request for assistance data is included in the message:

2> if Endpoint B supports this positioning method:

3> include the assistance data for that supported positioning method in the response message;

1> set the field *sessionID* in the response message to the same value as the field *sessionID* in the received message if received;

1> set the field *transactionID* in the response message to the same value as the field *transactionID* in the received message;

1> deliver the response message to lower layers for transmission.

5.2.6 Reception of SLPP Provide Assistance Data

Upon receiving a *ProvideAssistanceData* message, Endpoint A shall:

1> for each positioning method contained in the message:

2> deliver the related assistance data to upper layers.

5.3 Procedures related to Location Information Transfer

5.3.1 General

The purpose of the procedures that are grouped together in this clause is to enable Endpoint B to request location measurement data and/or a location estimate from Endpoint A, and to enable Endpoint A to transfer location measurement data and/or a location estimate to Endpoint B without a request. These procedures instantiate the Location Information Transfer procedure from TS 38.305 [3].

5.3.2 Location Information Transfer procedure

The Location Information Transfer procedure is shown in Figure 5.3.2-1.

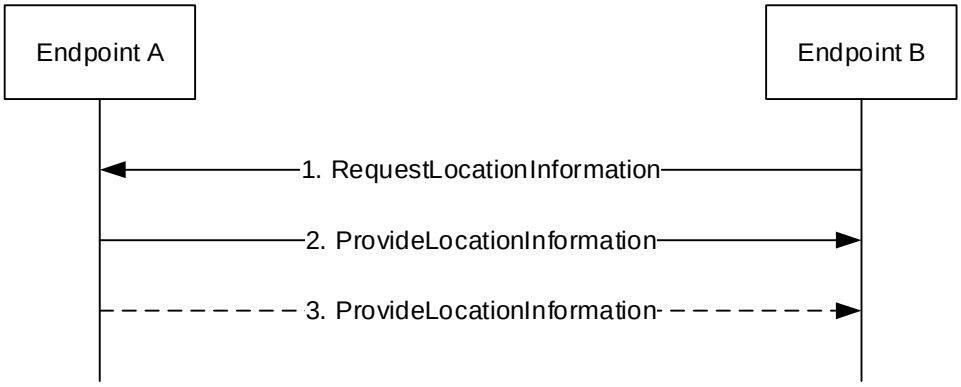

Figure 5.3.2-1: SLPP Location Information transfer procedure

1. Endpoint B sends a *RequestLocationInformation* message to Endpoint A to request location information, indicating the type of location information requested and optionally the associated QoS.
2. Endpoint A sends a *ProvideLocationInformation* message to Endpoint B to transfer location information. The location information transferred should match or be a subset of the location information requested in step 1 unless Endpoint B explicitly allows additional location information. If step 3 is not expected, this message shall set the field *endTransaction* to TRUE.
3. If requested in step 1, Endpoint A sends additional *ProvideLocationInformation* messages to Endpoint B to transfer location information. The location information transferred should match or be a subset of the location information requested in step 1 unless Endpoint B explicitly allows additional location information. The last message shall include the field *endTransaction* set to TRUE.

5.3.3 Location Information Delivery procedure

The Location Information Delivery procedure allows Endpoint A to provide unsolicited location information to Endpoint B. The procedure is shown in Figure 5.3.3-1.

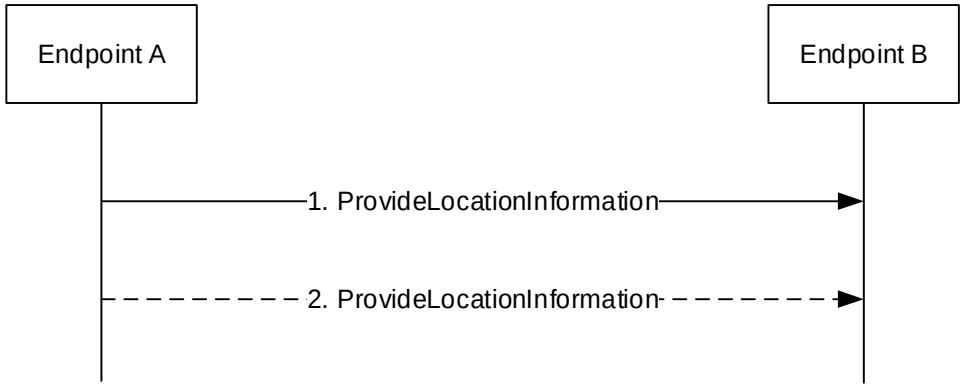

Figure 5.3.3-1: SLPP Location Information Delivery procedure

1. Endpoint A sends a *ProvideLocationInformation* message to Endpoint B to transfer location information. If step 2 is not expected, this message shall set the field *endTransaction* to TRUE.

2. Endpoint A may send one or more additional *ProvideLocationInformation* messages to Endpoint B containing additional location information data. The last message shall include the field *endTransaction* set to TRUE.

5.3.4 Transmission of Request Location Information

When triggered to transmit a *RequestLocationInformation* message, Endpoint B shall:

1> set the positioning method specific *RequestLocationInformation* PDUs in accordance with the information received from upper layers.

1> deliver the message to lower layers for transmission.

5.3.5 Reception of Request Location Information

Upon receiving a *RequestLocationInformation* message, Endpoint A shall:

1> if the requested information is compatible with Endpoint A's capabilities and configuration:

2> include the requested information in a *ProvideLocationInformation* message;

2> set the field *sessionID* in the response message to the same value as the field *sessionID* in the received message if received;

2> set the field *transactionID* in the response to the same value as the field *transactionID* in the received message;

2> deliver the *ProvideLocationInformation* message to lower layers for transmission.

1> else if one or more positioning methods are included that Endpoint A does not support:

2> continue to process the message as if it contained only information for the supported positioning methods;

2> handle the signaling content of the unsupported positioning methods by SLPP error detection as in 5.4.3.

5.3.6 Transmission of Provide Location Information

When triggered to transmit a *ProvideLocationInformation* message, Endpoint A shall:

1> for each positioning method contained in the message:

2> set the corresponding fields to include the available location information;

1> deliver the response to lower layers for transmission.

5.4 Error Handling Procedures

5.4.1 General

This clause describes how a receiving endpoint behaves in cases when it receives erroneous or unexpected data or detects that certain data are missing.

5.4.2 Procedures related to Error Indication

Figure 5.4.2-1 shows the Error indication procedure.

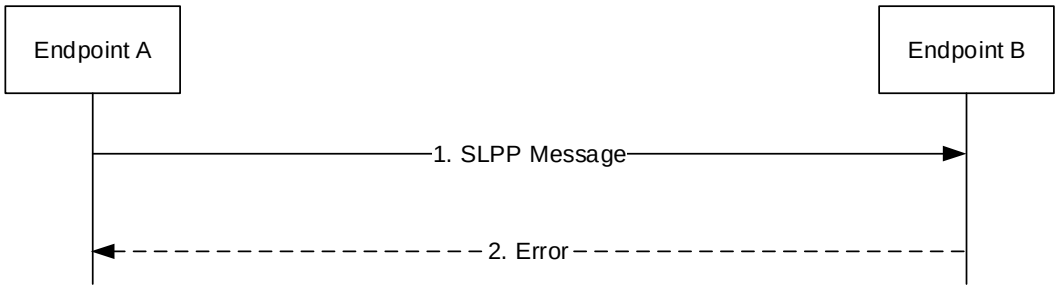

Figure 5.4.2-1: SLPP Error Indication procedure

1. Endpoint A sends an SLPP message to Endpoint B.
2. Endpoint B determines that the SLPP message in step 1 contains an error. Endpoint B returns an *Error* message to Endpoint A indicating the error or errors and discards the message in step 1. If Endpoint B is able to determine that the erroneous SLPP message in step 1 is an SLPP Error or Abort Message, Endpoint B discards the message in step 1 without returning an *Error* message to Endpoint A.

5.4.3 SLPP Error Detection

Upon receiving any SLPP message, the receiving endpoint shall attempt to decode the message and verify the presence of any errors and:

1> if decoding errors are encountered:

2> if the receiver cannot determine that the received message is an SLPP *Error* or *Abort* message:

3> return an SLPP *Error* message to the sender and include the field *sessionID* (if PC5-U is used as transport layer) and the received *transactionID*, if they were decoded, and type of error;

3> discard the received message and stop the error detection procedure;

1> if the message is a duplicate of a previously received message:

2> discard the message and stop the error detection procedure;

1> if the field *transactionID* matches the field *transactionID* for a procedure that is still ongoing for the same session and the message type is invalid for the current state of the procedure:

2> abort the ongoing procedure;

2> return an SLPP *Error* message to the sender and include the field *sessionID* (if PC5-U is used as transport layer), the received field *transactionID* and type of error;

2> discard the message and stop the error detection procedure;

1> if the message type is an SLPP *RequestCapabilities* and some of the requested information is not supported:

2> return any information that can be provided in a normal response.

1> if the message type is an SLPP *RequestAssistanceData* or *RequestLocationInformation* and some or all of the requested information is not supported:

2> return any information that can be provided in a normal response, which includes indications on other information that is not supported.

5.4.4 Reception of an SLPP Error Message

Upon receiving an *Error* message, Endpoint A shall:

1> abort any ongoing procedure associated with the field *sessionID* and the field *transactionID* if included in the received message.

Endpoint A may:

1> restart the aborted procedure taking into consideration the returned error information.

5.5 Abort Procedure

5.5.1 General

The purpose of the abort procedure is to allow Endpoints to abort an ongoing procedure due to some unexpected event (e.g., cancellation of a location request by an LCS client). It can also be used to stop an ongoing procedure (e.g., periodic location reporting from an Endpoint).

5.5.2 Procedures related to Abort

Figure 5.5.2-1 shows the Abort procedure.

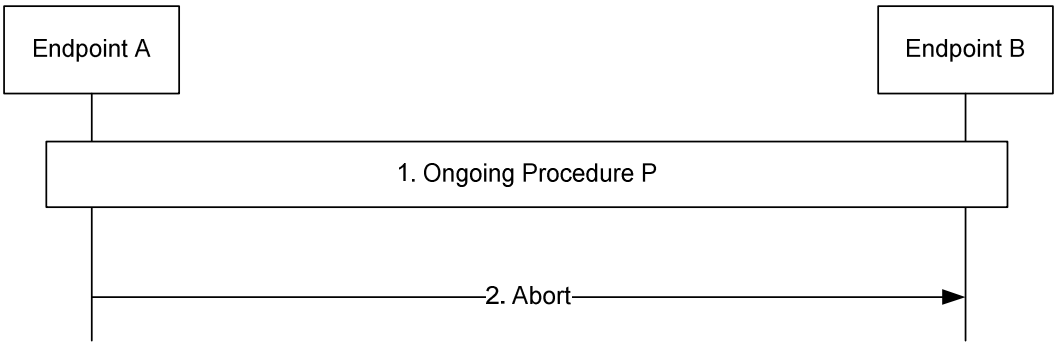

Figure 5.5.2-1: SLPP Abort procedure

1. A procedure P is ongoing between endpoints A and B.
2. Endpoint A determines that the procedure must be aborted and sends an *Abort* message to Endpoint B carrying the field *sessionID* (if PC5-U is used as transport layer) and the field *transactionID* for procedure P. Endpoint B aborts procedure P.

5.5.3 Reception of an SLPP Abort Message

Upon receiving an *Abort* message, Endpoint shall:

1> abort any ongoing procedure associated with the field *sessionID* and the field *transactionID* indicated in the message.

6 Protocol data units, formats and parameters (ASN.1)

6.1 General

The contents of each SLPP message is specified in clause 6.2 using ASN.1 to specify the message syntax and using tables when needed to provide further detailed information about the fields specified in the message syntax. The syntax of the information elements that are defined as stand-alone abstract types is further specified in a similar manner in clause 6.3.

The ASN.1 in this clause uses the same format and coding conventions as described in Annex A of TS 38.331 [2].

Transfer syntax for SLPP messages is derived from their ASN.1 definitions by use of Basic Packed Encoding Rules (BASIC-PER), Unaligned Variant, as specified in ITU-T Rec. X.691 [4]. The encoded SLPP message always contains a multiple of 8 bits.

Transfer syntax for SLPP IEs is derived from their ASN.1 definitions by use of Basic Packed Encoding Rules (BASIC-PER), Unaligned Variant, as specified in ITU-T Rec. X.691 [4]. The encoded SLPP IE always contains a multiple of 8 bits. This applies when a single SLPP IE is encoded as the basic production, i.e. for other purposes than encoding the SLPP IE within an SLPP message.

When specifying information elements which are to be represented by BIT STRINGs, if not otherwise specifically stated in the field description of the concerned IE or elsewhere, the following principle applies with regards to the ordering of bits:

- The first bit (leftmost bit) contains the most significant bit (MSB);
- the last bit (rightmost bit) contains the least significant bit (LSB).

6.2 SLPP messages

6.2.1 General message structure

– *SLPP-PDU-Definitions*

This ASN.1 segment is the start of the SLPP PDU definitions.

```
-- ASN1START
-- TAG-SLPP-PDU-DEFINITIONS-START

SLPP-PDU-Definitions DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS
    CommonIEsRequestCapabilities,
```

```
    CommonIEsProvideCapabilities,
    CommonIEsRequestAssistanceData,
    CommonIEsProvideAssistanceData,
    CommonIEsRequestLocationInformation,
    CommonIEsProvideLocationInformation

FROM
    SLPP-PDU-CommonContents

    CommonSL-PRS-MethodsIEsRequestCapabilities,
    CommonSL-PRS-MethodsIEsProvideCapabilities,
    CommonSL-PRS-MethodsIEsRequestAssistanceData,
    CommonSL-PRS-MethodsIEsProvideAssistanceData,
    CommonSL-PRS-MethodsIEsRequestLocationInformation,
    CommonSL-PRS-MethodsIEsProvideLocationInformation

FROM
    SLPP-PDU-CommonSL-PRS-MethodsContents

    SL-AoA-RequestCapabilities,
    SL-AoA-ProvideCapabilities,
    SL-AoA-RequestAssistanceData,
    SL-AoA-ProvideAssistanceData,
    SL-AoA-RequestLocationInformation,
    SL-AoA-ProvideLocationInformation

FROM
    SLPP-PDU-SL-AoA-Contents

    SL-RTT-RequestCapabilities,
    SL-RTT-ProvideCapabilities,
    SL-RTT-RequestAssistanceData,
    SL-RTT-ProvideAssistanceData,
    SL-RTT-RequestLocationInformation,
    SL-RTT-ProvideLocationInformation

FROM
    SLPP-PDU-SL-RTT-Contents

    SL-TDOA-RequestCapabilities,
    SL-TDOA-ProvideCapabilities,
    SL-TDOA-RequestAssistanceData,
    SL-TDOA-ProvideAssistanceData,
    SL-TDOA-RequestLocationInformation,
    SL-TDOA-ProvideLocationInformation

FROM
    SLPP-PDU-SL-TDOA-Contents

    SL-TOA-RequestCapabilities,
    SL-TOA-ProvideCapabilities,
    SL-TOA-RequestAssistanceData,
    SL-TOA-ProvideAssistanceData,
    SL-TOA-RequestLocationInformation,
```

```
    SL-TOA-ProvideLocationInformation

FROM
    SLPP-PDU-SL-TOA-Contents;

-- TAG-SLPP-PDU-DEFINITIONS-STOP
-- ASN1STOP
```

NOTE 1: An implementation needs to include only the supported "Method" PDUs. Not supported methods do not need to be included. For example, if SL-RTT is not supported by an implementation, the *SLPP-PDU-SL-RTT-Contents* PDU does not need to be included in the protocol.

NOTE 2: An implementation supporting SL-RTT, SL-AoA, SL-TDOA, or SL-TOA must also support the *SLPP-PDU-CommonSL-PRS-MethodsContents* PDU.

– *SLPP-Message*

The *SLPP-Message* provides the complete set of information for an invocation or response pertaining to an SLPP transaction.

```
-- ASN1START
-- TAG-SLPP-MESSAGE-START

SLPP-Message ::=            SEQUENCE {
    applicationLayerID          OCTET STRING        OPTIONAL,
    transactionID               INTEGER (0..255)    OPTIONAL,
    endTransaction              BOOLEAN,
    sequenceNumber              SequenceNumber      OPTIONAL,
    sessionID                   SessionID           OPTIONAL,
    acknowledgement             Acknowledgement     OPTIONAL,
    slpp-MessageBody            SLPP-MessageBody    OPTIONAL,
    nonCriticalExtension        SEQUENCE {}         OPTIONAL
}

SequenceNumber ::= INTEGER (0..255)
SessionID ::= OCTET STRING (SIZE (6))

Acknowledgement ::= SEQUENCE {
    ackRequested        BOOLEAN,
    ackIndicator        SequenceNumber        OPTIONAL
}

-- TAG-SLPP-MESSAGE-STOP
-- ASN1STOP
```

***SLPP-Message* field descriptions**
acknowledgement This field is included in an SLPP acknowledgement and in any SLPP message requesting an acknowledgement and is omitted otherwise. - ***ackRequested***: This field indicates whether an SLPP acknowledgement is requested (TRUE) or not (FALSE). A value of TRUE may only be included when an *slpp-MessageBody* is included. - ***ackIndicator***: This field indicates the sequence number of the message being acknowledged.
applicationLayerID This field indicates the application layer ID of the UE which is sending the message.
endTransaction This field indicates whether an SLPP message is the last message carrying an *slpp-MessageBody* in a transaction (TRUE) or not last (FALSE).
sequenceNumber This field may be included when an s*lpp-MessageBody* is included but shall be omitted otherwise.
sessionID This field indicates the session ID which is used to identify messages belonging to the same session.
slpp-MessageBody This field may be omitted in the case the message is sent only to acknowledge a previously received message.
transactionID This field is omitted if an s*lpp-MessageBody* is not present (i.e. in an SLPP message sent only to acknowledge a previously received message) or if it is not available to the transmitting endpoint (e.g., in an S*LPP-Error* message triggered by a message that could not be parsed). If present, this field shall be ignored at a receiver in an SLPP message for which the s*lpp-MessageBody* is not present.

– *SLPP-MessageBody*

The *SLPP-MessageBody* identifies the type of an SLPP message and contains all SLPP information specifically associated with that type.

```
-- ASN1START
-- TAG-SLPP-MESSAGEBODY-START

SLPP-MessageBody ::= CHOICE {
    c1                          CHOICE {
        requestCapabilities         RequestCapabilities,
        provideCapabilities         ProvideCapabilities,
        requestAssistanceData       RequestAssistanceData,
        provideAssistanceData       ProvideAssistanceData,
        requestLocationInformation  RequestLocationInformation,
        provideLocationInformation  ProvideLocationInformation,
        abort                       Abort,
        error                       Error,
        spare8 NULL, spare7 NULL, spare6 NULL, spare5 NULL, spare4 NULL, spare3 NULL, spare2 NULL, spare1 NULL
    },
    messageClassExtension    SEQUENCE {}
}

-- TAG-SLPP-MESSAGEBODY-STOP
-- ASN1STOP
```

6.2.2 Message body information elements definitions

– *RequestCapabilities*

The *RequestCapabilities* message body in an SLPP message is used by Endpoint B to request Endpoint A capability information for SLPP and the supported individual positioning methods.

```
-- ASN1START
-- TAG-REQUESTCAPABILITIES-START

RequestCapabilities ::= SEQUENCE {
    criticalExtensions      CHOICE {
        requestCapabilities         RequestCapabilities-IEs,
        criticalExtensionsFuture    SEQUENCE {}
    }
}

RequestCapabilities-IEs ::= SEQUENCE {
    commonIEsRequestCapabilities                OCTET STRING    OPTIONAL, -- Containing CommonIEsRequestCapabilities
    commonSL-PRS-MethodsIEsRequestCapabilities    OCTET STRING    OPTIONAL, -- Containing CommonSL-PRS-MethodsIEsRequestCapabilities
    sl-AoA-RequestCapabilities                  OCTET STRING    OPTIONAL, -- Containing SL-AoA-RequestCapabilities
    sl-RTT-RequestCapabilities                  OCTET STRING    OPTIONAL, -- Containing SL-RTT-RequestCapabilities
    sl-TDOA-RequestCapabilities                 OCTET STRING    OPTIONAL, -- Containing SL-TDOA-RequestCapabilities
    sl-TOA-RequestCapabilities                  OCTET STRING    OPTIONAL, -- Containing SL-TOA-RequestCapabilities
    lateNonCriticalExtension                    OCTET STRING    OPTIONAL,
    nonCriticalExtension                        SEQUENCE {}     OPTIONAL

}

-- TAG-REQUESTCAPABILITIES-STOP
-- ASN1STOP
```

– *ProvideCapabilities*

The *ProvideCapabilities* message body in an SLPP message indicates the SLPP capabilities of Endpoint A to Endpoint B.

```
-- ASN1START
-- TAG-PROVIDECAPABILITIES-START

ProvideCapabilities ::= SEQUENCE {
    criticalExtensions      CHOICE {
        provideCapabilities         ProvideCapabilities-IEs,
        criticalExtensionsFuture    SEQUENCE {}
    }
}

ProvideCapabilities-IEs ::= SEQUENCE {
    commonIEsProvideCapabilities                OCTET STRING    OPTIONAL, -- Containing CommonIEsProvideCapabilities
    commonSL-PRS-MethodsIEsProvideCapabilities    OCTET STRING    OPTIONAL, -- Containing CommonSL-PRS-MethodsIEsProvideCapabilities
```

```
    sl-AoA-ProvideCapabilities                  OCTET STRING    OPTIONAL, -- Containing SL-AoA-ProvideCapabilities
    sl-RTT-ProvideCapabilities                  OCTET STRING    OPTIONAL, -- Containing SL-RTT-ProvideCapabilities
    sl-TDOA-ProvideCapabilities                 OCTET STRING    OPTIONAL, -- Containing SL-TDOA-ProvideCapabilities
    sl-TOA-ProvideCapabilities                  OCTET STRING    OPTIONAL, -- Containing SL-TOA-ProvideCapabilities
    lateNonCriticalExtension                    OCTET STRING    OPTIONAL,
    nonCriticalExtension                        SEQUENCE {}     OPTIONAL

}

-- TAG-PROVIDECAPABILITIES-STOP
-- ASN1STOP
```

– *RequestAssistanceData*

The *RequestAssistanceData* message body in an SLPP message is used by the Endpoint A to request assistance data from Endpoint B.

```
-- ASN1START
-- TAG-REQUESTASSISTANCEDATA-START

RequestAssistanceData ::= SEQUENCE {
    criticalExtensions        CHOICE {
        requestAssistanceData     RequestAssistanceData-IEs,
        criticalExtensionsFuture  SEQUENCE {}
    }
}

RequestAssistanceData-IEs ::= SEQUENCE {
    commonIEsRequestAssistanceData                  OCTET STRING    OPTIONAL, -- Containing CommonIEsRequestAssistanceData
    commonSL-PRS-MethodsIEsRequestAssistanceData    OCTET STRING    OPTIONAL, -- Containing CommonSL-PRS-MethodsIEsRequestAssistanceData
    sl-AoA-RequestAssistanceData                    OCTET STRING    OPTIONAL, -- Containing SL-AoA-RequestAssistanceData
    sl-RTT-RequestAssistanceData                    OCTET STRING    OPTIONAL, -- Containing SL-RTT-RequestAssistanceData
    sl-TDOA-RequestAssistanceData                   OCTET STRING    OPTIONAL, -- Containing SL-TDOA-RequestAssistanceData
    sl-TOA-RequestAssistanceData                    OCTET STRING    OPTIONAL, -- Containing SL-TOA-RequestAssistanceData
    lateNonCriticalExtension                        OCTET STRING    OPTIONAL,
    nonCriticalExtension                            SEQUENCE {}     OPTIONAL
}

-- TAG-REQUESTASSISTANCEDATA-STOP
-- ASN1STOP
```

– *ProvideAssistanceData*

The *ProvideAssistanceData* message body in an SLPP message is used by Endpoint B to provide assistance data to Endpoint A either in response to a request from Endpoint A or in an unsolicited manner. Upon receiving an SLPP message *ProvideAsssistanceData*, the UE releases the value received in previous SLPP message *ProvideAsssistanceData* if any.

```
-- ASN1START
-- TAG-PROVIDEASSISTANCEDATA-START
```

```
ProvideAssistanceData ::= SEQUENCE {
    criticalExtensions        CHOICE {
        provideAssistanceData     ProvideAssistanceData-IEs,
        criticalExtensionsFuture  SEQUENCE {}
    }
}

ProvideAssistanceData-IEs ::= SEQUENCE {
    commonIEsProvideAssistanceData                OCTET STRING    OPTIONAL, -- Containing CommonIEsProvideAssistanceData
    commonSL-PRS-MethodsIEsProvideAssistanceData  OCTET STRING    OPTIONAL, -- Containing CommonSL-PRS-MethodsIEsProvideAssistanceData
    sl-AoA-ProvideAssistanceData                  OCTET STRING    OPTIONAL, -- Containing SL-AoA-ProvideAssistanceData
    sl-RTT-ProvideAssistanceData                  OCTET STRING    OPTIONAL, -- Containing SL-RTT-ProvideAssistanceData
    sl-TDOA-ProvideAssistanceData                 OCTET STRING    OPTIONAL, -- Containing SL-TDOA-ProvideAssistanceData
    sl-TOA-ProvideAssistanceData                  OCTET STRING    OPTIONAL, -- Containing SL-TOA-ProvideAssistanceData
    lateNonCriticalExtension                      OCTET STRING    OPTIONAL,
    nonCriticalExtension                          SEQUENCE {}     OPTIONAL
}

-- TAG-PROVIDEASSISTANCEDATA-STOP
-- ASN1STOP
```

– *RequestLocationInformation*

The *RequestLocationInformation* message body in an SLPP message is used by Endpoint B to request positioning measurements or a position estimate from Endpoint A.

```
-- ASN1START
-- TAG-REQUESTLOCATIONINFORMATION-START

RequestLocationInformation ::= SEQUENCE {
    criticalExtensions            CHOICE {
        requestLocationInformation     RequestLocationInformation-IEs,
        criticalExtensionsFuture       SEQUENCE {}
    }
}

RequestLocationInformation-IEs ::= SEQUENCE {
    commonIEsRequestLocationInformation                OCTET STRING    OPTIONAL, -- Containing CommonIEsRequestLocationInformation
    commonSL-PRS-MethodsIEsRequestLocationInformation  OCTET STRING    OPTIONAL, -- Containing CommonSL-PRS-MethodsIEsRequestLocationInformation
    sl-AoA-RequestLocationInformation                  OCTET STRING    OPTIONAL, -- Containing SL-AoA-RequestLocationInformation
    sl-RTT-RequestLocationInformation                  OCTET STRING    OPTIONAL, -- Containing SL-RTT-RequestLocationInformation
    sl-TDOA-RequestLocationInformation                 OCTET STRING    OPTIONAL, -- Containing SL-TDOA-RequestLocationInformation
    sl-TOA-RequestLocationInformation                  OCTET STRING    OPTIONAL, -- Containing SL-TOA-RequestLocationInformation
    lateNonCriticalExtension                           OCTET STRING    OPTIONAL,
    nonCriticalExtension                               SEQUENCE {}     OPTIONAL
}

-- TAG-REQUESTLOCATIONINFORMATION-STOP
-- ASN1STOP
```

– *ProvideLocationInformation*

The *ProvideLocationInformation* message body in an SLPP message is used by Endpoint A to provide positioning measurements or position estimates to Endpoint B.

```
-- ASN1START
-- TAG-PROVIDELOCATIONINFORMATION-START

ProvideLocationInformation ::= SEQUENCE {
    criticalExtensions            CHOICE {
        provideLocationInformation    ProvideLocationInformation-IEs,
        criticalExtensionsFuture      SEQUENCE {}
    }
}

ProvideLocationInformation-IEs ::= SEQUENCE {
    commonIEsProvideLocationInformation                 OCTET STRING    OPTIONAL, -- Containing CommonIEsProvideLocationInformation
    commonSL-PRS-MethodsIEsProvideLocationInformation   OCTET STRING    OPTIONAL, -- Containing CommonSL-PRS-MethodsIEsProvideLocationInformation
    sl-AoA-ProvideLocationInformation                   OCTET STRING    OPTIONAL, -- Containing SL-AoA-ProvideLocationInformation
    sl-RTT-ProvideLocationInformation                   OCTET STRING    OPTIONAL, -- Containing SL-RTT-ProvideLocationInformation
    sl-TDOA-ProvideLocationInformation                  OCTET STRING    OPTIONAL, -- Containing SL-TDOA-ProvideLocationInformation
    sl-TOA-ProvideLocationInformation                   OCTET STRING    OPTIONAL, -- Containing SL-TOA-ProvideLocationInformation
    lateNonCriticalExtension                            OCTET STRING    OPTIONAL,
    nonCriticalExtension                                SEQUENCE {}     OPTIONAL
}

-- TAG-PROVIDELOCATIONINFORMATION-STOP
-- ASN1STOP
```

– *Abort*

The *Abort* message body in an SLPP message carries a request to abort an ongoing SLPP procedure.

```
-- ASN1START
-- TAG-ABORT-START

Abort ::= SEQUENCE {
    criticalExtensions    CHOICE {
        abort                       Abort-IEs,
        criticalExtensionsFuture    SEQUENCE {}
    }
}

Abort-IEs ::= SEQUENCE {
    commonIEsAbort             CommonIEsAbort  OPTIONAL,
    lateNonCriticalExtension   OCTET STRING    OPTIONAL,
    nonCriticalExtension       SEQUENCE {}     OPTIONAL
}

-- TAG-ABORT-STOP
-- ASN1STOP
```

– *Error*

The *Error* message body in an SLPP message carries information concerning an SLPP message that was received with errors.

```
-- ASN1START
-- TAG-ERROR-START

Error ::= CHOICE {
    criticalExtensions    CHOICE {
        error                       Error-IEs,
        criticalExtensionsFuture    SEQUENCE {}
    }
}

Error-IEs ::= SEQUENCE {
    commonIEsError              CommonIEsError  OPTIONAL,
    lateNonCriticalExtension    OCTET STRING    OPTIONAL,
    nonCriticalExtension        SEQUENCE {}     OPTIONAL
}
-- TAG-ERROR-STOP
-- ASN1STOP
```

6.3 SLPP information elements

6.3.1 Common information elements

– *ARFCN-ValueNR*

The IE *ARFCN-ValueNR* is used to indicate the ARFCN applicable for a downlink, uplink or bi-directional (TDD) NR global frequency raster, as defined in TS 38.101-2 [10] and TS 38.101-1 [11].

```
-- ASN1START
-- TAG-ARFCN-VALUENR-START

ARFCN-ValueNR ::= INTEGER (0..3279165)

-- TAG-ARFCN-VALUENR-STOP
-- ASN1STOP
```

– *CommonIEsAbort*

The IE *CommonIEsAbort* carries common IEs for an Abort SLPP message Type.

```
-- ASN1START
-- TAG-COMMONIESABORT-START

CommonIEsAbort ::= SEQUENCE {
    abortCause        ENUMERATED { undefined, stopPeriodicReporting }
}

-- TAG-COMMONIESABORT-STOP
-- ASN1STOP
```

***CommonIEsAbort* field descriptions**
abortCause This field defines the request to abort an ongoing procedure. The abort cause '*stopPeriodicReporting*' is used by an endpoint to stop any ongoing location reporting configured as *periodicalReporting* in the IE *CommonIEsRequestLocationInformation*.

– *CommonIEsError*

The IE *CommonIEsError* carries common IEs for an Error SLPP message Type.

```
-- ASN1START
-- TAG-COMMONIESERROR-START

CommonIEsError ::= SEQUENCE {
    errorCause         ENUMERATED { undefined, slppMessageHeaderError, slppMessageBodyError, incorrectDataValue }
}

-- TAG-COMMONIESERROR-STOP
-- ASN1STOP
```

***CommonIEsError* field descriptions**
errorCause This field defines the cause for an error. '*slppMessageHeaderError*' and '*slppMessageBodyError*' are used if a receiver is able to detect a coding error in the SLPP header (i.e., in the common fields) or SLPP message body respectively. '*incorrectDataValue*' is used if a receiver receives an incorrect data value.

– *GNSS-ID-Bitmap*

The IE *GNSS-ID-Bitmap* is used to indicate several GNSSs using a bit map.

```
-- ASN1START
-- TAG-GNSS-ID-BITMAP-START
```

```
GNSS-ID-Bitmap ::= BIT STRING { gps (0), sbas (1), qzss (2), galileo (3), glonass (4), bds (5), navic (6) } (SIZE (1..16))

-- TAG-GNSS-ID-BITMAP-STOP
-- ASN1STOP
```

– *LCS-GCS-Translation*

The IE *LCS-GCS-Translation* provides the angles α (bearing angle), β (downtilt angle) and γ (slant angle) for the translation of a Local Coordinate System (LCS) to a Global Coordinate System (GCS) as defined in TR 38.901 [8].

```
-- ASN1START
-- TAG-LCS-GCS-TRANSLATION-START

LCS-GCS-Translation ::= SEQUENCE {
    alpha                   INTEGER (0..3599),
    beta                    INTEGER (0..3599),
    gamma                   INTEGER (0..3599)
}
-- TAG-LCS-GCS-TRANSLATION-STOP
-- ASN1STOP
```

***LCS-GCS-Translation* field descriptions**
alpha This field specifies the bearing angle α for the translation of the LCS to a GCS as defined in TR 38.901 [8]. Scale factor 0.1 degree; range 0 to 359.9 degrees.
beta This field specifies the downtilt angle β for the translation of the LCS to a GCS as defined in TR 38.901 [8]. Scale factor 0.1 degrees; range 0 to 359.9 degrees.
gamma This field specifies the slant angle γ for the translation of the LCS to a GCS as defined in TR 38.901 [8]. Scale factor 0.1 degree; range 0 to 359.9 degrees.

– *LOS-NLOS-Indicator*

The IE *LOS-NLOS-Indicator* provides information on the likelihood of a Line-of-Sight (LOS) propagation path from the source to the receiver.

```
-- ASN1START
-- TAG-LOS-NLOS-INDICATOR-START

LOS-NLOS-Indicator ::= SEQUENCE {
    indicator               CHOICE {
        soft                    INTEGER (0..10),
        hard                    BOOLEAN
    }
}

-- TAG-LOS-NLOS-INDICATOR-STOP
-- ASN1STOP
```

***LOS-NLOS-Indicator* field descriptions**
indicator This field provides information on the likelihood of a Line-of-Sight propagation path from the source to the receiver with a value of 1 corresponding to LoS and a value of 0 corresponding to NLoS. - ***soft***: Integer value '0' indicates likelihood 0, integer value '10' indicates likelihood 1. Scale factor 0.1; range 0 to 1. - ***hard***: FALSE indicates likelihood '0', TRUE indicates likelihood '1'.

– *NCGI*

The IE *NCGI* specifies the NR Cell Global Identifier (NCGI) which is used to identify NR cells globally (TS 38.331 [2]).

```
-- ASN1START
-- TAG-NCGI-START

NCGI ::= SEQUENCE {
    mcc                SEQUENCE (SIZE (3))     OF INTEGER (0..9),
    mnc                SEQUENCE (SIZE (2..3))  OF INTEGER (0..9),
    nr-CellIdentity    BIT STRING (SIZE (36))
}

-- TAG-NCGI-STOP
-- ASN1STOP
```

– *NR-PhysCellID*

The IE *NR-PhysCellID* specifies the NR physical cell identifier (TS 38.331 [2]).

```
-- ASN1START
-- TAG-NR-PHYSCELLID-START

NR-PhysCellID ::= INTEGER (0..1007)

-- TAG-NR-PHYSCELLID-STOP
-- ASN1STOP
```

– *PositioningModes*

The IE *PositioningModes* is used to indicate several positioning modes using a bit map. This is represented by a bit string, with a one value at the bit position means the particular positioning mode is addressed; a zero value means not addressed.

```
-- ASN1START
-- TAG-POSITIONINGMODES-START
```

```
PositioningModes ::= BIT STRING { sl-TargetUE-Based (0), sl-TargetUE-Assisted (1) } (SIZE (1..8))

-- TAG-POSITIONINGMODES-STOP
-- ASN1STOP
```

– *SL-RTD-Info*

The IE *SL-RTD-Info* provides time synchronization information of SL Anchor UEs.

```
-- ASN1START
-- TAG-SL-RTD-INFO-START

SL-RTD-Info ::= SEQUENCE ( SIZE (1.. maxNrOfUEs)) OF RTD-InfoListPerAnchorUE

RTD-InfoListPerAnchorUE ::= SEQUENCE {
    applicationLayerID          OCTET STRING,
    referenceRTD-Info           ReferenceRTD-Info                   OPTIONAL,
    rtd-BetweenAnchorUEs        CHOICE {
        subframeOffset              INTEGER (0..1966079),
        sl-OffsetDFN                INTEGER (0..1000)
    }                                                               OPTIONAL,
    rtd-Quality                 SL-TimingQuality                    OPTIONAL,
    syncSourceType              ENUMERATED { gnss, gNB-eNB, ue}     OPTIONAL
}

ReferenceRTD-Info ::= SEQUENCE {
    syncSourceType        ENUMERATED { gnss, gNB-eNB, ue},
    applicationLayerID    OCTET STRING                          OPTIONAL,
    nrCell-Identify       SEQUENCE {
        nr-PhysCellID             NR-PhysCellID               OPTIONAL,
        nr-ARFCN                  ARFCN-ValueNR               OPTIONAL,
        nr-CellGlobalID           NCGI                        OPTIONAL
    }                                                         OPTIONAL
}

-- TAG-SL-RTD-INFO-STOP
-- ASN1STOP
```

***SL-RTD-Info* field descriptions**
nrCell-Identify This field provides NR cell identity information. The field is present only if the synchronization source of an SL Anchor UE is gNB/eNB.
referenceRTD-Info This field defines the reference RTD and comprises the following sub-fields: - ***syncSourceType***: This field specifies the synchronization source type. - ***applicationLayerID***: This field provides the application layer ID of the reference UE if the *syncSourceType* is set to UE.
rtdBetweenAnchorUEs This field specifies the RTD between SL Anchor UEs: - ***subframeOffset***: This field specifies the subframe boundary offset at the TRP antenna location between the reference UE and this neighbour UE in time units $T_c = 1/(\Delta f_{max} \cdot N_f)$ where $\Delta f_{max} = 480 \cdot 10^3$ Hz and $N_f = 4096$ (TS 38.211 [6]). The offset is counted from the beginning of a subframe #0 of the reference UE to the beginning of the closest subsequent subframe of this neighbour UE. Scale factor 1 Tc. - ***sl-OffsetDFN***: This field indicates the timing offset for the UE to determine DFN timing when GNSS is used for timing reference. Value 1 corresponds to 0.001 milliseconds, value 2 corresponds to 0.002 milliseconds, and so on.
rtd-Quality This field specifies the quality of the RTD.

– *SL-TimeStamp*

The IE *SL-TimeStamp* defines the UE measurement associated time stamp.

```
-- ASN1START
-- TAG-SL-TIMESTAMP-START

SL-TimeStamp ::= CHOICE {
    dfn-Time                    SEQUENCE {
        syncSourceType              ENUMERATED { gnss, ue}    OPTIONAL,
        applicationLayerID          OCTET STRING              OPTIONAL,
        dfn                         INTEGER (0.. 1023),
        nr-Slot                     CHOICE {
            scs15                       INTEGER (0..9),
            scs30                       INTEGER (0..19),
            scs60                       INTEGER (0..39),
            scs120                      INTEGER (0..79)
        }
    },
    sfn-Time                    SEQUENCE {
        nr-PhysCellID               NR-PhysCellID             OPTIONAL,
        nr-ARFCN                    ARFCN-ValueNR             OPTIONAL,
        nr-CellGlobalID             NCGI                      OPTIONAL,
        nr-SFN                      INTEGER (0..1023),
        nr-Slot                     CHOICE {
            scs15                       INTEGER (0..9),
            scs30                       INTEGER (0..19),
            scs60                       INTEGER (0..39),
            scs120                      INTEGER (0..79)
        }
    }
```

```
}
-- TAG-SL-TIMESTAMP-STOP
-- ASN1STOP
```

***SL-TimeStamp* field descriptions**
dfn-Time
This field provides the DFN based time stamp.
sfn-Time
This field provides the SFN based time stamp. If this field is present, at least one of *nr-PhysCellID*, *nr-ARFCN*, or *nr-CellGlobalID* shall be present.

– *SL-TimingQuality*

The IE *SL-TimingQuality* defines the quality of a timing value (e.g., of a TOA measurement).

```
-- ASN1START
-- TAG-SL-TIMINGQUALITY-START

SL-TimingQuality ::= SEQUENCE {
    timingQualityValue        INTEGER (0..31),
    timingQualityResolution   ENUMERATED {mdot1, m1, m10, m30}
}
-- TAG-SL-TIMINGQUALITY-STOP
-- ASN1STOP
```

***SL-TimingQuality* field descriptions**
timingQualityValue
This field provides an estimate of uncertainty of the timing value for which the IE *SL-TimingQuality* is provided in units of metres.
timingQualityResolution
This field provides the resolution used in the *timingQualityValue* field. Enumerated values mdot1, m1, m10, m30 correspond to 0.1, 1, 10, 30 metres, respectively.

6.3.2 UE capability information elements

– *ScheduledLocationTimeSupportPerMode*

The IE *ScheduledLocationTimeSupportPerMode* is used by the endpoint to indicate the time bases supported for scheduled location requests for each positioning mode indicated by *PositioningModes*.

```
-- ASN1START
-- TAG-SCHEDULEDLOCATIONTIMESUPPORTPERMODE-START

ScheduledLocationTimeSupportPerMode ::= SEQUENCE {
    utcTime                             PositioningModes                            OPTIONAL,
    gnssTime                            SEQUENCE {
```

```
        posModes                                PositioningModes,
        gnss-TimeIDs                            GNSS-ID-Bitmap
    }                                                                               OPTIONAL,
    nrTime                                  PositioningModes                        OPTIONAL,
    relativeTime                            PositioningModes                        OPTIONAL
}
-- TAG-SCHEDULEDLOCATIONTIMESUPPORTPERMODE-STOP
-- ASN1STOP
```

6.3.3 Void

6.4 Multiplicity and type constraint values

– *Multiplicity and type constraint definitions*

```
-- ASN1START
-- TAG-MULTIPLICITY-AND-TYPE-CONSTRAINT-DEFINITIONS-START

maxNrOfUEs                                  INTEGER ::= 256        -- Max number of Tx UEs or Rx UEs
nrMaxBands                                  INTEGER ::= 1024       -- Maximum number of supported bands in UE capability

-- TAG-MULTIPLICITY-AND-TYPE-CONSTRAINT-DEFINITIONS-STOP
-- ASN1STOP
```

– *End of SLPP-PDU-Definitions*

```
-- ASN1START

END

-- ASN1STOP
```

6.5 SLPP PDU Common Contents

– *SLPP-PDU-CommonContents*

This ASN.1 segment is the start of the SLPP PDU Common Contents definitions.

```
-- ASN1START
-- TAG-SLPP-PDU-COMMONCONTENTS-START
```

```
SLPP-PDU-CommonContents DEFINITIONS AUTOMATIC TAGS ::=

BEGIN
IMPORTS
    ARFCN-ValueNR,
    NCGI,
    NR-PhysCellID
FROM
    SLPP-PDU-Definitions;

-- TAG-SLPP-PDU-COMMON-CONTENTS-STOP
-- ASN1STOP
```

– *CommonIEsRequestCapabilities*

```
-- ASN1START
-- TAG-COMMONIESREQUESTCAPABILITIES-START

CommonIEsRequestCapabilities ::= SEQUENCE {
    ...
}

-- TAG-COMMONIESREQUESTCAPABILITIES-STOP
-- ASN1STOP
```

– *CommonIEsProvideCapabilities*

```
-- ASN1START
-- TAG-COMMONIESPROVIDECAPABILITIES-START

CommonIEsProvideCapabilities ::= SEQUENCE {
    ...
}
-- TAG-COMMONIESPROVIDECAPABILITIES-STOP
-- ASN1STOP
```

– *CommonIEsRequestAssistanceData*

```
-- ASN1START
-- TAG-COMMONIESREQUESTASSISTANCEDATA-START

CommonIEsRequestAssistanceData ::= SEQUENCE {
    ...
}
-- TAG-COMMONIESREQUESTASSISTANCEDATA-STOP
-- ASN1STOP
```

– *CommonIEsProvideAssistanceData*

```
-- ASN1START
-- TAG-COMMONIESPROVIDEASSISTANCEDATA-START

CommonIEsProvideAssistanceData ::= SEQUENCE {
    ...
}

-- TAG-COMMONIESPROVIDEASSISTANCEDATA-STOP
-- ASN1STOP
```

– *CommonIEsRequestLocationInformation*

The IE *CommonIEsRequestLocationInformation* carries common IEs for a Request Location Information SLPP message Type.

```
-- ASN1START
-- TAG-COMMONIESREQUESTLOCATIONINFORMATION-START

CommonIEsRequestLocationInformation ::= SEQUENCE {
    locationInformationType                LocationInformationType,
    periodicalReporting                    PeriodicalReportingCriteria OPTIONAL,
    additionalInformation                  AdditionalInformation       OPTIONAL,
    qos                                    QoS                         OPTIONAL,
    environment                            Environment                 OPTIONAL,
    scheduledLocationTime                  ScheduledLocationTime       OPTIONAL,
    locationCoordinateTypes                LocationCoordinateTypes     OPTIONAL,
    velocityTypes                          VelocityTypes               OPTIONAL,
    ...
}

LocationInformationType ::= ENUMERATED { locationEstimateRequired, locationMeasurementsRequired, locationEstimatePreferred,
                                         locationMeasurementsPreferred, rangeEstimateRequired, rangeMeasurementsRequired,
                                         rangeEstimatePreferred, rangeMeasurementsPreferred, directionEstimateRequired,
                                         directionMeasurementsRequired, directionEstimatePreferred, directionMeasurementsPreferred,
                                         rangeDirectionEstimateRequired, rangeDirectionMeasurementsRequired,
                                         rangeDirectionEstimatePreferred, rangeDirectionMeasurementsPreferred,
                                         relativeLocationEstimateRequired, relativeLocationMeasurementsRequired,
                                         relativeLocationEstimatePreferred, relativeLocationMeasurementsPreferred, spare12, spare11,
                                         spare10, spare9, spare8, spare7, spare6, spare5, spare4, spare3, spare2, spare1 }

PeriodicalReportingCriteria ::= SEQUENCE {
    reportingAmount                ENUMERATED { ra2, ra4, ra8, ra16, ra32, ra64, ra-Infinity },
    reportingInterval              ENUMERATED { ri1, ri2, ri4, ri8, ri10, ri16, ri20, ri32, ri64}
}

AdditionalInformation ::= ENUMERATED { onlyReturnInformationRequested, mayReturnAdditionalInformation}

QoS ::= SEQUENCE {
    horizontalAccuracy             HorizontalAccuracy    OPTIONAL,
    verticalCoordinateRequest      BOOLEAN,
```

```
    verticalAccuracy                VerticalAccuracy      OPTIONAL,
    rangeAccuracy                   RangeAccuracy         OPTIONAL,
    azimuthAccuracy                 AzimuthAccuracy       OPTIONAL,
    elevationAccuracy               ElevationAccuracy     OPTIONAL,
    responseTime                    ResponseTime          OPTIONAL,
    velocityRequest                 BOOLEAN
}

HorizontalAccuracy ::= SEQUENCE {
    accuracy                INTEGER(0..255),
    confidence              INTEGER(0..100)
}

VerticalAccuracy ::= SEQUENCE {
    accuracy              INTEGER(0..255),
    confidence            INTEGER(0..100)
}

RangeAccuracy ::= SEQUENCE {
    accuracy           INTEGER(0..127),
    confidence         INTEGER(0..100)
}
AzimuthAccuracy ::= SEQUENCE {
    accuracy             INTEGER(0..127),
    confidence           INTEGER(0..100)
}

ElevationAccuracy ::= SEQUENCE {
    accuracy               INTEGER(0..127),
    confidence             INTEGER(0..100)
}

ResponseTime ::= SEQUENCE {
    time              INTEGER (1..128),
    tenMilliSeconds  ENUMERATED { true}    OPTIONAL
}

Environment ::= ENUMERATED { badArea, notBadArea, mixedArea}

ScheduledLocationTime ::= SEQUENCE {
    utc-Time                    UTCTime                                     OPTIONAL,
    gnss-Time                   SEQUENCE {
        gnss-TOD-Msec               INTEGER (0..3599999),
        gnss-TimeID                 GNSS-ID
    }                                                                       OPTIONAL,
    nr-Time                     SEQUENCE {
        nr-PhysCellID               NR-PhysCellID,
        nr-ARFCN                    ARFCN-ValueNR,
        nr-CellGlobalID             NCGI                                    OPTIONAL,
        nr-SFN                      INTEGER (0..1023),
        nr-Slot                     CHOICE {
            scs15                       INTEGER (0..9),
            scs30                       INTEGER (0..19),
            scs60                       INTEGER (0..39),
```

```
            scs120                  INTEGER (0..79)
        }                                                                   OPTIONAL
    }                                                                       OPTIONAL,
    relativeTime              INTEGER (1..1024)                             OPTIONAL
}

GNSS-ID ::= ENUMERATED{ gps, sbas, qzss, galileo, glonass, bds, navic, spare1}

LocationCoordinateTypes ::= SEQUENCE {
    ellipsoidPoint                                          BOOLEAN,
    ellipsoidPointWithUncertaintyCircle                     BOOLEAN,
    ellipsoidPointWithUncertaintyEllipse                    BOOLEAN,
    polygon                                                 BOOLEAN,
    ellipsoidPointWithAltitude                              BOOLEAN,
    ellipsoidPointWithAltitudeAndUncertaintyEllipsoid       BOOLEAN,
    ellipsoidArc                                            BOOLEAN,
    relative2D-LocationWithUncertaintyEllipse               BOOLEAN,
    relative3D-LocationWithUncertaintyEllipsoid             BOOLEAN,
    rangeAndDirection-range                                 BOOLEAN,
    rangeAndDirection-azimuth                               BOOLEAN,
    rangeAndDirection-elevation                             BOOLEAN,
    ...
}

VelocityTypes ::= SEQUENCE {
    horizontalVelocity                                      BOOLEAN,
    horizontalWithVerticalVelocity                          BOOLEAN,
    horizontalVelocityWithUncertainty                       BOOLEAN,
    horizontalWithVerticalVelocityAndUncertainty            BOOLEAN,
    relativeVelocityWithUncertainty                         BOOLEAN,
    ...
}

-- TAG-COMMONIESREQUESTLOCATIONINFORMATION-STOP
-- ASN1STOP
```

***CommonIEsRequestLocationInformation* field descriptions**
additionalInformation
This field indicates whether the UE is allowed to return additional information to that requested. If this field indicates '*onlyReturnInformationRequested*' then the UE shall not return any additional information. If this field indicates '*mayReturnAdditionalInformation*' then the UE may return additional information. If a location estimate is returned, any additional information is restricted to that associated with a location estimate (e.g. might include velocity if velocity was not requested but cannot include measurements). If measurements are returned, any additional information is restricted to additional measurements (e.g. might include SL-AoA measurements if SL-TDOA measurements were requested but not SL-AoA measurements).
environment
This field provides the UE with information about expected multipath and non line of sight (NLOS) in the current area. The following values are defined: - badArea: possibly heavy multipath and NLOS conditions (e.g. bad urban or urban). - notBadArea: no or light multipath and usually LOS conditions (e.g. suburban or rural). - mixedArea: environment that is mixed or not defined. If this field is absent, a default value of 'mixedArea' applies.
locationCoordinateTypes
This field provides a list of the types of location estimate that an endpoint may return when a location estimate is obtained by the endpoint.

locationInformationType
This field indicates whether an endpoint requires a location estimate or measurements. For '*locationEstimateRequired*', '*rangeEstimateRequired*' or '*relativeLocationEstimateRequired*', the UE shall return a location or range estimate if possible, or indicate a location error if not possible. For '*locationMeasurementsRequired*', '*rangeMeasurementsRequired*' or '*relativeLocationMeasurementsRequired*', the UE shall return measurements if possible, or indicate a location error if not possible. For '*locationEstimatePreferred*', '*rangeEstimatePreferred*' or '*relativeLocationEstimatePreferred*', the UE shall return a location or range estimate if possible, but may also or instead return measurements for any requested position methods for which a location or range estimate is not possible. For '*locationMeasurementsPreferred*, '*rangeMeasurementsPreferred*' or '*relativeLocationMeasurementsPreferred*', the UE shall return location or range measurements if possible, but may also or instead return a location estimate for any requested position methods for which return of location measurements is not possible.

periodicalReporting
This field indicates that periodic reporting is requested and comprises the following subfields:
- ***reportingAmount*** indicates the number of periodic location information reports requested. Enumerated values correspond to 2, 4, 8, 16, 32, 64, or infinite/indefinite number of reports. If the *reportingAmount* is set to '*ra-Infinity*', the UE should continue periodic reporting until an SLPP *Abort* message is received.
- ***reportingInterval*** indicates the interval between location information reports and the response time requirement for the first location information report. Enumerated values correspond to reporting intervals of 1, 2, 4, 8, 10, 16, 20, 32, and 64 seconds, respectively. Measurement reports containing no measurements or no location estimate are required when a *reportingInterval* expires before a UE is able to obtain new measurements or obtain a new location estimate.

qos
This field indicates the quality of service and comprises a number of sub-fields. In the case of measurements, some of the sub-fields apply to the location estimate that could be obtained by the endpoint from the measurements provided by the UE assuming that the measurements are the only sources of error. This field comprises the following subfields:
- ***azimuthAccuracy*** indicates the maximum (single-sided) horizontal direction error at an indicated confidence level. Scale factor of *accuracy* is 1 degree; range 0 to 127 degrees. '*confidence*' corresponds to confidence as defined in TS 23.032 [7].
- ***elevationAccuracy*** indicates the maximum (single-sided) vertical direction error at an indicated confidence level. Scale factor of *accuracy* is 1 degree; range 0 to 63 degrees. '*confidence*' corresponds to confidence as defined in TS 23.032 [7].
- ***horizontalAccuracy*** indicates the maximum horizontal error in the location estimate at an indicated confidence level. The '*accuracy*' corresponds to the encoded high accuracy extended uncertainty as defined in TS 23.032 [7] and '*confidence*' corresponds to confidence as defined in TS 23.032 [7].
- ***verticalCoordinateRequest*** indicates whether a vertical coordinate is required (TRUE) or not (FALSE)
- ***verticalAccuracy*** indicates the maximum vertical error in the location estimate at an indicated confidence level and is only applicable when a vertical coordinate is requested. The '*accuracy*' corresponds to the encoded high accuracy extended uncertainty as defined in TS 23.032 [7] and '*confidence*' corresponds to confidence as defined in TS 23.032 [7].
- ***rangeAccuracy*** indicates the maximum range error at an indicated confidence level. The '*accuracy'* corresponds to the encoded high accuracy extended uncertainty as defined in TS 23.032 [7] and '*confidence*' corresponds to confidence as defined in TS 23.032 [7].
- ***responseTime***
  - ***time*** indicates the maximum response time as measured between receipt of the *RequestLocationInformation* and transmission of a *ProvideLocationInformation*.
  - ***tenMilliSeconds*** indicates the unit of the *time* field. If this field is present, the unit/resolution is 0.01 seconds. If this field is absent, the unit/resolution is 1 second.
  - ***velocityRequest*** indicates whether velocity (or measurements related to velocity) is requested (TRUE) or not (FALSE).

All QoS requirements shall be obtained by the UE to the degree possible but it is permitted to return a response that does not fulfill all QoS requirements if some were not attainable.

scheduledLocationTime
This field indicates that the UE is requested to obtain location measurements or location estimate valid at the *scheduledLocationTime T* and comprises the following subfields:
- ***utc-Time*** provides *T* in UTC in the form of YYMMDDhhmmssZ.
- ***gnss-Time*** provides *T* in GNSS system time of the GNSS indicated by *gnss-TimeID*.
  - ***gnss-TOD-Msec*** specifies the GNSS TOD in 1-milli-second resolution rounded down to the nearest millisecond unit.
- ***nr-Time*** provides *T* in NR network time.
  - ***nr-PhysCellID***, ***nr-ARFCN***, ***nr-CellGlobalID*** identifies the reference cell (NR) that is used for the network time.
  - ***nr-SFN*** specifies the system frame number in NR.
  - ***nr-Slot*** specifies the slot number in NR for the indicated subcarrier spacing (SCS). The total NR network time is given by *nr-SFN* + *nr-Slot*.
- ***relativeTime*** provides *T* in seconds from current time, where current time is defined as the time the IE *CommonIEsRequestLocationInformation* was received.

NOTE 1: A location estimate returned to an LCS Client, AF or UE for a scheduled location time can be treated by the LCS Client, AF or UE as an estimate of the location of the UE at the scheduled location time (see TS 23.273 [5]).
NOTE 2: If this field is present, at least one of *utc-Time*, *gnss-Time*, *nr-Time,* or *relativeTime* shall be present.

velocityTypes
This fields provides a list of the types of velocity estimate that an endpoint may return when a velocity estimate is obtained by the endpoint.

– *CommonIEsProvideLocationInformation*

The IE *CommonIEsProvideLocationInformation* carries common IEs for a Provide Location Information SLPP message Type.

```
-- ASN1START
-- TAG-COMMONIESPROVIDELOCATIONINFORMATION-START

CommonIEsProvideLocationInformation ::= SEQUENCE {
    locationEstimate                        LocationCoordinates            OPTIONAL, -- locationTargetUe-sl-pos
    rangeAndOrDirection                     RangeAndOrDirection            OPTIONAL,
    velocityEstimate                        Velocity                       OPTIONAL,
    relativeLocationEstimate                RelativeLocationCoordinates    OPTIONAL,
    locationError                           LocationError                  OPTIONAL,
    ...
}
LocationCoordinates ::= CHOICE {
    ellipsoidPoint                                      EllipsoidPoint,
    ellipsoidPointWithUncertaintyCircle                 EllipsoidPointWithUncertaintyCircle,
    ellipsoidPointWithUncertaintyEllipse                EllipsoidPointWithUncertaintyEllipse,
    polygon                                             Polygon,
    ellipsoidPointWithAltitude                          EllipsoidPointWithAltitude,
    ellipsoidPointWithAltitudeAndUncertaintyEllipsoid   EllipsoidPointWithAltitudeAndUncertaintyEllipsoid,
    ellipsoidArc                                        EllipsoidArc
}

RelativeLocationCoordinates ::= CHOICE {
    relative2D-LocationWithUncertaintyEllipse                                   Relative2D-LocationWithUncertaintyEllipse,
    relative3D-LocationWithUncertaintyEllipsoid                                 Relative3D-LocationWithUncertaintyEllipsoid,
    ...
}

Relative2D-LocationWithUncertaintyEllipse ::=   SEQUENCE {
    x                                               INTEGER (-134217728..134217727),   -- 28 bit field
```

```
    y                                               INTEGER (-134217728..134217727),   -- 28 bit field
    uncertaintySemiMajor                            INTEGER (0..255),
    uncertaintySemiMinor                            INTEGER (0..255),
    orientationMajorAxis                            INTEGER (0..179),
    confidence                                      INTEGER (0..100)
}

Relative3D-LocationWithUncertaintyEllipsoid ::= SEQUENCE {
    x                                               INTEGER (-134217728..134217727),     -- 28 bit field
    y                                               INTEGER (-134217728..134217727),     -- 28 bit field
    z                                               INTEGER (-16777216..16777215),       -- 25 bit field
    uncertaintySemiMajor                            INTEGER (0..255),
    uncertaintySemiMinor                            INTEGER (0..255),
    orientationMajorAxis                            INTEGER (0..179),
    uncertaintyAltitude                             INTEGER (0..255),
    confidence                                      INTEGER (0..100)
}

Velocity ::= CHOICE {
    horizontalVelocity                              HorizontalVelocity,
    horizontalWithVerticalVelocity                  HorizontalWithVerticalVelocity,
    horizontalVelocityWithUncertainty               HorizontalVelocityWithUncertainty,
    horizontalWithVerticalVelocityAndUncertainty    HorizontalWithVerticalVelocityAndUncertainty,
    relativeVelocityWithUncertainty                 RelativeVelocityWithUncertainty
}

LocationError ::= SEQUENCE {
    locationfailurecause        LocationFailureCause
}

LocationFailureCause ::= ENUMERATED { undefined, requestedMethodNotSupported, positionMethodFailure, periodicLocationMeasurementsNotAvailable}

EllipsoidPoint ::= SEQUENCE {
    latitudeSign        ENUMERATED {north, south},
    degreesLatitude     INTEGER (0..8388607),        -- 23 bit field
    degreesLongitude    INTEGER (-8388608..8388607)  -- 24 bit field
}

EllipsoidPointWithUncertaintyCircle ::= SEQUENCE {
    latitudeSign                            ENUMERATED {north, south},
    degreesLatitude                         INTEGER (0..8388607),        -- 23 bit field
    degreesLongitude                        INTEGER (-8388608..8388607), -- 24 bit field
    uncertainty                             INTEGER (0..127)
}

EllipsoidPointWithUncertaintyEllipse ::= SEQUENCE {
    latitudeSign                            ENUMERATED {north, south},
    degreesLatitude                         INTEGER (0..8388607),        -- 23 bit field
    degreesLongitude                        INTEGER (-8388608..8388607), -- 24 bit field
    uncertaintySemiMajor                    INTEGER (0..127),
    uncertaintySemiMinor                    INTEGER (0..127),
    orientationMajorAxis                    INTEGER (0..179),
    confidence                              INTEGER (0..100)
}
```

```
EllipsoidPointWithAltitude ::= SEQUENCE {
    latitudeSign                  ENUMERATED {north, south},
    degreesLatitude               INTEGER (0..8388607),        -- 23 bit field
    degreesLongitude              INTEGER (-8388608..8388607), -- 24 bit field
    altitudeDirection             ENUMERATED {height, depth},
    altitude                      INTEGER (0..32767)           -- 15 bit field
}

EllipsoidPointWithAltitudeAndUncertaintyEllipsoid ::= SEQUENCE {
    latitudeSign                                        ENUMERATED {north, south},
    degreesLatitude                                     INTEGER (0..8388607),        -- 23 bit field
    degreesLongitude                                    INTEGER (-8388608..8388607), -- 24 bit field
    altitudeDirection                                   ENUMERATED {height, depth},
    altitude                                            INTEGER (0..32767),          -- 15 bit field
    uncertaintySemiMajor                                INTEGER (0..127),
    uncertaintySemiMinor                                INTEGER (0..127),
    orientationMajorAxis                                INTEGER (0..179),
    uncertaintyAltitude                                 INTEGER (0..127),
    confidence                                          INTEGER (0..100)
}

EllipsoidArc ::= SEQUENCE {
    latitudeSign                ENUMERATED {north, south},
    degreesLatitude             INTEGER (0..8388607),        -- 23 bit field
    degreesLongitude            INTEGER (-8388608..8388607), -- 24 bit field
    innerRadius                 INTEGER (0..65535),          -- 16 bit field,
    uncertaintyRadius           INTEGER (0..127),
    offsetAngle                 INTEGER (0..179),
    includedAngle               INTEGER (0..179),
    confidence                  INTEGER (0..100)
}

RangeAndOrDirection ::= SEQUENCE {
    range                   Range       OPTIONAL,
    azimuth                 Azimuth     OPTIONAL,
    elevation               Elevation   OPTIONAL
}

Range ::= SEQUENCE {
    rangeResult                 INTEGER (0..134217727),
    uncertainty                 INTEGER (0..255),
    confidence                  INTEGER (0..100)            OPTIONAL
}

Azimuth ::= SEQUENCE {
    azimuthResult               INTEGER (0..3599),
    uncertainty                 INTEGER (0..127),
    confidence                  INTEGER (0..100)            OPTIONAL
}

Elevation ::= SEQUENCE {
    elevationResult             INTEGER (0..1800),
    uncertainty                 INTEGER (0..63),
```

```
    confidence                  INTEGER (0..100)            OPTIONAL
}

HorizontalVelocity ::= SEQUENCE {
    bearing              INTEGER(0..359),
    horizontalSpeed      INTEGER(0..2047)
}

HorizontalWithVerticalVelocity ::= SEQUENCE {
    bearing                           INTEGER(0..359),
    horizontalSpeed                   INTEGER(0..2047),
    verticalDirection                 ENUMERATED{upward, downward},
    verticalSpeed                     INTEGER(0..255)
}

HorizontalVelocityWithUncertainty ::= SEQUENCE {
    bearing                              INTEGER(0..359),
    horizontalSpeed                      INTEGER(0..2047),
    uncertaintySpeed                     INTEGER(0..255)
}

HorizontalWithVerticalVelocityAndUncertainty ::= SEQUENCE {
    bearing                                      INTEGER(0..359),
    horizontalSpeed                              INTEGER(0..2047),
    verticalDirection                            ENUMERATED{upward, downward},
    verticalSpeed                                INTEGER(0..255),
    horizontalUncertaintySpeed                   INTEGER(0..255),
    verticalUncertaintySpeed                     INTEGER(0..255)
}

Polygon ::= SEQUENCE (SIZE (3..15)) OF PolygonPoints

PolygonPoints ::= SEQUENCE {
    latitudeSign      ENUMERATED {north, south},
    degreesLatitude   INTEGER (0..8388607),        -- 23 bit field
    degreesLongitude  INTEGER (-8388608..8388607)  -- 24 bit field
}

RelativeVelocityWithUncertainty ::=        SEQUENCE {
    radialVelocityComponent                    SEQUENCE {
        unitsRadialVelocity                        ENUMERATED { mPerS, cmPerS, ... },
        radialVelocity                             INTEGER (-2048..2047),
        uncertaintyRadialVelocity                  INTEGER (0..255),
        confidenceUncertaintyRadialVelocity        INTEGER (0..100)
    }                                                                                  OPTIONAL,
    transverseVelocityComponent                SEQUENCE {
        unitsTransverseVelocity                    ENUMERATED { degPerSec1, degPerSec0-1, ... },
        azimuth                                    SEQUENCE {
            azimuthRateOfChange                        INTEGER (0..1023),
            uncertaintyAzimuthRateOfChange             INTEGER (0..255),
            confidenceUncertaintyAzimuthRateOfChange   INTEGER (0..100)
        }                                                                              OPTIONAL,
        elevation                        SEQUENCE {
            elevationRateOfChange                      INTEGER (0..1023),
```

```
            uncertaintyElevationRateOfChange           INTEGER (0..255),
            confidenceUncertaintyElevationRateOfChange INTEGER (0..100)
        }                                                                                   OPTIONAL
    }                                                                                       OPTIONAL,
    ...
}

-- TAG-COMMONIESPROVIDELOCATIONINFORMATION-STOP
-- ASN1STOP
```

***CommonIEsProvideLocationInformation* field descriptions**
locationError
This field shall be included if and only if a location estimate and measurements are not included in the SLPP PDU. The field includes information concerning the reason for the lack of location information. The enumerated value '*periodicLocationMeasurementsNotAvailable*' shall be used by the UE if periodic location reporting was requested, but no measurements or location estimate are available when *the reportingInterval* expired.
locationEstimate
This field provides a location estimate using one of the geographic shapes defined in TS 23.032 [7]. Coding of the values of the various fields internal to each geographic shape follows the rules in TS 23.032 [7]. The conditions for including this field are defined for the *locationInformationType* field in a Request Location Information message.
rangeAndOrDirection

This field provides a range and/or direction estimate as defined in TS 23.032 [7] for the "Range and Direction".
- ***range*** provides the range component and comprises the following subfields:
  - ***rangeResult*** provides the range estimate in units of milli-metres, as defined in TS 23.032 [7] for the "Range and Direction".
  - ***uncertainty*** provides the uncertainty of the *rangeResult* and corresponds to the encoded high accuracy extended uncertainty as defined in TS 23.032 [7].
  - ***confidence*** provides the confidence level for the *uncertainty* and corresponds to confidence as defined in TS 23.032 [7].
- ***azimuth*** provides the horizontal direction component and comprises the following subfields:
  - ***azimuthResult*** provides the horizontal direction (azimuth) as defined in TS 23.032 [7] for the "Range and Direction". Scale factor 0.1 degree; range 0 to 359.9 degrees.
  - ***uncertainty*** provides the single-sided uncertainty of the *azimuthResult.* Scale factor 1 degree; range 0 to 127 degrees.
  - ***confidence*** provides the confidence level for the *uncertainty* and corresponds to confidence as defined in TS 23.032 [7].
- ***elevation*** provides the vertical direction component and comprises the following subfields:
  - ***elevationResult*** provides the vertical direction (elevation) as defined in TS 23.032 [7] for the "Range and Direction". Scale factor 0.1 degree; range 0 to 180.0 degrees.
  - ***uncertainty*** provides the single-sided uncertainty of the *elevationResult.* Scale factor 1 degree; range 0 to 63 degrees.
  - ***confidence*** provides the confidence level for the *uncertainty* and corresponds to confidence as defined in TS 23.032 [7].

relativeLocationEstimate

This field provides a relative location estimate.
- ***relative2D-LocationWithUncertaintyEllipse*** provides the "relative 2D location with uncertainty ellipse" as defined in TS 23.032 [7] and comprises the following subfields:
  - ***x, y*** provides the value (in the unit of milli-metres) on x-axis and y-axis, respectively, of the relative location in the local cartesian system, as defined in TS 23.032 [7]. The origin of the cartesian system is the reference location of the relative positioning.
  - ***uncertaintySemiMajor*** provides the semi-major axis of the uncertainty ellipse. The value corresponds to the encoded high accuracy extended uncertainty as defined in TS 23.032 [7].
  - ***uncertaintySemiMinor*** provides the semi-minor axis of the uncertainty ellipse. The value corresponds to the encoded high accuracy extended uncertainty as defined in TS 23.032 [7].
  - ***orientationMajorAxis*** provides the orientation angle of the major axis as defined in TS 23.032 [7].
  - ***confidence*** provides the confidence level for the uncertainty ellipse and corresponds to confidence as defined in TS 23.032 [7].
- ***relative3D-LocationWithUncertaintyEllipsoid*** provides the "relative 3D location with uncertainty ellipsoid" as defined in TS 23.032 [7] and comprises the following subfields:
  - ***x, y, z*** provides the value (in the unit of milli-meters) on x-axis, y-axis and z-axis, respectively, of the relative location in the local cartesian system, as defined in TS 23.032 [7]. The origin of the cartesian system is the reference location of the relative positioning.
  - ***uncertaintySemiMajor*** provides the semi-major axis of the uncertainty ellipsoid. The value corresponds to the encoded high accuracy extended uncertainty as defined in TS 23.032 [7].
  - ***uncertaintySemiMinor*** provides the semi-minor axis of the uncertainty ellipsoid. The value corresponds to the encoded high accuracy extended uncertainty as defined in TS 23.032 [7].
  - ***orientationMajorAxis*** provides the orientation angle of the major axis as defined in TS 23.032 [7].
  - ***uncertaintyAltitude*** provides uncertainty altitude. The value corresponds to the encoded high accuracy extended uncertainty as defined in TS 23.032 [7].
  - ***confidence*** provides the confidence level for the uncertainty ellipsoid and corresponds to confidence as defined in TS 23.032 [7].

relativeVelocityWithUncertainty
This field provides the relative velocity with uncertainty as defined in TS 23.032 [7] and comprises the following subfields:

- ***radialVelocityComponent*** provides the radial velocity component characterised by a rate of change of range between the endpoint A and endpoint B:
  - ***unitsRadialVelocity*** provides the unit for the *radialVelocity*. Enumerated values '*mPerS*' and '*cmPerS*' indicate units m/s and cm/s, respectively.
  - ***radialVelocity*** provides the radial velocity as defined in TS 23.032 [7] in units given in the *unitsRadialVelocity* field. Positive values indicate increasing range between endpoint A and B; negative values indicate decreasing range between endpoint A and B.
  - ***uncertaintyRadialVelocity*** provides the (single-sided) uncertainty of the *radialVelocity* in increments of 1 the unit given in the *unitsRadialVelocity* field.
  - ***confidenceUncertaintyRadialVelocity*** provides the confidence of the *uncertaintyRadialVelocity*, as defined in TS 23.032 [7] for the "Confidence".
- ***transverseVelocityComponent*** provides the transverse velocity component characterised by a rate of change of direction to the endpoint B from the endpoint A:
  - ***unitsTransverseVelocity*** provides the unit for the *azimuth* and *elevation* components. Enumerated values '*degPerSec1*' and '*degPerSec0-1*' indicate units 1-degree per second and 0.1 degree per second, respectively.
  - ***azimuthRateOfChange*** provides the rate of change of azimuth measured clockwise from North in a horizontal plane through the endpoint A as defined in TS 23.032 [7] in units given in the *unitsTransverseVelocity* field.
  - ***uncertaintyAzimuthRateOfChange*** provides the (single-sided) uncertainty of the *azimuthRateOfChange* in increments of 1 units given in the *unitsTransverseVelocity* field.
  - ***confidenceUncertaintyAzimuthRateOfChange*** provides the confidence of the *uncertaintyAzimuthRateOfChange*, as defined in TS 23.032 [7] for the "Confidence".
  - ***elevationRateOfChange*** provides the rate of change of elevation measured from Zenith in a vertical plane through the endpoint A and B, as defined in TS 23.032 [7] in units given in the *unitsTransverseVelocity* field.
  - ***uncertaintyElevationRateOfChange*** provides the (single-sided) uncertainty of the *elevationRateOfChange* in increments of 1 in units given in the *unitsTransverseVelocity* field.
  - ***confidenceUncertaintyElevationRateOfChange*** provides the confidence of the *uncertaintyElevationRateOfChange*, as defined in TS 23.032 [7] for the "Confidence".

velocityEstimate
This field provides a velocity estimate using one of the velocity shapes defined in TS 23.032 [7]. Coding of the values of the various fields internal to each velocity shape (except for *relativeVelocityWithUncertainty*) follows the rules in TS 23.032 [7].

– *End of SLPP-PDU-CommonContents*

```
-- ASN1START

END

-- ASN1STOP
```

6.6 SLPP PDU Common SL-PRS Methods Contents

– *SLPP-PDU-CommonSL-PRS-MethodsContents*

This ASN.1 segment is the start of the SLPP PDU Common SL-PRS Methods Contents definitions.

```
-- ASN1START
-- TAG-SLPP-PDU-COMMONSL-PRS-METHODSCONTENTS-START
```

```
SLPP-PDU-CommonSL-PRS-MethodsContents DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS
    EllipsoidPoint,
    EllipsoidPointWithUncertaintyEllipse,
    EllipsoidPointWithAltitude,
    EllipsoidPointWithAltitudeAndUncertaintyEllipsoid

FROM
    SLPP-PDU-CommonContents

    SL-TimeStamp,
    maxNrOfUEs,
    nrMaxBands

FROM
    SLPP-PDU-Definitions;

-- TAG-SLPP-PDU-COMMONSL-PRS-METHODSCONTENTS-STOP
-- ASN1STOP
```

– *CommonSL-PRS-MethodsIEsRequestCapabilities*

```
-- ASN1START
-- TAG-COMMONSL-PRS-METHODSIESREQUESTCAPABILITIES-START

CommonSL-PRS-MethodsIEsRequestCapabilities ::= SEQUENCE {
    ...
}

-- TAG-COMMONSL-PRS-METHODSIESREQUESTCAPABILITIES-STOP
-- ASN1STOP
```

– *CommonSL-PRS-MethodsIEsProvideCapabilities*

```
-- ASN1START
-- TAG-COMMONSL-PRS-METHODSIESPROVIDECAPABILITIES-START

CommonSL-PRS-MethodsIEsProvideCapabilities ::= SEQUENCE {
    --R1 41-1-1a Common SL-PRS processing capability per UE
    sl-PRS-CommonProcCapabilityPerUE              SL-PRS-CommonProcCapabilityPerUE           OPTIONAL,
    sl-PRS-CapabilityBandList                     SEQUENCE (SIZE (1..nrMaxBands)) OF SL-PRS-CapabilityPerBand,
    ...
}

SL-PRS-CapabilityPerBand ::=               SEQUENCE {
    freqBandIndicatorNR                       INTEGER (1..1024),
```

```
    --R1 41-1-1 Common SL-PRS processing capability in an SL BWP
    sl-PRS-CommonProcCapabilityPerBand          SL-PRS-CommonProcCapabilityPerBand             OPTIONAL,
    --R1 41-1-19 ARP location provision for sidelink as assistance data
    sl-PositioningARP-LocationProvision         ENUMERATED {supported}                         OPTIONAL,
    --R1 41-1-19a Report of Rx ARP-ID with SL positioning measurements
    sl-PositioningMeasReportWithRxARP-ID        ENUMERATED {supported}                         OPTIONAL,
    --R1 41-1-19b Report of Tx ARP-ID to LMF or another UE for the transmitted SL PRS
    sl-PRS-ReportTxARP-ID                       ENUMERATED {supported}                         OPTIONAL,
    --R1 41-1-2 Receiving SL-PRS in a shared resource pool
    sl-PRS-RxInSharedResourcePool               ENUMERATED {supported}                         OPTIONAL,
    --R1 41-1-3 Receiving SL-PRS in a dedicated resource pool
    sl-PRS-RxInDedicatedResourcePool            SL-PRS-RxInDedicatedResourcePool               OPTIONAL,
    --R1 41-1-4a Transmitting SL-PRS in a shared resource pool
    sl-PRS-TxInSharedResourcePool               ENUMERATED {supported}                         OPTIONAL,
    --R1 41-1-4b Transmitting SL-PRS mode 1 in a dedicated resource pool
    sl-PRS-TxScheme1InDedicatedResourcePool     ENUMERATED {supported}                         OPTIONAL,
    --R1 41-1-4c Transmitting SL-PRS mode 2 in a dedicated resource pool
    sl-PRS-TxScheme2InDedicatedResourcePool     ENUMERATED {supported}                         OPTIONAL,
    --R1 41-1-7e SL PRS measurement for SL PRS-RSRP
    sl-PRS-RSRP-Meas                            ENUMERATED {supported}                         OPTIONAL,
    --R1 41-1-7f SL PRS measurement for SL PRS-RSRPP
    sl-PRS-RSRPP-Meas                           ENUMERATED {supported}                         OPTIONAL,
    --R1 41-1-11 TDM-based multiplexing of SL-PRS reception from different UEs in the same slot in dedicated resource pool
    sl-PRS-TDM-Multiplexing                     ENUMERATED {supported}                         OPTIONAL,
    --R1 41-1-12 Comb-based multiplexing for SL-PRS reception from different UEs in the same slot in dedicated resource pool
    sl-PRS-RxCombMultiplexing                  ENUMERATED {supported}                          OPTIONAL,
    --R1 41-1-13 Reporting the additional paths for SL positioning
    sl-PRS-AdditionalPathsReport                ENUMERATED {n1,n2,n4,n6,n8}                    OPTIONAL,
    --R1 41-1-14 LoS/NLoS indicator for SL positioning per measurement
    sl-PRS-LOS-NLOS-Indication                  ENUMERATED {hard, hard-soft}                   OPTIONAL,
    -- R1 41-1-20: Supports SL PRS Rx for a band configured with SL CA
    sl-PRS-RxForBandWithSL-CA                   ENUMERATED {supported}                         OPTIONAL,
    -- R1 41-1-21: Supports SL PRS Tx for a band configured with SL CA
    sl-PRS-TxForBandWithSL-CA                   ENUMERATED {supported}                         OPTIONAL,
    ...
}

SL-PRS-CommonProcCapabilityPerUE ::=     SEQUENCE {
    --R1 41-1-1a    Common SL-PRS processing capability
    maxNumOfActiveSL-PRS-Resources          SEQUENCE {
        fr1                                     ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24}                          OPTIONAL,
        fr2                                     ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24, n32, n48, n64, n128}     OPTIONAL
    },
    maxNumOfSlotswithActiveSL-PRS-Resources  SEQUENCE {
        fr1                                     ENUMERATED {n1, n2, n3, n4, n6, n8}                                     OPTIONAL,
        fr2                                     ENUMERATED {n1, n2, n4, n8, n12, n16, n24, n32, n48, n64}               OPTIONAL
    }
}

SL-PRS-CommonProcCapabilityPerBand ::=   SEQUENCE {
    maxSL-PRS-Bandwidth                     CHOICE {
        fr1                                     ENUMERATED {mhz5, mhz10, mhz20, mhz40, mhz50, mhz80, mhz100},
        fr2                                     ENUMERATED {mhz50, mhz100, mhz200, mhz400}
    },
```

```
    maxNumOfActiveSL-PRS-ResourcesInOneSlot  CHOICE {
        fr1                                      ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24},
        fr2                                      ENUMERATED {n1, n2, n4, n6, n8, n12, n16, n24, n32, n48, n64, n128}
    },
    maxNumOfSlotsWithActiveSL-PRS-Resources  CHOICE {
        fr1                                      ENUMERATED {n1, n2, n3, n4, n6, n8},
        fr2                                      ENUMERATED {n1, n2, n4, n8, n12, n16, n24, n32, n48, n64}
    },
    minTimeAfterEndofSlotCarryActiveSL-PRS-Resources    ENUMERATED {ms20, ms30, ms40, ms50, ms80, ms100, ms160}
}

SL-PRS-RxInDedicatedResourcePool ::=  SEQUENCE {
    numOfSupportedRxPSCCH-PerSlot         ENUMERATED {value1, value2},
    supportedCP-TypeFor60kHzSCS           ENUMERATED {ncp, ncpAndECP}
}

-- TAG-COMMONSL-PRS-METHODSIESPROVIDECAPABILITIES-STOP
-- ASN1STOP
```

***CommonSL-PRS-MethodsIEsProvideCapabilities* field descriptions**
sl-PositioningARP-LocationProvision Indicates whether UE supports provisioning of ARP location for sidelink as assistance data.
sl-PositioningMeasReportWithARP-ID Indicates whether UE supports providing Rx ARP-ID with SL positioning measurements.
sl-PRS-AdditionalPathsReport Indicates whether UE supports RSRPP reporting for additional paths. The value indicates the maximum number of additional detected path timing reporting for K additional paths for SL positioning. UE supporting this feature shall also support at least one of *sl-PRS-RSTD-Meas*, *sl-RTOA-Meas*, *sl-PRS-RxTxTimeDiffWithoutTxTimeStamp*, *sl-PRS-RxTxTimeDiffWithTxTimeStamp*, *sl-PRS-RSRPP-Meas*, or *sl-AoA-Meas*.
sl-PRS-CommonProcCapabilityPerBand Indicates the common SL-PRS processing capability per band, and comprises the following sub-fields: - *maxSL-PRS-Bandwidth*: Maximum SL PRS bandwidth in MHz in a resource pool for positioning, which is supported and reported by UE for SL-PRS measurement; - *maxNumOfActiveSL-PRS-ResourcesInOneSlot*: Maximum number of active SL PRS resources across all configured RPs in a slot assuming maximum SL PRS bandwidth in MHz, which is supported and reported by UE; - *maxNumOfSlotsWithActiveSL-PRS-Resources*: Maximum number of slots with active SL PRS resources across all configured RPs assuming maximum SL PRS bandwidth in MHz, which is supported and reported by UE; - *minTimeAfterEndofSlotCarryActiveSL-PRS-Resources*: Minimum time after the end of a slot carrying the active SL-PRS resource(s) assuming maximum number of symbols and maximum bandwidth for a UE to finish the SL-PRS resource and the associated PSCCH processing which is supported and reported by UE; NOTE 1: An SL PRS resource is considered as active starting at the end of the last symbol of the PSCCH carrying the SCI trigger and the occupancy is released at the end of timeline indicated in *minTimeAfterEndofSlotCarryActiveSL-PRS-Resources*.
sl-PRS-CommonProcCapabilityPerUE Indicates the common SL-PRS processing capability, and comprises the following sub-fields: - *maxNumOfActiveSL-PRS-Resources*: Maximum number of active SL PRS resources across all configured RPs across all bands in a slot assuming maximum SL PRS bandwidth in MHz, which is supported and reported by UE; - *maxNumOfSlotswithActiveSL-PRS-Resources*: Maximum number of slots with active SL PRS resources across all configured RPs across all bands assuming maximum SL PRS bandwidth in MHz, which is supported and reported by UE. UE supporting this feature shall also support *sl-PRS-CommonProcCapabilityPerBand*.
sl-PRS-LOS-NLOS-Indication Indicates whether UE supports LoS/NLoS indicator for SL positioning per measurement. The value indicates whether the indicator is hard value or hard+soft value. UE supporting this feature shall also support at least one of *sl-PRS-RSTD-Meas*, *sl-RTOA-Meas*, *sl-PRS-RxTxTimeDiffWithoutTxTimeStamp*, *sl-PRS-RxTxTimeDiffWithTxTimeStamp*, or *sl-AoA-Meas*.
sl-PRS-ReportTxARP-ID Indicates whether UE supports providing Tx ARP-ID for the transmitted SL PRS.
sl-PRS-RSRP-Meas Indicates whether UE supports SL PRS measurement for SL PRS-RSRP, and is comprised of the following functional components: - Support SL PRS-RSRP measurement based on SL-PRS; - Support SL PRS-RSRP measurement reporting. UE supporting this feature shall also support *sl-PRS-CommonProcCapabilityPerBand*.
sl-PRS-RSRPP-Meas Indicates whether UE supports SL PRS measurement for SL PRS-RSRPP, and is comprised of the following functional components: - Support SL PRS-RSRPP measurement based on SL-PRS; - Support SL PRS-RSRPP measurement reporting. UE supporting this feature shall also support *sl-PRS-CommonProcCapabilityPerBand*.

sl-PRS-RxCombMultiplexing
Indicates whether UE supports comb-based multiplexing for SL-PRS reception from different UEs in the same slot in dedicated resource pool.
UE supporting this feature shall also support *sl-PRS-RxInDedicatedResourcePool*.

sl-PRS-RxForBandWithSL-CA
Indicates whether UE supports SL PRS reception in a single carrier for a shared SL PRS resource pool and/or a dedicated SL PRS resource pool for a band configured with SL CA.
A UE that supports this feature shall also support *sl-CA-Communication-r18*, defined in TS 38.331 [2] and one of *sl-PRS-RxInSharedResourcePool* or *sl-PRS-RxInDedicatedResourcePool*.
NOTE 1: In a shared SL PRS resource pool in a single SL carrier: Tx power control follows the rule defined for SL CA in NR Rel-18.
NOTE 2: In a dedicated SL PRS resource pool in a single SL carrier when the slots (pre)configured for the dedicated SL PRS resource pool do not collide with the slots (pre)configured for any other resource pool or S-SSB resource(s) in other carriers.

sl-PRS-RxInDedicatedResourcePool
Indicates whether UE supports receiving SL-PRS in dedicated resource pool and receiving SCI format 1B.
This field comprises the following sub-fields:
- *numOfSupportedRxPSCCH-PerSlot*: Indicates the number of PSCCH UE can receive in a slot. value1 corresponds to floor (N_{RB} /10 RBs), value2 corresponds to 2*floor (N_{RB} /10 RBs). N_{RB} is the number of RBs defined per channel bandwidth in TS 38.101-1 [11] Table 5.3.2-1 for FR1 and TS 38.101-2 [10] Table 5.3.2-1 for FR2.
- *supportedCP-TypeFor60kHzSCS*: Indicates the supported CP type for 60 kHz SCS.

UE supporting this feature shall also support *sl-PRS-CommonProcCapabilityPerBand*.

sl-PRS-RxInSharedResourcePool
Indicates whether UE supports receiving SL-PRS in shared resource pool and receiving SCI format 2D.
UE supporting this feature shall also support *sl-PRS-CommonProcCapabilityPerBand* and *sl-Reception-r16* defined in TS 38.331 [2].

sl-PRS-TDM-Multiplexing
Indicates whether UE supports TDM-based multiplexing of SL-PRS reception from different UEs in the same slot in dedicated resource pool.
UE supporting this feature shall also support *sl-PRS-RxInDedicatedResourcePool*.

sl-PRS-TxForBandWithSL-CA
Indicates whether UE supports SL PRS transmission in a single carrier for a shared SL PRS resource pool and/or a dedicated SL PRS resource pool for a band configured with SL CA.
A UE that supports this feature shall also support *sl-CA-Communication-r18*, defined in TS 38.331 [2] and one of *sl-PRS-TxInSharedResourcePool, sl-PRS-TxScheme1InDedicatedResourcePool,* or *sl-PRS-TxScheme2InDedicatedResourcePool*.
NOTE 1: In a shared SL PRS resource pool in a single SL carrier: Tx power control follows the rule defined for SL CA in NR Rel-18.
NOTE 2: In a dedicated SL PRS resource pool in a single SL carrier when the slots (pre)configured for the dedicated SL PRS resource pool do not collide with the slots (pre)configured for any other resource pool or S-SSB resource(s) in other carriers.

sl-PRS-TxInSharedResourcePool
Indicates whether UE supports transmitting SL-PRS in a shared resource pool, and is comprised of the following functional components:
- Support transmitting SL-PRS in shared resource pool;
- Support transmitting SCI format 2D;
- Support downlink pathloss based open loop power control.

The supported resource allocation modes are the same as for communication and signaled in *sl-TransmissionMode1-r16* and *sl-TransmissionMode2-r16* defined in TS 38.331 [2].
UE supporting this feature shall also support *sl-TransmissionMode1-r16* or *sl-TransmissionMode2-r16* defined in TS 38.331 [2], and *sl-PRS-RxInSharedResourcePool*.

sl-PRS-TxScheme1InDedicatedResourcePool Indicates whether UE supports transmitting SL-PRS scheme 1 in a dedicated resource pool, and is comprised of the following functional components: - Support transmitting SL-PRS and PSCCH within a slot without PSSCH in dedicated resource pool; - Support transmitting SL-PRS according to the mapping rule between PSCCH and SL-PRS; - Support transmitting SCI format 1B; - Support receiving DCI format 3_2; - Support downlink pathloss based open loop power control of SL-PRS (NOTE 1). UE supporting this feature shall also support *sl-PRS-RxInDedicatedResourcePool*. NOTE 1: It is not required to be supported in a band indicated with only the PC5 interface in TS 38.101-1 [11] Table 5.2E.1-1.
sl-PRS-TxScheme2InDedicatedResourcePool Indicates whether UE supports transmitting SL-PRS scheme 2 in a dedicated resource pool, and is comprised of the following functional components: - Support transmitting SL-PRS and PSCCH within a slot without PSSCH in dedicated resource pool; - Support transmitting SL-PRS according to the mapping rule between PSCCH and SL-PRS; - Support transmitting SCI format 1B. UE supporting this feature shall also support at least one of *sl-PRS-TxRandomSelection-r18* or *sl-PRS-TxUsingFullSensing-r18* defined in TS 38.331 [2].

– *CommonSL-PRS-MethodsIEsRequestAssistanceData*

```
-- ASN1START
-- TAG-COMMONSL-PRS-METHODSIESREQUESTASSISTANCEDATA-START

CommonSL-PRS-MethodsIEsRequestAssistanceData ::= SEQUENCE {
    sl-PRS-AssistanceDataInfoReq                    BIT STRING { sl-PRS-SequenceID-Req    (0),
                                                                 anchorUE-LocationInfoReq (1),
                                                                 arp-LocationInfoReq      (2),
                                                                 sl-POS-ARP-ID-Tx-Req     (3)
    }    (SIZE (1..8))                                                                        OPTIONAL,
    ...
}
-- TAG-COMMONSL-PRS-METHODSIESREQUESTASSISTANCEDATA-STOP
-- ASN1STOP
```

***CommonSL-PRS-MethodsIEsRequestAssistanceData* field descriptions**
sl-PRS-AssistanceDataInfoReq This field indicates the SL PRS Assistance Data requested. - bit 0 indicates whether the field *sl-PRS-SequenceID* in IE *CommonSL-PRS-MethodsIEsProvideAssistanceData* is requested or not; - bit 1 indicates whether the field *anchorUE-LocationInformation* in IE *CommonSL-PRS-MethodsIEsProvideAssistanceData* is requested or not; - bit 2 indicates whether the field *arp-LocationInfo* in IE *CommonSL-PRS-MethodsIEsProvideAssistanceData* is requested or not; - bit 3 indicates whether the field *sl-POS-ARP-ID-Tx* in IE *CommonSL-PRS-MethodsIEsProvideAssistanceData* is requested or not.

– *CommonSL-PRS-MethodsIEsProvideAssistanceData*

```
-- ASN1START
-- TAG-COMMONSL-PRS-METHODSIESPROVIDEASSISTANCEDDATA-START
```

```
CommonSL-PRS-MethodsIEsProvideAssistanceData ::= SEQUENCE {
    sl-PRS-AssistanceDataInfo                       SEQUENCE (SIZE (1..maxNrOfUEs)) OF SL-PRS-AssistanceData              OPTIONAL,
    sl-PRS-Error                                    SL-PRS-AssistanceDataError                                            OPTIONAL,
    ...
}

SL-PRS-AssistanceData ::= SEQUENCE {
    applicationLayerID            OCTET STRING,
    sl-PRS-SequenceID             INTEGER(0..4095)              OPTIONAL,  -- SL PRS sequence ID for transmitting SL-PRS
    anchorUE-LocationInformation  AnchorLocationCoordinates     OPTIONAL,
    arp-LocationInfo              ARP-LocationInfo              OPTIONAL,
    sl-PRS-TxInfo                 SL-PRS-TxInfo                 OPTIONAL,
    sl-POS-ARP-ID-Tx              SL-POS-ARP-ID-Tx-InfoList     OPTIONAL,
    ...
}

AnchorLocationCoordinates ::= CHOICE {
    ellipsoidPoint                                      EllipsoidPoint,
    ellipsoidPointWithUncertaintyEllipse                EllipsoidPointWithUncertaintyEllipse,
    ellipsoidPointWithAltitude                          EllipsoidPointWithAltitude,
    ellipsoidPointWithAltitudeAndUncertaintyEllipsoid   EllipsoidPointWithAltitudeAndUncertaintyEllipsoid
}

ARP-LocationInfo ::= SEQUENCE {
    referencePoint         ReferencePoint           OPTIONAL,
    arp-LocationInfoList   SEQUENCE (SIZE (1..4)) OF ARP-LocationInfoElement
}

ReferencePoint ::= CHOICE {
    location2D                          EllipsoidPointWithUncertaintyEllipse,
    location3D                          EllipsoidPointWithAltitudeAndUncertaintyEllipsoid
}

ARP-LocationInfoElement ::= SEQUENCE {
    sl-PRS-ARP-ID               INTEGER (1..4),
    arp-LocationInfo            RelativeLocation
}

RelativeLocation ::= SEQUENCE {
    milliArcSecondUnits  ENUMERATED { mas0-03, mas0-3, mas3, mas30},
    heightUnits          ENUMERATED { mm, cm, m, spare1},
    deltaLatitude        DeltaLatitude,
    deltaLongitude       DeltaLongitude,
    deltaHeight          DeltaHeight,
    locationUNC          LocationUncertainty                          OPTIONAL
}

DeltaLatitude ::= SEQUENCE {
    deltaLatitude        INTEGER (-1024..1023),
    coarseDeltaLatitude  INTEGER (0..4095)        OPTIONAL
}

DeltaLongitude ::= SEQUENCE {
    deltaLongitude        INTEGER (-1024..1023),
```

```
    coarseDeltaLongitude  INTEGER (0..4095)        OPTIONAL
}

DeltaHeight ::= SEQUENCE {
    deltaHeight        INTEGER (-1024..1023),
    coarseDeltaHeight  INTEGER (0..4095)        OPTIONAL
}

LocationUncertainty ::= SEQUENCE {
    horizontalUncertainty    INTEGER (0..255),
    horizontalConfidence     INTEGER (0..100),
    verticalUncertainty      INTEGER (0..255),
    verticalConfidence       INTEGER (0..100)
}

SL-PRS-AssistanceDataError ::= ENUMERATED { undefined, assistanceDataNotAvailable, ... }

SL-PRS-TxInfo ::=                SEQUENCE {
    sl-PRS-Priority                  INTEGER (1..8)                                                                  OPTIONAL,
    sl-PRS-DelayBudget               INTEGER (0..1023)                                                               OPTIONAL,
    sl-PRS-Bandwidth                 ENUMERATED {mhz5, mhz10, mhz15, mhz20, mhz25, mhz30, mhz35, mhz40,
                                                 mhz45, mhz50, mhz60, mhz70, mhz80, mhz90, mhz100, mhz200, mhz400,
                                                 spare15, spare14, spare13, spare12, spare11, spare10, spare9, spare8,
                                                 spare7, spare6, spare5, spare4, spare3, spare2, spare1}         OPTIONAL,
    sl-PRS-Periodicity               ENUMERATED {ms100, ms200, ms300, ms400, ms500, ms600, ms700, ms800,
                                                ms900, ms1000, spare6, spare5, spare4, spare3, spare2, spare1}   OPTIONAL,
    sl-PRS-Transmission              ENUMERATED {true}                                                               OPTIONAL
}

-- TAG-COMMONSL-PRS-METHODSIESPROVIDEASSISTANCEDDATA-STOP
-- ASN1STOP
```

***CommonSL-PRS-MethodsIEsProvideAssistanceData* field descriptions**
anchorUE-LocationInformation This field provides the location coordinates of an SL Anchor UE identified by *applicationLayerID*.
arp-LocationInfo This field provides the location coordinates of the ARPs of the UE identified by *applicationLayerID*.
applicationLayerID This field provides the application layer ID as defined in TS 23.287 [9] for which the *SL-PRS-AssistanceData* is applicable.
referencePoint This field provides the reference point used to define the location of ARPs provided in the *arp-LocationInfoList*. If this field is absent, the reference point is the same as in the previous entry of the *sl-PRS-AssistanceDataInfo* list.
sl-PRS-ARP-ID This field provides the ARP ID of an ARP. The ARP ID is used to uniquely identify an ARP associated with the UE identified by *applicationLayerID*.
sl-PRS-Bandwidth This field provides the bandwidth of SL-PRS transmission which is used in *UEAssistanceInformation* message as defined in TS 38.331 [2] and the SL-PRS resource request MAC CE as defined in TS 38.321 [15]. Value *mhz5* corresponds to 5 MHz, value *mhz10* corresponds to 10 MHz, and so on.
sl-PRS-DelayBudget This field provides the SL-PRS delay budget which is used in *UEAssistanceInformation* message as defined in TS 38.331 [2] and the resource selection as defined in TS 38.321 [15].
sl-PRS-Error This field provides SL-PRS error reasons.
sl-PRS-Periodicity This field provides the periodicity of SL-PRS which is used in *UEAssistanceInformation* message as defined in TS 38.331 [2]. Value *ms100* corresponds to 100 ms, value *ms200* corresponds to 200 ms, and so on.
sl-PRS-Priority This field provides the priority of SL-PRS which is used in *UEAssistanceInformation* message as defined in TS 38.331 [2] and the resource selection as defined in TS 38.321 [15]. Value 1 is the highest priority whereas value 8 is the lowest priority.
sl-PRS-SequenceID This field specifies the sequence ID used to initialize cinit value used in pseudo random generator for generation of SL PRS sequence for transmission on a given SL PRS Resource, as specified in TS 38.211 [6] for a UE identified by *applicationLayerID*. If a UE does not receive a sequence ID via this SLPP message, the sequence ID is based on the 12 LSB bits CRC of PSCCH associated with the SL PRS.
sl-PRS-Transmission This field, if present, indicates that the UE is requested to start the SL-PRS transmission once the resource is available. If this field is absent, the UE can store the *SL-PRS-TxInfo* for future SL-PRS transmission (e.g., triggered by SCI from a peer UE).

– *CommonSL-PRS-MethodsIEsRequestLocationInformation*

```
-- ASN1START
-- TAG-COMMONSL-PRS-METHODSIESREQUESTLOCATIONINFORMATION-START

CommonSL-PRS-MethodsIEsRequestLocationInformation ::= SEQUENCE {
    sl-POS-ARP-ID-Tx-Req                                ENUMERATED { true }                OPTIONAL,
   ...
}

-- TAG-COMMONSL-PRS-METHODSIESREQUESTLOCATIONINFORMATION-STOP
-- ASN1STOP
```

– *CommonSL-PRS-MethodsIEsProvideLocationInformation*

```
-- ASN1START
-- TAG-COMMONSL-PRS-METHODSIESPROVIDELOCATIONINFORMATION-START

CommonSL-PRS-MethodsIEsProvideLocationInformation ::= SEQUENCE {
    sl-POS-ARP-ID-Tx                                    SL-POS-ARP-ID-Tx-InfoList           OPTIONAL,
    sl-PRS-Error                                        SL-PRS-LocationInformationError     OPTIONAL,
    ...
}

SL-POS-ARP-ID-Tx-InfoList ::= SEQUENCE (SIZE (1..4)) OF SL-POS-ARP-ID-Tx-Info

SL-POS-ARP-ID-Tx-Info ::= SEQUENCE {
    sl-POS-ARP-ID                       INTEGER (1..4),
    sl-PRS-ResourceIdList-Tx            SEQUENCE (SIZE(1..16)) OF SL-PRS-ResourceId-Tx
}

SL-PRS-LocationInformationError ::= ENUMERATED { undefined, ... }

SL-PRS-ResourceId-Tx ::= SEQUENCE {
    sl-PRS-ResourceId       INTEGER (0..16)                 OPTIONAL,
    tx-TimeStamp            SL-TimeStamp
}

-- TAG-COMMONSL-PRS-METHODSIESPROVIDELOCATIONINFORMATION-STOP
-- ASN1STOP
```

– *End of SLPP-PDU-CommonSL-PRS-MethodsContents*

```
-- ASN1START

END

-- ASN1STOP
```

6.7 SLPP PDU SL-AoA Contents

– *SLPP-PDU-SL-AoA-Contents*

This ASN.1 segment is the start of the SLPP PDU SL-AoA Contents definitions.

```
-- ASN1START
-- TAG-SLPP-PDU-SL-AOA-CONTENTS-START
```

```
SLPP-PDU-SL-AoA-Contents DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS
    LCS-GCS-Translation,
    LOS-NLOS-Indicator,
    PositioningModes,
    SL-TimeStamp,
    SL-TimingQuality,
    maxNrOfUEs,
    ScheduledLocationTimeSupportPerMode,
    nrMaxBands
FROM
    SLPP-PDU-Definitions

    LocationCoordinateTypes,
    VelocityTypes
FROM
    SLPP-PDU-CommonContents;

-- TAG-SLPP-PDU-SL-AOA-CONTENTS-STOP
-- ASN1STOP
```

– *SL-AoA-RequestCapabilities*

```
-- ASN1START
-- TAG-SL-AOA-REQUESTCAPABILITIES-START

SL-AoA-RequestCapabilities ::= SEQUENCE {
    ...
}

-- TAG-SL-AOA-REQUESTCAPABILITIES-STOP
-- ASN1STOP
```

– *SL-AoA-ProvideCapabilities*

The IE *SL-AoA-ProvideCapabilities* is used to indicate the support of SL-AoA and to provide SL-AoA positioning capabilities.

```
-- ASN1START
-- TAG-SL-AOA-PROVIDECAPABILITIES-START

SL-AoA-ProvideCapabilities ::= SEQUENCE {
    positioningModes                    PositioningModes,
    tenMsUnitResponseTime               PositioningModes                          OPTIONAL,
    periodicalReporting                 PositioningModes                          OPTIONAL,
    scheduledLocationRequestSupported   ScheduledLocationTimeSupportPerMode       OPTIONAL,
```

```
    locationCoordinateTypes             LocationCoordinateTypes                     OPTIONAL,
    velocityTypes                       VelocityTypes                               OPTIONAL,
    sl-AoA-CapabilityBandList           SEQUENCE (SIZE (1..nrMaxBands)) OF SL-AoA-CapabilityPerBand,
    ...
}

SL-AoA-CapabilityPerBand ::= SEQUENCE {
    --R1 41-1-7g SL PRS measurement for SL AoA
    sl-AoA-Meas                         BIT STRING { gcs (0), lcsWithTranslation (1), lcsWithoutTranslation (2) } (SIZE (1..8))
                                                                                    OPTIONAL,
    measurementsForMultipleARP-IDs-Rx  ENUMERATED { supported }                     OPTIONAL,
    ...
}

-- TAG-SL-AOA-PROVIDECAPABILITIES-STOP
-- ASN1STOP
```

***SL-AoA-ProvideCapabilities* field descriptions**
locationCoordinateTypes This parameter identifies the geographical location coordinate types that a target UE supports for SL-AoA. TRUE indicates that a location coordinate type is supported and FALSE indicates that it is not.
measurementsForMultipleARP-IDs-Rx This field, if present, indicates that the UE supports SL-AoA measurements for multiple SL-PRS Rx ARP-IDs.
periodicalReporting This field, if present, specifies the positioning modes for which the UE supports *periodicalReporting*. This is represented by a bit string, with a one value at the bit position means *periodicalReporting* for the positioning mode is supported; a zero value means not supported. If this field is absent, the UE does not support *periodicalReporting* in IE *CommonIEsRequestLocationInformation*.
positioningModes This field specifies the SL-AoA mode(s) supported by the UE.
scheduledLocationRequestSupported This field, if present, specifies the positioning modes for which the UE supports scheduled location requests, i.e., supports the IE *ScheduledLocationTime* in IE *CommonIEsRequestLocationInformation* and the time base(s) supported for the scheduled location time for each positioning mode. If this field is absent, the UE does not support scheduled location requests.
sl-AoA-Meas Indicates whether UE supports SL PRS measurement for SL-AoA, and is comprised of the following functional components: - Support SL AoA measurement based on SL-PRS; - Support SL AoA measurement reporting types. The value indicates the supported SL AoA measurement reporting types. The left most bit in the bitmap corresponds to GCS, the next bit in the bitmap corresponds to LCS with translation, the right most bit in the bitmap corresponds to LCS without translation. A bit in the bitmap is set to 1 if the corresponding type is supported by the UE. UE supporting this feature shall also support *sl-PRS-CommonProcCapabilityPerBand*.
tenMsUnitResponseTime This field, if present, specifies the positioning modes for which the UE supports the enumerated value '*tenMilliSeconds*' in the IE *ResponseTime* in IE *CommonIEsRequestLocationInformation*. This is represented by a bit string, with a one value at the bit position means '*tenMilliSeconds*' response time unit for the positioning mode is supported; a zero value means not supported. If this field is absent, the UE does not support '*tenMilliSeconds*' response time unit in *CommonIEsRequestLocationInformation*.
velocityTypes This parameter identifies the velocity types that a target UE supports for SL-AoA. TRUE indicates that a velocity type is supported and FALSE indicates that it is not. If this field is absent, velocity reporting is not supported.

– *SL-AoA-RequestAssistanceData*

```
-- ASN1START
-- TAG-SL-AOA-REQUESTASSISTANCEDATA-START

SL-AoA-RequestAssistanceData ::= SEQUENCE {
    expectedSL-ElevationAoA-AndUncertainty          ENUMERATED { true}                          OPTIONAL,
    ...
}
-- TAG-SL-AOA-REQUESTASSISTANCEDATA-STOP
-- ASN1STOP
```

– *SL-AoA-ProvideAssistanceData*

```
-- ASN1START
-- TAG-SL-AOA-PROVIDEASSISTANCEDATA-START

SL-AoA-ProvideAssistanceData ::= SEQUENCE {
    sl-AoA-AssistanceDataInfo        SEQUENCE (SIZE (1..maxNrOfUEs)) OF SL-AoA-AssistanceData     OPTIONAL,
    sl-AoA-Error                     SL-AoA-AssistanceDataError                                   OPTIONAL,
    ...
}

SL-AoA-AssistanceData ::= SEQUENCE {
    applicationLayerID                          OCTET STRING,
    expectedSL-AoA                              SEQUENCE {
        expectedSL-AzimuthAoA                       INTEGER(0..3599),                 -- expected-SL-AoA-and-Uncertainty
        expectedSL-AzimuthAoA-Uncertainty           INTEGER (0..60)         OPTIONAL,
        expectedSL-ElevationAoA                     INTEGER(0..1800)        OPTIONAL,  -- expected-SL-AoA-and-Uncertainty
        expectedSL-ElevationAoA-Uncertainty         INTEGER(0..30)          OPTIONAL
    },
    lcs-GCS-TranslationParameter                LCS-GCS-Translation         OPTIONAL,
    ...
}

SL-AoA-AssistanceDataError ::= ENUMERATED { undefined, assistanceDataNotAvailable, ... }

-- TAG-SL-AoA-PROVIDEASSISTANCEDATA-STOP
-- ASN1STOP
```

***SL-AoA-ProvideAssistanceData* field descriptions**
applicationLayerID This field provides an application layer ID as defined in TS 23.287 [9] which is used to identify a UE.
expectedSL-AzimuthAoA This field specifies expected azimuth angle of arrival. Scale factor 0.1 degree; range 0 to 359.9 degrees.
expectedSL-AzimuthAoA-Uncertainty This field specifies the (single-sided) uncertainty of the expected azimuth angle of arrival. If this field is absent, it indicates maximum uncertainty (60 degrees). Scale factor 1 degree; range 0 to 60 degrees.
expectedSL-ElevationAoA This field specifies expected elevation angle of arrival. Scale factor 0.1 degree; range 0 to 180 degrees.
expectedSL-ElevationAoA-Uncertainty This field specifies expected the (single-sided) uncertainty of the expected elevation angle of arrival. If this field is absent, it indicates maximum uncertainty (30 degrees). Scale factor 1 degree; range 0 to 30 degrees.
lcs-GCS-TranslationParameter This field provides the angles α (bearing angle), β (downtilt angle) and γ (slant angle) for the translation of a Local Coordinate System (LCS) to a Global Coordinate System (GCS) as defined in TR 38.901 [8].
sl-AoA-Error This field provides SL-AoA error reasons.

– *SL-AoA-RequestLocationInformation*

```
-- ASN1START
-- TAG-SL-AOA-REQUESTLOCATIONINFORMATION-START

SL-AoA-RequestLocationInformation ::= SEQUENCE {
    sl-AoA-Request                      ENUMERATED { aoa, zoa, both},
    measurementReportingType            ENUMERATED { gcs, lcsWithTranslation, lcsWithoutTranslation }    OPTIONAL,
    measurementsForMultipleARP-IDs-Rx   SEQUENCE {
        requestedARP-IDs-Rx                 BIT STRING (SIZE (4))                                         OPTIONAL
    }                                                                                                     OPTIONAL,
    sl-ARP-InfoRequest                  ENUMERATED { true }                                               OPTIONAL,
    sl-LOS-NLOS-IndicatorRequest        ENUMERATED { true }                                               OPTIONAL,
    sl-PRS-RSRP-Request                 ENUMERATED { true }                                               OPTIONAL,
    sl-RSRPP-Request                    ENUMERATED { true }                                               OPTIONAL,
    sl-AdditionalPathsRequest           ENUMERATED { true }                                               OPTIONAL,
    ...
}

-- TAG-SL-AOA-REQUESTLOCATIONINFORMATION-STOP
-- ASN1STOP
```

***SL-AoA-RequestLocationInformation* field descriptions**
measurementsForMultipleARP-IDs-Rx This field, if present, indicates that the UE is requested to provide the requested SL-AoA measurements for multiple SL-PRS Rx ARP-IDs.
requestedARP-IDs-Rx This field, if present, indicates that the UE is requested to provide the requested SL-AoA measurements for indicated SL-PRS Rx ARP-IDs. Bit 1 in the bit string indicates ARP-ID = 1, bit 2 indicates ARP-ID = 2, and so on.
sl-AdditionalPathsRequest This field, if present, indicates that the UE is requested to provide *sl-AoA-AdditionalPathList*.
sl-ARP-InfoRequest This field, if present, indicates that the UE is requested to provide *sl-POS-ARP-ID-Rx*.
sl-LOS-NLOS-IndicatorRequest This field, if present, indicates that the UE is requested to provide the estimated *los-NLOS-Indicator*.
sl-PRS-RSRP-Request This field, if present, indicates that the UE is requested to provide *sl-PRS-RSRP-Result*.
sl-RSRPP-Request This field, if present, indicates that the UE is requested to provide sl-RSRPP.

– *SL-AoA-ProvideLocationInformation*

```
-- ASN1START
-- TAG-SL-AOA-PROVIDELOCATIONINFORMATION-START

SL-AoA-ProvideLocationInformation ::= SEQUENCE {
    sl-AoA-SignalMeasurementInformation   SL-AoA-SignalMeasurementInformation    OPTIONAL,
    sl-AoA-Error                          SL-AoA-LocationInformationError        OPTIONAL,
```

```
    ...
}

SL-AoA-SignalMeasurementInformation ::= SEQUENCE {
    sl-AoA-MeasList                       SEQUENCE (SIZE(1.. maxNrOfUEs)) OF SL-AoA-MeasElementPerARP-ID-Rx,
    ...
}

SL-AoA-MeasElementPerARP-ID-Rx ::= SEQUENCE (SIZE(1..4)) OF SL-AoA-MeasElement

SL-AoA-MeasElement ::= SEQUENCE {
    applicationLayerID                    OCTET STRING              OPTIONAL,  -- Cond FirstElement
    sl-LCS-GCS-Translation                LCS-GCS-Translation       OPTIONAL,  -- Cond FirstElement
    los-NLOS-Indicator                    LOS-NLOS-Indicator        OPTIONAL,  -- sl-losNlosIndicator
    sl-AngleQuality                       MeasurementAngleQuality   OPTIONAL,  -- sl-AngleQuality
    sl-AoA-AdditionalPathList             SL-AoA-AdditionalPathList OPTIONAL,
    sl-AzimuthAoA-Result                  INTEGER (0..3599)         OPTIONAL,  -- sl-PRS-AoA
    sl-POS-ARP-ID-Rx                      INTEGER (1..4)            OPTIONAL,  -- sl-pos-arpID-Rx
    sl-PRS-ResourceId                     INTEGER (0..16)           OPTIONAL,  -- sl-PRS-ResourceId
    sl-PRS-RSRP-Result                    INTEGER (0..126)          OPTIONAL,  -- sl-PRS-RSRP
    sl-PRS-RSRPP-Result                   INTEGER (0..126)          OPTIONAL,  -- sl-PRS-RSRPP
    sl-TimeStamp                          SL-TimeStamp              OPTIONAL,  -- sl-Timestamp
    sl-ElevationAoA-Result                INTEGER (0..1800)         OPTIONAL,  -- sl-PRS-AoA
    ...
}

SL-AoA-AdditionalPathList ::= SEQUENCE (SIZE(1..2)) OF SL-AoA-AdditionalPath

SL-AoA-AdditionalPath  ::= SEQUENCE {
    sl-AngleQuality                           MeasurementAngleQuality   OPTIONAL,  -- sl-AngleQuality
    sl-AzimuthAoA-AdditionalPathResult        INTEGER (0..3599)         OPTIONAL,  -- additionalPath-SL-PRS-AoA
    sl-ElevationAoA-AdditionalPathResult      INTEGER (0..1800)         OPTIONAL,  -- additionalPath-SL-PRS-AoA
    sl-PRS-AdditionalPathRSRPP-Result         INTEGER (0..126)          OPTIONAL,  -- additionalPath-SL-PRS-RSRPP
    ...
}

MeasurementAngleQuality ::= SEQUENCE {
    azimuthQuality              INTEGER (0..255),
    elevationQuality            INTEGER (0..255)        OPTIONAL
}

SL-AoA-LocationInformationError ::= ENUMERATED { undefined, assistanceDataMissing, notAllRequestedMeasurementsPossible, ... }

-- TAG-SL-AOA-PROVIDELOCATIONINFORMATION-STOP
-- ASN1STOP
```

Conditional presence	Explanation
FirstElement	The field is mandatory present in the first *SL-AoA-MeasElement* in IE *SL-AoA-MeasElementPerARP-ID-Rx*. Otherwise, it is not present.

***SL-AoA-ProvideLocationInformation* field descriptions**
los-NLOS-Indicator This field specifies the UE's best estimate of the LOS or NLOS of the UE measurements (including RSTD, RTOA, RSRP, RSRPP, AoA and UE Rx-Tx time difference).
sl-AngleQuality This field specifies the angle quality for measurement results reported. Scale factor 0.1 degree.
sl-AoA-AdditionalPathList This field specifies the sidelink PRS measurements based on additional path of arrival.
sl-AzimuthAoA-Result This field specifies the first path result of azimuth angle of arrival. Scale factor 0.1 degree; range 0 to 359.9 degrees.
sl-ElevationAoA-Result This field specifies the first path result of elevation angle of arrival. Scale factor 0.1 degree; range 0 to 180 degrees.
sl-LCS-GCS-Translation This field provides the angles α (bearing angle), β (downtilt angle) and γ (slant angle) for the translation of a Local Coordinate System (LCS) to a Global Coordinate System (GCS) as defined in TR 38.901 [8].
sl-POS-ARP-ID-Rx This field indicates ARP ID of an ARP used for reception for per-ARP measurement reporting. The ARP ID is used to uniquely identify an ARP associated with a UE.
sl-PRS-ResourceId This field specifies the sidelink PRS resource ID used for SL positioning measurements.
sl-PRS-RSRP-Result This field specifies the sidelink PRS reference signal received power (RSRP) measurement.
sl-PRS-RSRPP-Result This field specifies the SL-RSRPP measurement based on first path of arrival.
sl-TimeStamp This field specifies the time instance at which the SL-PRS RSRP (if included) measurement is performed.

– End of SLPP-PDU-SL-AoA-Contents

```
-- ASN1START

END

-- ASN1STOP
```

6.8 SLPP PDU SL-RTT Contents

– SLPP-PDU-SL-RTT-Contents

This ASN.1 segment is the start of the SLPP PDU SL-RTT Contents definitions.

```
-- ASN1START
-- TAG-SLPP-PDU-SL-RTT-CONTENTS-START

SLPP-PDU-SL-RTT-Contents DEFINITIONS AUTOMATIC TAGS ::=
```

```
BEGIN

IMPORTS
    LOS-NLOS-Indicator,
    PositioningModes,
    SL-TimeStamp,
    SL-TimingQuality,
    maxNrOfUEs,
    ScheduledLocationTimeSupportPerMode,
    nrMaxBands

FROM
    SLPP-PDU-Definitions

    LocationCoordinateTypes,
    VelocityTypes

FROM
    SLPP-PDU-CommonContents;

-- TAG-SLPP-PDU-SL-RTT-CONTENTS-STOP
-- ASN1STOP
```

– *SL-RTT-RequestCapabilities*

```
-- ASN1START
-- TAG-SL-RTT-REQUESTCAPABILITIES-START

SL-RTT-RequestCapabilities ::= SEQUENCE {
    ...
}

-- TAG-SL-RTT-REQUESTCAPABILITIES-STOP
-- ASN1STOP
```

– *SL-RTT-ProvideCapabilities*

The IE *SL-RTT-ProvideCapabilities* is used to indicate the support of SL-RTT and to provide SL-RTT positioning capabilities.

```
-- ASN1START
-- TAG-SL-RTT-PROVIDECAPABILITIES-START

SL-RTT-ProvideCapabilities ::= SEQUENCE {
    positioningModes                    PositioningModes,
    tenMsUnitResponseTime               PositioningModes                        OPTIONAL,
    periodicalReporting                 PositioningModes                        OPTIONAL,
    scheduledLocationRequestSupported   ScheduledLocationTimeSupportPerMode     OPTIONAL,
    locationCoordinateTypes             LocationCoordinateTypes                 OPTIONAL,
```

```
    velocityTypes                       VelocityTypes                               OPTIONAL,
    sl-RTT-CapabilityBandList           SEQUENCE (SIZE (1..nrMaxBands)) OF SL-RTT-CapabilityPerBand,
    ...
}

SL-RTT-CapabilityPerBand ::= SEQUENCE {
    --R1 41-1-7c SL PRS measurement for UE Rx–Tx time difference without Tx time stamp
    sl-PRS-RxTxTimeDiffWithoutTxTimeStamp ENUMERATED {n1,n2,n3,n4}                      OPTIONAL,
    --R1 41-1-7d SL PRS measurement for UE Rx–Tx time difference with Tx time stamp
    sl-PRS-RxTxTimeDiffWithTxTimeStamp    SEQUENCE {
        numOfMeasForSameSL-PRS              ENUMERATED {n1,n2,n3,n4},
        maxMeasReportingForDiffSL-PRS       ENUMERATED {n1,n2,n3,n4}
    }                                                                               OPTIONAL,
    measurementsForMultipleARP-IDs-Rx     ENUMERATED { supported }                  OPTIONAL,
...
}

-- TAG-SL-RTT-PROVIDECAPABILITIES-STOP
-- ASN1STOP
```

***SL-RTT-ProvideCapabilities* field descriptions**
locationCoordinateTypes
This parameter identifies the geographical location coordinate types that a target UE supports for SL-RTT. TRUE indicates that a location coordinate type is supported and FALSE that it is not.
measurementsForMultipleARP-IDs-Rx
This field, if present, indicates that the UE supports SL-RTT measurements for multiple SL-PRS Rx ARP-IDs.
periodicalReporting
This field, if present, specifies the positioning modes for which the UE supports *periodicalReporting*. This is represented by a bit string, with a one value at the bit position means *periodicalReporting* for the positioning mode is supported; a zero value means not supported. If this field is absent, the UE does not support *periodicalReporting* in IE *CommonIEsRequestLocationInformation*.
positioningModes
This field specifies the SL-RTT mode(s) supported by the UE.
scheduledLocationRequestSupported
This field, if present, specifies the positioning modes for which the UE supports scheduled location requests, i.e., supports the IE *ScheduledLocationTime* in IE *CommonIEsRequestLocationInformation* and the time base(s) supported for the scheduled location time for each positioning mode. If this field is absent, the UE does not support scheduled location requests.
sl-PRS-RxTxTimeDiffWithoutTxTimeStamp
Indicates whether UE supports SL PRS measurement for UE Rx–Tx time difference without Tx time stamp, and is comprised of the following functional components: - Support UE Rx–Tx time difference measurement based on SL PRS; - Support UE Rx–Tx time difference measurement reporting without Tx time stamp. The value indicates the supported maximum number of Rx-Tx measurement reporting for different SL-PRS reception for the same pair of UEs. UE supporting this feature shall also support *sl-PRS-CommonProcCapabilityPerBand*, and at least one of *sl-PRS-TxInSharedResourcePool*, *sl-PRS-TxScheme1InDedicatedResourcePool* or *sl-PRS-TxScheme2InDedicatedResourcePool*.
sl-PRS-RxTxTimeDiffWithTxTimeStamp
Indicates whether UE supports SL PRS measurement for UE Rx–Tx time difference with Tx time stamp, and is comprised of the following functional components: - Support UE Rx–Tx time difference measurement based on SL PRS; - Support UE Rx–Tx time difference measurement reporting with Tx time stamp; This field comprises the following sub-fields: - *numOfMeasForSameSL-PRS*: indicates the reported number of Rx-Tx measurements for the same SL-PRS transmission (or reception) and different SL-PRS reception (or transmission) for the same pair of UEs; - *maxMeasReportingForDiffSL-PRS*: indicates the supported maximum number of Rx-Tx measurement reporting for different SL-PRS reception for the same pair of UEs. UE supporting this feature shall also support *sl-PRS-CommonProcCapabilityPerBand*, and at least one of *sl-PRS-TxInSharedResourcePool*, *sl-PRS-TxScheme1InDedicatedResourcePool* or *sl-PRS-TxScheme2InDedicatedResourcePool*.
tenMsUnitResponseTime
This field, if present, specifies the positioning modes for which the UE supports the enumerated value '*tenMilliSeconds*' in the IE *ResponseTime* in IE *CommonIEsRequestLocationInformation*. This is represented by a bit string, with a one value at the bit position means '*tenMilliSeconds*' response time unit for the positioning mode is supported; a zero value means not supported. If this field is absent, the UE does not support '*tenMilliSeconds*' response time unit in *CommonIEsRequestLocationInformation*.
velocityTypes
This parameter identifies the velocity types that a target UE supports for SL-RTT. TRUE indicates that a velocity type is supported and FALSE that it is not. If this field is absent, velocity reporting is not supported.

– *SL-RTT-RequestAssistanceData*

```
-- ASN1START
```

```
-- TAG-SL-RTT-REQUESTASSISTANCEDATA-START

SL-RTT-RequestAssistanceData ::= SEQUENCE {
    ...
}
-- TAG-SL-RTT-REQUESTASSISTANCEDATA-STOP
-- ASN1STOP
```

– *SL-RTT-ProvideAssistanceData*

```
-- ASN1START
-- TAG-SL-RTT-PROVIDEASSISTANCEDATA-START

SL-RTT-ProvideAssistanceData ::= SEQUENCE {
    ...
}

-- TAG-SL-RTT-PROVIDEASSISTANCEDATA-STOP
-- ASN1STOP
```

– *SL-RTT-RequestLocationInformation*

```
-- ASN1START
-- TAG-SL-RTT-REQUESTLOCATIONINFORMATION-START

SL-RTT-RequestLocationInformation ::= SEQUENCE {
    sl-ARP-InfoRequest                  ENUMERATED { true }             OPTIONAL,
    sl-LOS-NLOS-IndicatorRequest        ENUMERATED { true }             OPTIONAL,
    sl-PRS-RSRP-Request                 ENUMERATED { true }             OPTIONAL,
    sl-RSRPP-Request                    ENUMERATED { true }             OPTIONAL,
    sl-AdditionalPathsRequest           ENUMERATED { true }             OPTIONAL,
    tx-TimeInfoRequest                  ENUMERATED { true }             OPTIONAL,
    multipleSL-PRS-RxTxTimeDiffRequest  SEQUENCE {
        diffSL-PRS-Receptions               ENUMERATED { n2, n3, n4 }   OPTIONAL,
        diffSL-PRS-Transmissions            ENUMERATED { n2, n3, n4 }   OPTIONAL
    }                                                                   OPTIONAL,
    measurementsForMultipleARP-IDs-Rx   SEQUENCE {
        requestedARP-IDs-Rx                 BIT STRING (SIZE (4))       OPTIONAL
    }                                                                   OPTIONAL,
associatedSL-PRS-TxTimeStampRequest   ENUMERATED { true }            OPTIONAL,
    ...
}

-- TAG-SL-RTT-REQUESTLOCATIONINFORMATION-STOP
-- ASN1STOP
```

***SL-RTT-RequestLocationInformation* field descriptions**
associatedSL-PRS-TxTimeStampRequest This field, if present, indicates that the UE is requested to provide the associated SL PRS transmission time stamp.
measurementsForMultipleARP-IDs-Rx This field, if present, indicates that the UE is requested to provide the requested SL-RTT measurements for multiple SL-PRS Rx ARP-IDs.
multipleSL-PRS-RxTxTimeDiffRequest This field, if present, indicates that the UE is requested to provide multiple Rx-Tx measurements for the same SL PRS transmission (resp. reception) and up to N different SL PRS receptions (resp. transmissions) for the same pair of UE(s). Fields are as follows: - ***diffSL-PRS-Receptions*** indicates that the UE is requested to provide multiple Rx-Tx measurements for the same SL PRS transmission and up to N different SL PRS receptions. - ***diffSL-PRS-Transmissions*** indicates that the UE is requested to provide multiple Rx-Tx measurements for the same SL PRS transmission and up to N different SL PRS transmissions.
requestedARP-IDs-Rx This field, if present, indicates that the UE is requested to provide the requested SL-RTT measurements for indicated SL-PRS Rx ARP-IDs. Bit 1 in the bit string indicates ARP-ID = 1, bit 2 indicates ARP-ID = 2, and so on.
sl-AdditionalPathsRequest This field, if present, indicates that the UE is requested to provide *sl-RTT-AdditionalPathList*.
sl-ARP-InfoRequest This field, if present, indicates that the UE is requested to provide *sl-POS-ARP-ID-Rx*.
sl-RSRPP-Request This field, if present, indicates that the UE is requested to provide *sl-RSRPP*.
sl-LOS-NLOS-IndicatorRequest This field, if present, indicates that the UE is requested to provide the estimated *los-NLOS-Indicator*.
sl-PRS-RSRP-Request This field, if present, indicates that the UE is requested to provide *sl-PRS-RSRP-Result*.

– *SL-RTT-ProvideLocationInformation*

```
-- ASN1START
-- TAG-SL-RTT-PROVIDELOCATIONINFORMATION-START

SL-RTT-ProvideLocationInformation ::= SEQUENCE {
    sl-RTT-SignalMeasurementInformation   SL-RTT-SignalMeasurementInformation    OPTIONAL,
    sl-RTT-Error                          SL-RTT-LocationInformationError        OPTIONAL,
    ...
}

SL-RTT-MeasElementPerARP-ID-Rx ::= SEQUENCE (SIZE(1..4)) OF SL-RTT-MeasElement

SL-RTT-SignalMeasurementInformation ::= SEQUENCE {
    sl-RTT-MeasList                       SEQUENCE (SIZE(1..maxNrOfUEs)) OF SL-RTT-MeasElementPerARP-ID-Rx,
    ...
}

SL-RTT-MeasElement ::= SEQUENCE {
    applicationLayerID                    OCTET STRING             OPTIONAL,  -- Cond FirstElement
    los-NLOS-Indicator                    LOS-NLOS-Indicator       OPTIONAL,  -- sl-losNlosIndicator
    sl-POS-ARP-ID-Rx                      INTEGER (1..4)           OPTIONAL,  -- sl-pos-arpID-Rx
```

```
    sl-PRS-RxTxTimeDiffMeasResult         SL-PRS-RxTxTimeDiffMeasResult,
    ...
}

SL-PRS-RxTxTimeDiffMeasResult ::= CHOICE {
    single-SL-PRS-RxTxTimeDiff        SL-PRS-RxTxTimeDiffResult,
    multiple-SL-PRS-RxTxTimeDiff          SEQUENCE {
        sameSL-PRS-TxAndDiffSL-PRS-Rx         SEQUENCE (SIZE (2..4)) OF SL-PRS-RxTxTimeDiffResult    OPTIONAL,
        sameSL-PRS-RxAndDiffSL-PRS-Tx         SEQUENCE (SIZE (2..4)) OF SL-PRS-RxTxTimeDiffResult    OPTIONAL
    },
    ...
}

SL-PRS-RxTxTimeDiffResult ::= SEQUENCE {
    sl-PRS-ResourceId             INTEGER (0..16)              OPTIONAL,  -- sl-PRS-ResourceId
    sl-PRS-RxTxTimeDiffResult         CHOICE {
        k0                                INTEGER (0..1970049),
        k1                                INTEGER (0..985025),
        k2                                INTEGER (0..492513),
        k3                                INTEGER (0..246257),
        k4                                INTEGER (0..123129),
        k5                                INTEGER (0..61565)
    }                                                          OPTIONAL,  -- sl-PRS-RxTxTimeDiff
    sl-PRS-RSRP-Result            INTEGER (0..126)             OPTIONAL,  -- sl-PRS-RSRP
    sl-PRS-RSRPP-Result           INTEGER (0..126)             OPTIONAL,  -- sl-PRS-RSRPP
    sl-RTT-AdditionalPathList     SL-RTT-AdditionalPathList    OPTIONAL,
    sl-TimeStamp                  SL-TimeStamp                 OPTIONAL,  -- sl-Timestamp
    sl-TimingQuality              SL-TimingQuality             OPTIONAL,  -- sl-TimingQuality
    tx-TimeInfo                   SL-TimeStamp                 OPTIONAL,  -- tx-Time-Info
    ...

}

SL-RTT-AdditionalPathList ::= SEQUENCE (SIZE(1..8)) OF SL-RTT-AdditionalPath

SL-RTT-AdditionalPath  ::= SEQUENCE {
    sl-PRS-RxTxTimeDiffAdditionalPathResult    CHOICE {
        k0                                        INTEGER (0..8191),
        k1                                        INTEGER (0..4095),
        k2                                        INTEGER (0..2047),
        k3                                        INTEGER (0..1023),
        k4                                        INTEGER (0..511),
        k5                                        INTEGER (0..255)
    }                                                                  OPTIONAL,  -- additionalPath-SL-PRS-Rx-Tx-TimeDiff
    sl-PRS-AdditionalPathRSRPP-Result         INTEGER (0..126)         OPTIONAL,  -- additionalPath-SL-PRS-RSRPP
    sl-TimingQuality                          SL-TimingQuality         OPTIONAL,  -- sl-TimingQuality
    ...
}

SL-RTT-LocationInformationError ::= ENUMERATED { undefined, assistanceDataMissing, notAllRequestedMeasurementsPossible, ... }

-- TAG-SL-RTT-PROVIDELOCATIONINFORMATION-STOP
-- ASN1STOP
```

Conditional presence	Explanation
FirstElement	The field is mandatory present in the first *SL-RTT-MeasElement* in IE *SL-RTT-MeasElementPerARP-ID-Rx*. Otherwise, it is not present.

***SL-RTT-ProvideLocationInformation* field descriptions**
los-NLOS-Indicator This field specifies the UE's best estimate of the LOS or NLOS of the UE measurements (including RSTD, RTOA, RSRP, RSRPP, AoA and UE Rx-Tx time difference).
sl-POS-ARP-ID-Rx This field indicates ARP ID of an ARP used for reception for per-ARP measurement reporting. The ARP ID is used to uniquely identify an ARP associated with a UE.
sl-PRS-ResourceId This field specifies the sidelink PRS resource ID used for SL positioning measurements.
sl-PRS-RSRP-Result This field specifies the sidelink PRS reference signal received power (RSRP) measurement.
sl-PRS-RSRPP-Result This field specifies the SL-RSRPP measurement based on first path of arrival.
sl-PRS-RxTxTimeDiffResult This field specifies SL Rx-Tx time difference measurement based on first path of arrival. The mapping of the field is defined in TS 38.133 [13].
sl-RTT-AdditionalPathList This field specifies the sidelink PRS measurements based on additional path of arrival.
sl-RTT-Error This field provides SL-RTT error reasons.
sl-TimeStamp This field specifies the time instance at which the SL Rx-Tx time difference and SL-PRS RSRP (if included) measurement is performed.
tx-TimeInfo This field specifies the transmission timestamp of the SL-PRS, referred to as T_{UE-TX} in clause 5.1.40 in TS 38.215 [16].

– End of SLPP-PDU-SL-RTT-Contents

```
-- ASN1START

END

-- ASN1STOP
```

6.9 SLPP PDU SL-TDOA Contents

– SLPP-PDU-SL-TDOA-Contents

This ASN.1 segment is the start of the SLPP PDU SL-TDOA Contents definitions.

```
-- ASN1START
-- TAG-SLPP-PDU-SL-TDOA-CONTENTS-START
```

```
SLPP-PDU-SL-TDOA-Contents DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS
    LOS-NLOS-Indicator,
    PositioningModes,
    SL-RTD-Info,
    SL-TimeStamp,
    SL-TimingQuality,
    maxNrOfUEs,
    ScheduledLocationTimeSupportPerMode,
    nrMaxBands

FROM
    SLPP-PDU-Definitions

    LocationCoordinateTypes,
    VelocityTypes

FROM
    SLPP-PDU-CommonContents;

-- TAG-SLPP-PDU-SL-TDOA-CONTENTS-STOP
-- ASN1STOP
```

– *SL-TDOA-RequestCapabilities*

```
-- ASN1START
-- TAG-SL-TDOA-REQUESTCAPABILITIES-START

SL-TDOA-RequestCapabilities ::= SEQUENCE {
    ...
}

-- TAG-SL-TDOA-REQUESTCAPABILITIES-STOP
-- ASN1STOP
```

– *SL-TDOA-ProvideCapabilities*

The IE *SL-TDOA-ProvideCapabilities* is used to indicate the support of SL-TDOA and to provide SL-TDOA positioning capabilities.

```
-- ASN1START
-- TAG-SL-TDOA-PROVIDECAPABILITIES-START

SL-TDOA-ProvideCapabilities ::= SEQUENCE {
    positioningModes                    PositioningModes,
    tenMsUnitResponseTime               PositioningModes                            OPTIONAL,
```

```
    periodicalReporting                  PositioningModes                              OPTIONAL,
    scheduledLocationRequestSupported    ScheduledLocationTimeSupportPerMode           OPTIONAL,
    locationCoordinateTypes              LocationCoordinateTypes                       OPTIONAL,
    velocityTypes                        VelocityTypes                                 OPTIONAL,
    sl-TDOA-CapabilityBandList           SEQUENCE (SIZE (1..nrMaxBands)) OF SL-TDOA-CapabilityPerBand,
    ...
}

SL-TDOA-CapabilityPerBand ::=      SEQUENCE {
    --R1 41-1-7a    SL PRS measurement for SL-RSTD
    sl-PRS-RSTD-Meas                   ENUMERATED {n1,n2,n3,n4}                      OPTIONAL,
    measurementsForMultipleARP-IDs-Rx  ENUMERATED { supported }                      OPTIONAL,
    ...
}

-- TAG-SL-TDOA-PROVIDECAPABILITIES-STOP
-- ASN1STOP
```

***SL-TDOA-ProvideCapabilities* field descriptions**
locationCoordinateTypes This parameter identifies the geographical location coordinate types that a target UE supports for SL-TDOA. TRUE indicates that a location coordinate type is supported and FALSE that it is not.
measurementsForMultipleARP-IDs-Rx This field, if present, indicates that the UE supports SL-TDOA measurements for multiple SL-PRS Rx ARP-IDs.
periodicalReporting This field, if present, specifies the positioning modes for which the UE supports *periodicalReporting*. This is represented by a bit string, with a one value at the bit position means *periodicalReporting* for the positioning mode is supported; a zero value means not supported. If this field is absent, the UE does not support *periodicalReporting* in IE *CommonIEsRequestLocationInformation*.
positioningModes This field specifies the SL-TDOA mode(s) supported by the UE.
scheduledLocationRequestSupported This field, if present, specifies the positioning modes for which the UE supports scheduled location requests, i.e., supports the IE *ScheduledLocationTime* in IE *CommonIEsRequestLocationInformation* and the time base(s) supported for the scheduled location time for each positioning mode. If this field is absent, the UE does not support scheduled location requests.
sl-PRS-RSTD-Meas Indicates whether UE supports SL PRS measurement for SL-RSTD, and is comprised of the following functional components: - Support SL RSTD measurement based on SL-PRS; - Support SL RSTD measurement reporting; The value indicates the supported maximum number of SL RSTD measurement reporting for different SL-PRS reception for the same pair of UEs. UE supporting this feature shall also support *sl-PRS-CommonProcCapabilityPerBand*.
tenMsUnitResponseTime This field, if present, specifies the positioning modes for which the UE supports the enumerated value '*tenMilliSeconds*' in the IE *ResponseTime* in IE *CommonIEsRequestLocationInformation*. This is represented by a bit string, with a one value at the bit position means '*tenMilliSeconds*' response time unit for the positioning mode is supported; a zero value means not supported. If this field is absent, the UE does not support '*tenMilliSeconds*' response time unit in *CommonIEsRequestLocationInformation*.
velocityTypes This parameter identifies the velocity types that a target UE supports for SL-TDOA. TRUE indicates that a velocity type is supported and FALSE that it is not. If this field is absent, velocity reporting is not supported.

– *SL-TDOA-RequestAssistanceData*

```
-- ASN1START
-- TAG-SL-TDOA-REQUESTASSISTANCEDATA-START

SL-TDOA-RequestAssistanceData ::= SEQUENCE {
    sl-RTD-InfoRequest                ENUMERATED { true}                  OPTIONAL,
    ...
}
-- TAG-SL-TDOA-REQUESTASSISTANCEDATA-STOP
-- ASN1STOP
```

***SL-TDOA-RequestAssistanceData* field descriptions**
sl-RTD-InfoRequest
This field indicates that the SL RTD information is requested.

– *SL-TDOA-ProvideAssistanceData*

```
-- ASN1START
-- TAG-SL-TDOA-PROVIDEASSISTANCEDATA-START

SL-TDOA-ProvideAssistanceData ::= SEQUENCE {
    sl-RTD-Info                         SL-RTD-Info                                         OPTIONAL,
    sl-TDOA-Error                       SL-TDOA-AssistanceDataError                         OPTIONAL,
    ...
}

SL-TDOA-AssistanceDataError ::= ENUMERATED { undefined, assistanceDataNotAvailable, ... }

-- TAG-SL-TDOA-PROVIDEASSISTANCEDATA-STOP
-- ASN1STOP
```

***SL-TDOA-ProvideAssistanceData* field descriptions**
sl-RTD-Info
This field provides synchronization information of SL Anchor UEs.
sl-TDOA-Error
This field provides SL-TDOA error reasons.

– *SL-TDOA-RequestLocationInformation*

```
-- ASN1START
-- TAG-SL-TDOA-REQUESTLOCATIONINFORMATION-START

SL-TDOA-RequestLocationInformation ::= SEQUENCE {
    sl-ARP-InfoRequest                  ENUMERATED { true }        OPTIONAL,
    sl-LOS-NLOS-IndicatorRequest        ENUMERATED { true }        OPTIONAL,
    sl-PRS-RSRP-Request                 ENUMERATED { true }        OPTIONAL,
    sl-RSRPP-Request                    ENUMERATED { true }        OPTIONAL,
    sl-AdditionalPathsRequest           ENUMERATED { true }        OPTIONAL,
    measurementsForMultipleARP-IDs-Rx   SEQUENCE {
        requestedARP-IDs-Rx                 BIT STRING (SIZE (4))  OPTIONAL
    }                                                              OPTIONAL,
    ...
}

-- TAG-SL-TDOA-REQUESTLOCATIONINFORMATION-STOP
-- ASN1STOP
```

***SL-TDOA-RequestLocationInformation* field descriptions**
measurementsForMultipleARP-IDs-Rx This field, if present, indicates that the UE is requested to provide the requested SL-TDOA measurements for multiple SL-PRS Rx ARP-IDs.
requestedARP-IDs-Rx This field, if present, indicates that the UE is requested to provide the requested SL-TDOA measurements for indicated SL-PRS Rx ARP-IDs. Bit 1 in the bit string indicates ARP-ID = 1, bit 2 indicates ARP-ID = 2, and so on.
sl-AdditionalPathsRequest This field, if present, indicates that the UE is requested to provide *sl-TDOA-AdditionalPathList*.
sl-ARP-InfoRequest This field, if present, indicates that the UE is requested to provide *sl-POS-ARP-ID-Rx*.
sl-LOS-NLOS-IndicatorRequest This field, if present, indicates that the UE is requested to provide the estimated *los-NLOS-Indicator*.
sl-PRS-RSRP-Request This field, if present, indicates that the UE is requested to provide *sl-PRS-RSRP-Result*.
sl-RSRPP-Request This field, if present, indicates that the UE is requested to provide *sl-RSRPP*.

– *SL-TDOA-ProvideLocationInformation*

```
-- ASN1START
-- TAG-SL-TDOA-PROVIDELOCATIONINFORMATION-START

SL-TDOA-ProvideLocationInformation ::= SEQUENCE {
    sl-RSTD-ReferenceUE-Info              SEQUENCE {
        applicationLayerID                    OCTET STRING
    }                                                                       OPTIONAL,
    sl-TDOA-SignalMeasurementInformation   SL-TDOA-SignalMeasurementInformation    OPTIONAL,
    sl-TDOA-Error                          SL-TDOA-LocationInformationError        OPTIONAL,
    ...
}

SL-TDOA-SignalMeasurementInformation ::= SEQUENCE {
    sl-TDOA-MeasList                        SEQUENCE (SIZE(1..maxNrOfUEs)) OF SL-TDOA-MeasElementPerARP-ID-Rx,
    ...
}

SL-TDOA-MeasElementPerARP-ID-Rx ::= SEQUENCE (SIZE(1..4)) OF SL-TDOA-MeasElement

SL-TDOA-MeasElement ::= SEQUENCE {
    applicationLayerID                  OCTET STRING             OPTIONAL,  -- Cond FirstElement
    los-NLOS-Indicator                  LOS-NLOS-Indicator       OPTIONAL,  -- sl-losNlosIndicator
    sl-POS-ARP-ID-Rx                    INTEGER (1..4)           OPTIONAL,  -- sl-pos-arpID-Rx
    sl-PRS-ResourceId                   INTEGER (0..16)          OPTIONAL,  -- sl-PRS-ResourceId
    sl-PRS-RSRP-Result                  INTEGER (0..126)         OPTIONAL,  -- sl-PRS-RSRP
    sl-PRS-RSRPP-Result                 INTEGER (0..126)         OPTIONAL,  -- sl-PRS-RSRPP
    sl-RSTD-Result                      CHOICE {
        k0                                  INTEGER (0..1970049),
        k1                                  INTEGER (0..985025),
        k2                                  INTEGER (0..492513),
```

```
        k3                                  INTEGER (0..246257),
        k4                                  INTEGER (0..123129),
        k5                                  INTEGER (0..61565)
    }                                                           OPTIONAL,  -- sl-PRS-RSTD
    sl-TDOA-AdditionalPathList          SL-TDOA-AdditionalPathList OPTIONAL,
    sl-TimeStamp                        SL-TimeStamp               OPTIONAL,  -- sl-Timestamp
    sl-TimingQuality                    SL-TimingQuality           OPTIONAL,  -- sl-TimingQuality
    ...
}

SL-TDOA-AdditionalPathList ::= SEQUENCE (SIZE(1..8)) OF SL-TDOA-AdditionalPath

SL-TDOA-AdditionalPath  ::= SEQUENCE {
    sl-RSTD-AdditionalPathResult          CHOICE {
        k0                                  INTEGER (0..1970049),
        k1                                  INTEGER (0..985025),
        k2                                  INTEGER (0..492513),
        k3                                  INTEGER (0..246257),
        k4                                  INTEGER (0..123129),
        k5                                  INTEGER (0..61565)
    }                                                           OPTIONAL,  -- additionalPath-SL-PRS-RSTD
    sl-PRS-AdditionalPathRSRPP-Result      INTEGER (0..126)         OPTIONAL,  -- additionalPath-SL-PRS-RSRPP
    sl-TimingQuality                       SL-TimingQuality         OPTIONAL,  -- sl-TimingQuality
    ...
}

SL-TDOA-LocationInformationError ::= ENUMERATED { undefined, assistanceDataMissing, notAllRequestedMeasurementsPossible, ... }

-- TAG-SL-TDOA-PROVIDELOCATIONINFORMATION-STOP
-- ASN1STOP
```

Conditional presence	Explanation
FirstElement	The field is mandatory present in the first *SL-TDOA-MeasElement* in IE *SL-TDOA-MeasElementPerARP-ID-Rx*. Otherwise, it is not present.

***SL-TDOA-ProvideLocationInformation* field descriptions**
los-NLOS-Indicator This field specifies the UE's best estimate of the LOS or NLOS of the UE measurements (including RSTD, RTOA, RSRP, RSRPP, AoA and UE Rx-Tx time difference).
sl-POS-ARP-ID-Rx This field indicates ARP ID of an ARP used for reception for per-ARP measurement reporting. The ARP ID is used to uniquely identify an ARP associated with a UE.
sl-PRS-ResourceId This field specifies the sidelink PRS resource ID used for SL positioning measurements.
sl-PRS-RSRP-Result This field specifies the sidelink PRS reference signal received power (RSRP) measurement.
sl-PRS-RSRPP-Result This field specifies the SL-RSRPP measurement based on first path of arrival.
sl-TDOA-AdditionalPathList This field specifies the sidelink PRS measurements based on additional path of arrival.
sl-RSTD-Result This field specifies the SL-RSTD measurement based on first path of arrival.
sl-RSTD-ReferenceUE-Info This field indicates reference UE information for SL-PRS based RSTD measurement report.
sl-TimeStamp This field specifies the time instance at which the SL RSTD and SL-PRS RSRP (if included) measurement is performed.

– End of SLPP-PDU-SL-TDOA-Contents

```
-- ASN1START

END

-- ASN1STOP
```

6.10 SLPP PDU SL-TOA Contents

– SLPP-PDU-SL-TOA-Contents

This ASN.1 segment is the start of the SLPP PDU SL-TOA Contents definitions.

```
-- ASN1START
-- TAG-SLPP-PDU-SL-TOA-CONTENTS-START

SLPP-PDU-SL-TOA-Contents DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS
    LOS-NLOS-Indicator,
    PositioningModes,
```

```
    SL-RTD-Info,
    SL-TimeStamp,
    SL-TimingQuality,
    maxNrOfUEs,
    ScheduledLocationTimeSupportPerMode,
    nrMaxBands

FROM
    SLPP-PDU-Definitions

    LocationCoordinateTypes,
    VelocityTypes

FROM
    SLPP-PDU-CommonContents;

-- TAG-SLPP-PDU-SL-TOA-CONTENTS-STOP
-- ASN1STOP
```

– *SL-TOA-RequestCapabilities*

```
-- ASN1START
-- TAG-SL-TOA-REQUESTCAPABILITIES-START

SL-TOA-RequestCapabilities ::= SEQUENCE {
    ...
}

-- TAG-SL-TOA-REQUESTCAPABILITIES-STOP
-- ASN1STOP
```

– *SL-TOA-ProvideCapabilities*

The IE *SL-TOA-ProvideCapabilities* is used to indicate the support of SL-TOA and to provide SL-TOA positioning capabilities.

```
-- ASN1START
-- TAG-SL-TOA-PROVIDECAPABILITIES-START

SL-TOA-ProvideCapabilities ::= SEQUENCE {
    positioningModes                    PositioningModes,
    tenMsUnitResponseTime               PositioningModes                                    OPTIONAL,
    periodicalReporting                 PositioningModes                                    OPTIONAL,
    scheduledLocationRequestSupported   ScheduledLocationTimeSupportPerMode             OPTIONAL,
    locationCoordinateTypes             LocationCoordinateTypes                             OPTIONAL,
    velocityTypes                       VelocityTypes                                       OPTIONAL,
    sl-TOA-CapabilityBandList           SEQUENCE (SIZE (1..nrMaxBands)) OF SL-TOA-CapabilityPerBand,
    ...
}
```

```
SL-TOA-CapabilityPerBand ::= SEQUENCE {
    --R1 41-1-7b SL PRS measurement for SL RTOA
    sl-RTOA-Meas                        ENUMERATED {n1,n2,n3,n4}                    OPTIONAL,
    measurementsForMultipleARP-IDs-Rx   ENUMERATED { supported }                    OPTIONAL,
    ...
}

-- TAG-SL-TOA-PROVIDECAPABILITIES-STOP
-- ASN1STOP
```

***SL-TOA-ProvideCapabilities* field descriptions**
locationCoordinateTypes This parameter identifies the geographical location coordinate types that a target UE supports for SL-TOA. TRUE indicates that a location coordinate type is supported and FALSE that it is not.
measurementsForMultipleARP-IDs-Rx This field, if present, indicates that the UE supports SL-TOA measurements for multiple SL-PRS Rx ARP-IDs.
periodicalReporting This field, if present, specifies the positioning modes for which the UE supports *periodicalReporting*. This is represented by a bit string, with a one value at the bit position means *periodicalReporting* for the positioning mode is supported; a zero value means not supported. If this field is absent, the UE does not support *periodicalReporting* in IE *CommonIEsRequestLocationInformation*.
positioningModes This field specifies the SL-TOA mode(s) supported by the UE.
scheduledLocationRequestSupported This field, if present, specifies the positioning modes for which the UE supports scheduled location requests, i.e., supports the IE *ScheduledLocationTime* in IE *CommonIEsRequestLocationInformation* and the time base(s) supported for the scheduled location time for each positioning mode. If this field is absent, the UE does not support scheduled location requests.
sl-RTOA-Meas Indicates whether UE supports SL PRS measurement for SL-RTOA, and is comprised of the following functional components: - Support SL RTOA measurement based on SL-PRS; - Support SL RTOA measurement reporting. The value indicates the supported maximum number of SL RTOA measurement reporting for different SL-PRS reception for the same pair of UEs. UE supporting this feature shall also support *sl-PRS-CommonProcCapabilityPerBand*.
tenMsUnitResponseTime This field, if present, specifies the positioning modes for which the UE supports the enumerated value '*tenMilliSeconds*' in the IE *ResponseTime* in IE *CommonIEsRequestLocationInformation*. This is represented by a bit string, with a one value at the bit position means '*tenMilliSeconds*' response time unit for the positioning mode is supported; a zero value means not supported. If this field is absent, the UE does not support '*tenMilliSeconds*' response time unit in *CommonIEsRequestLocationInformation*.
velocityTypes This parameter identifies the velocity types that a target UE supports for SL-TOA. TRUE indicates that a velocity type is supported and FALSE that it is not. If this field is absent, velocity reporting is not supported.

– *SL-TOA-RequestAssistanceData*

```
-- ASN1START
-- TAG-SL-TOA-REQUESTASSISTANCEDATA-START
```

```
SL-TOA-RequestAssistanceData ::= SEQUENCE {
    sl-RTD-InfoRequest              ENUMERATED { true}                  OPTIONAL,
    ...
}
-- TAG-SL-TOA-REQUESTASSISTANCEDATA-STOP
-- ASN1STOP
```

***SL-TOA-RequestAssistanceData* field descriptions**
sl-RTD-InfoRequest
This field indicates that the SL RTD information is requested.

– *SL-TOA-ProvideAssistanceData*

```
-- ASN1START
-- TAG-SL-TOA-PROVIDEASSISTANCEDATA-START

SL-TOA-ProvideAssistanceData ::= SEQUENCE {
    sl-RTD-Info                         SL-RTD-Info                                     OPTIONAL,
    sl-TOA-Error                        SL-TOA-AssistanceDataError                      OPTIONAL,
    ...
}

SL-TOA-AssistanceDataError ::= ENUMERATED { undefined, assistanceDataNotAvailable, ... }

-- TAG-SL-TOA-PROVIDEASSISTANCEDATA-STOP
-- ASN1STOP
```

***SL-TOA-ProvideAssistanceData* field descriptions**
sl-RTD-Info
This field provides synchronization information of SL Anchor UEs.
sl-TOA-Error
This field provides SL-TOA error reasons.

– *SL-TOA-RequestLocationInformation*

```
-- ASN1START
-- TAG-SL-TOA-REQUESTLOCATIONINFORMATION-START

SL-TOA-RequestLocationInformation ::= SEQUENCE {
    sl-ARP-InfoRequest                  ENUMERATED { true }         OPTIONAL,
    sl-LOS-NLOS-IndicatorRequest        ENUMERATED { true }         OPTIONAL,
    sl-PRS-RSRP-Request                 ENUMERATED { true }         OPTIONAL,
    sl-RSRPP-Request                    ENUMERATED { true }         OPTIONAL,
    sl-AdditionalPathsRequest           ENUMERATED { true }         OPTIONAL,
    measurementsForMultipleARP-IDs-Rx   SEQUENCE {
```

```
        requestedARP-IDs-Rx                 BIT STRING (SIZE (4))  OPTIONAL
    }                                                              OPTIONAL,
    ...
}

-- TAG-SL-TOA-REQUESTLOCATIONINFORMATION-STOP
-- ASN1STOP
```

***SL-TOA-RequestLocationInformation* field descriptions**
measurementsForMultipleARP-IDs-Rx This field, if present, indicates that the UE is requested to provide the requested SL-TOA measurements for multiple SL-PRS Rx ARP-IDs.
requestedARP-IDs-Rx This field, if present, indicates that the UE is requested to provide the requested SL-TOA measurements for indicated SL-PRS Rx ARP-IDs. Bit 1 in the bit string indicates ARP-ID = 1, bit 2 indicates ARP-ID = 2, and so on.
sl-AdditionalPathsRequest This field, if present, indicates that the UE is requested to provide *sl-TOA-AdditionalPathList*.
sl-ARP-InfoRequest This field, if present, indicates that the UE is requested to provide *sl-POS-ARP-ID-Rx*.
sl-LOS-NLOS-IndicatorRequest This field, if present, indicates that the UE is requested to provide the estimated *los-NLOS-Indicator*.
sl-RSRPP-Request This field, if present, indicates that the UE is requested to provide *sl-RSRPP*.
sl-PRS-RSRP-Request This field, if present, indicates that the UE is requested to provide *sl-PRS-RSRP-Result*.

– *SL-TOA-ProvideLocationInformation*

```
-- ASN1START
-- TAG-SL-TOA-PROVIDELOCATIONINFORMATION-START

SL-TOA-ProvideLocationInformation ::= SEQUENCE {
    sl-TOA-SignalMeasurementInformation   SL-TOA-MeasElementPerARP-ID-Rx         OPTIONAL,
    sl-TOA-Error                          SL-TOA-LocationInformationError       OPTIONAL,
    ...
}

SL-TOA-MeasElementPerARP-ID-Rx ::= SEQUENCE (SIZE(1..4)) OF SL-TOA-MeasElement

SL-TOA-MeasElement ::= SEQUENCE {
    los-NLOS-Indicator                    LOS-NLOS-Indicator        OPTIONAL,  -- sl-losNlosIndicator
    sl-RTOA-Result                        CHOICE {
        k0                                    INTEGER (0..1970049),
        k1                                    INTEGER (0..985025),
        k2                                    INTEGER (0..492513),
        k3                                    INTEGER (0..246257),
        k4                                    INTEGER (0..123129),
        k5                                    INTEGER (0..61565)
    }                                                               OPTIONAL,  -- sl-PRS-RTOA
```

```
    sl-POS-ARP-ID-Rx                    INTEGER (1..4)           OPTIONAL,  -- sl-pos-arpID-Rx
    sl-PRS-ResourceId                   INTEGER (0..16)          OPTIONAL,  -- sl-PRS-ResourceId
    sl-PRS-RSRP-Result                  INTEGER (0..126)         OPTIONAL,  -- sl-PRS-RSRP
    sl-PRS-RSRPP-Result                 INTEGER (0..126)         OPTIONAL,  -- sl-PRS-RSRPP
    sl-TOA-AdditionalPathList           SL-TOA-AdditionalPathList OPTIONAL,
    sl-TimeStamp                        SL-TimeStamp             OPTIONAL,  -- sl-Timestamp
    sl-TimingQuality                    SL-TimingQuality         OPTIONAL,  -- sl-TimingQuality
    ...
}

SL-TOA-AdditionalPathList ::= SEQUENCE (SIZE(1..8)) OF SL-TOA-AdditionalPath

SL-TOA-AdditionalPath  ::= SEQUENCE {
    sl-RTOA-AdditionalPathResult              CHOICE {
        k0                                        INTEGER (0..16351),
        k1                                        INTEGER (0..8176),
        k2                                        INTEGER (0..4088),
        k3                                        INTEGER (0..2044),
        k4                                        INTEGER (0..1022),
        k5                                        INTEGER (0..511)
    }                                                                  OPTIONAL,  -- additionalPath-SL-PRS-RTOA
    sl-PRS-AdditionalPathRSRPP-Result         INTEGER (0..126)      OPTIONAL,  -- additionalPath-SL-PRS-RSRPP
    sl-TimingQuality                          SL-TimingQuality      OPTIONAL,  -- sl-TimingQuality
    ...
}

SL-TOA-LocationInformationError ::= ENUMERATED { undefined, assistanceDataMissing, notAllRequestedMeasurementsPossible, ... }

-- TAG-SL-TOA-PROVIDELOCATIONINFORMATION-STOP
-- ASN1STOP
```

***SL-TOA-ProvideLocationInformation* field descriptions**
los-NLOS-Indicator This field specifies the UE's best estimate of the LOS or NLOS of the UE measurements (including RSTD, RTOA, RSRP, RSRPP, AoA and UE Rx-Tx time difference).
sl-TOA-AdditionalPathList This field specifies the sidelink PRS measurements based on additional path of arrival.
sl-POS-ARP-ID-Rx This field indicates ARP ID of an ARP used for reception for per-ARP measurement reporting. The ARP ID is used to uniquely identify an ARP associated with a UE.
sl-PRS-ResourceId This field specifies the PRS sidelink resource ID used for SL positioning measurements.
sl-PRS-RSRP-Result This field specifies the sidelink PRS reference signal received power (RSRP) measurement.
sl-PRS-RSRPP-Result This field specifies the SL-RSRPP measurement based on first path of arrival.
sl-RTOA-Result This field specifies the SL-RTOA measurement based on first path of arrival.
sl-TimeStamp This field specifies the time instance at which the SL RTOA and SL-PRS RSRP (if included) measurement is performed.

– *End of SLPP-PDU-SL-TOA-Contents*

```
-- ASN1START

END

-- ASN1STOP
```

6.11 Information elements related to Discovery Message

This clause specifies information elements that are transferred in Discovery Message for ranging and sidelink positioning, as specified in TS 23.304 [14].

– *NR-DiscoveryMessageMetaDataContents*

This ASN.1 segment is the start of the *NR-DiscoveryMessageMetaDataContents* definitions.

```
-- ASN1START
-- TAG-NR-DISCOVERYMESSAGEMETADATACONTENTS-START

NR-DiscoveryMessageMetaDataContents DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

-- TAG-NR-DISCOVERYMESSAGEMETADATACONTENTS-STOP
-- ASN1STOP
```

– *RSPP-Metadata*

The IE *RSPP-Metadata* includes the UE information included in Discovery Message for ranging and sidelink positioning.

```
-- ASN1START
-- TAG-RSPP-METADATA-START

RSPP-Metadata ::= SEQUENCE {
    ue-RoleList               BIT STRING { sl-anchorUE(0), sl-ServerUE(1), sl-TargetUE(2) } (SIZE (1..8)),
    knownLocationAvailable    ENUMERATED {true}                                                 OPTIONAL,
    ...
}

-- TAG-RSPP-METADATA-STOP
-- ASN1STOP
```

***RSPP-Metadata* field descriptions**
ue-RoleList This field indicates the UE role associate with the discovery message. This is represented by a bit string, with a one value at the bit position means the particular UE role associate with the discovery message. In the case of solicitation message, this bit string is interpreted as: - bit 0 indicates whether the UE role as an SL Anchor UE is requested or not; - bit 1 indicates whether the UE role as an SL Server UE is requested or not; - bit 2 indicates whether the UE role as an SL Target UE is requested or not. Otherwise, the bit string is interpreted as: - bit 0 indicates whether the UE supports UE role as an SL Anchor UE or not; - bit 1 indicates whether the UE supports UE role as an SL Server UE or not; - bit 2 indicates whether the UE supports UE role as an SL Target UE or not.
knownLocationAvailable This field indicates whether the location of an SL Anchor UE is known or is able to be known, e.g., via Uu based positioning. The field can only be present if the bit 0 of *ue-RoleList* is set.

– End of NR-DiscoveryMessageMetaDataContents

```
-- ASN1START

END

-- ASN1STOP
```

Annex A (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
04/2023	RAN2#121 bis-e	R2-2302739					0.0.1
04/2023	RAN2#121 bis-e	R2-2304306					0.0.2
05/2023	RAN2#122	R2-2305439					0.0.3
08/2023	RAN2#123	R2-2307663					0.0.4
09/2023	RAN2#123	R2-2309183				Endorsed by RAN2 in email discussion [Post123][415]	0.0.5
09/2023	RP-101	RP-232009				To be presented to RAN for information	1.0.0
10/2023	RAN2#123 bis	R2-2310222				Not endorsed in RAN2#123bis	1.1.0
11/2023	RAN2#124	R2-2312021					1.2.0
11/2023	RAN2#124	R2-2313630				Agreed by RAN2 in email discussion [Post124][419]	1.3.0
12/2023	RP-102	RP-233391				To be presented to RAN for Approval	2.0.0
12/2023	RP-102					Promoted to Rel-18 after approval	18.0.0
03/2024	RP-103	RP-240696	0001	1	F	Miscellaneous corrections to SLPP specification	18.1.0
	RP-103	RP-240696	0002	-	B	CR 38.355 for SLPP capability	18.1.0
06/2024	RP-104	RP-241566	0003	3	F	Miscellaneous corrections to SLPP specification	18.2.0
	RP-104	RP-241542	0004	2	B	CR 38.355 for SLPP capability	18.2.0
09/2024	RP-105	RP-242239	0005	3	F	Miscellaneous corrections to SLPP specification	18.3.0

History

Document history		
V18.1.0	May 2024	Publication
V18.2.0	August 2024	Publication
V18.3.0	October 2024	Publication