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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.
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- [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
<i>sessionID</i>	Identify messages belonging to the same session
<i>transactionID</i>	Identify messages belonging to the same transaction
<i>endTransaction</i>	Indicate when a transaction (e.g. one with periodic responses) has ended
<i>sequenceNumber</i>	Enable detection of a duplicate SLPP message at a receiver
<i>acknowledgement</i>	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.

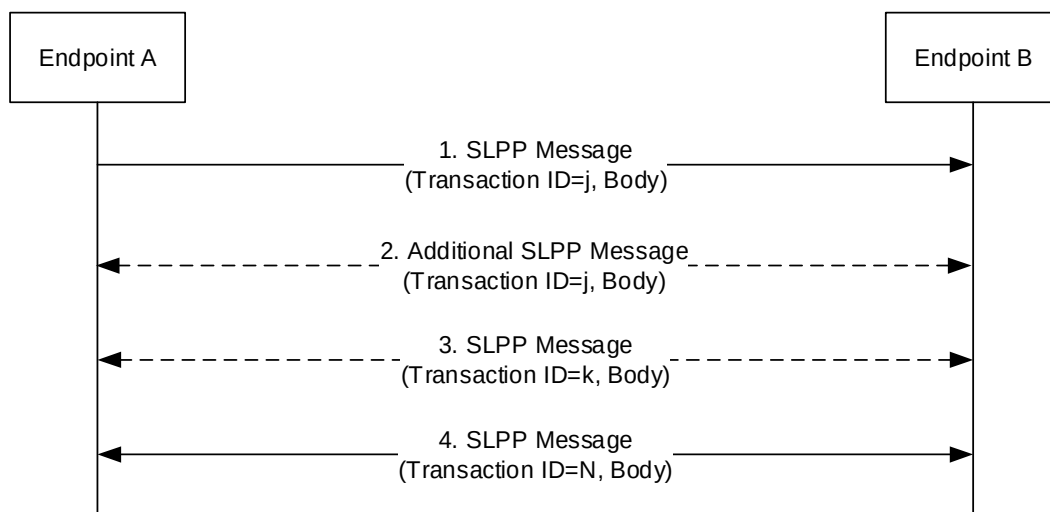


Figure 4.2-1 SLPP Session Procedure

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.

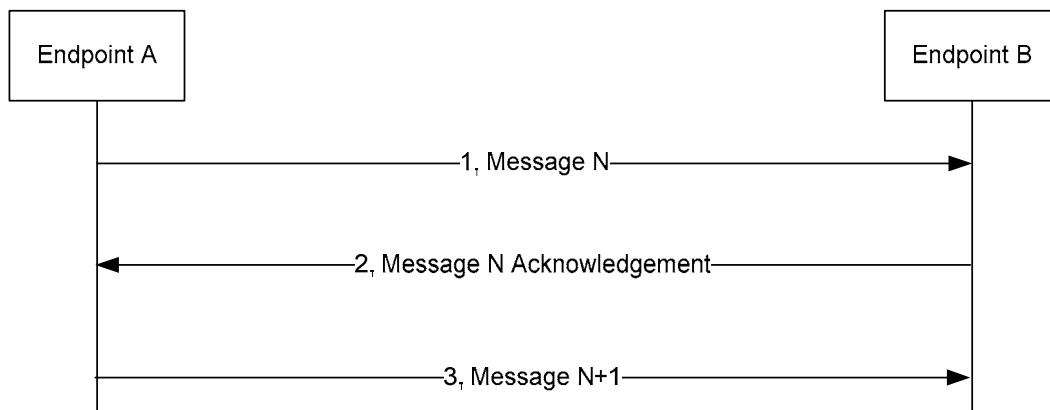


Figure 4.3.3.2-1: SLPP Acknowledgement procedure

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.

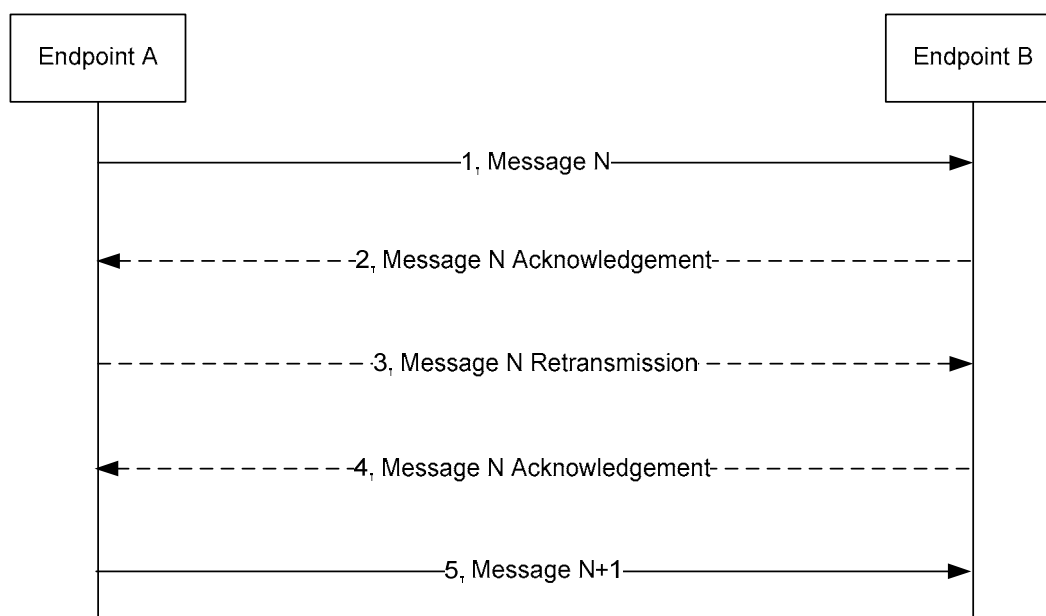


Figure 4.3.4.2-1: SLPP Retransmission procedure

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.

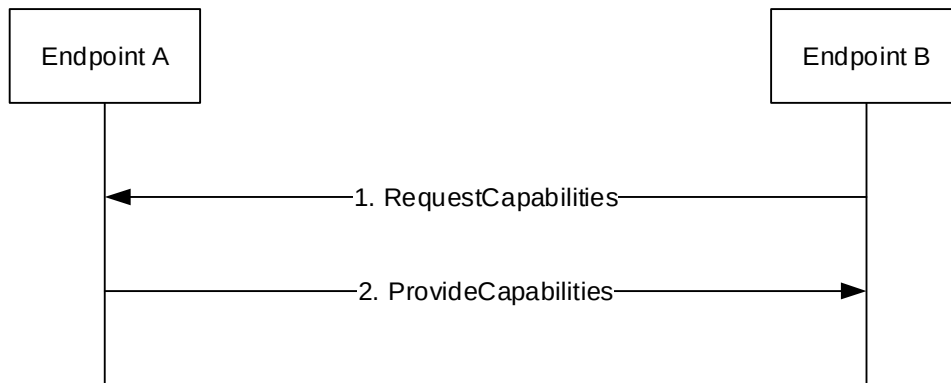


Figure 5.1.2-1: SLPP Capability Transfer procedure

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.

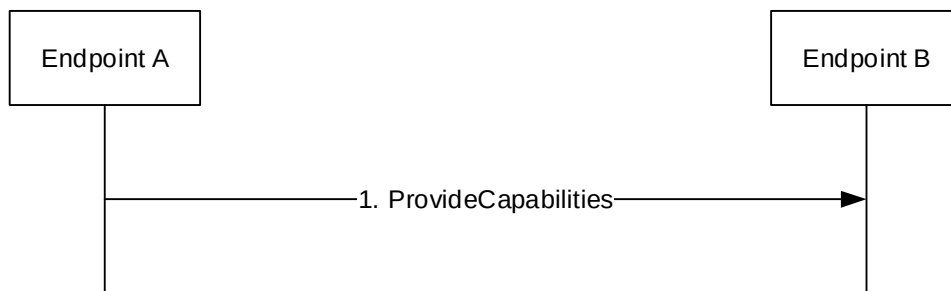


Figure 5.1.3-1: SLPP Capability Indication procedure

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.

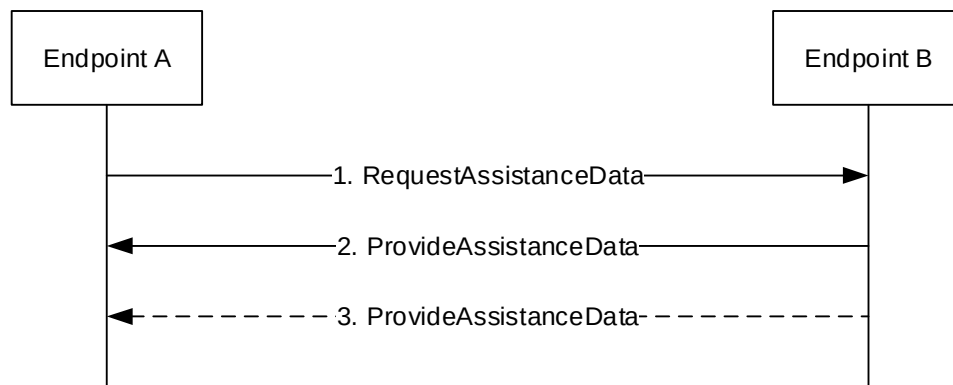


Figure 5.2.2-1: SLPP Assistance data transfer procedure

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.

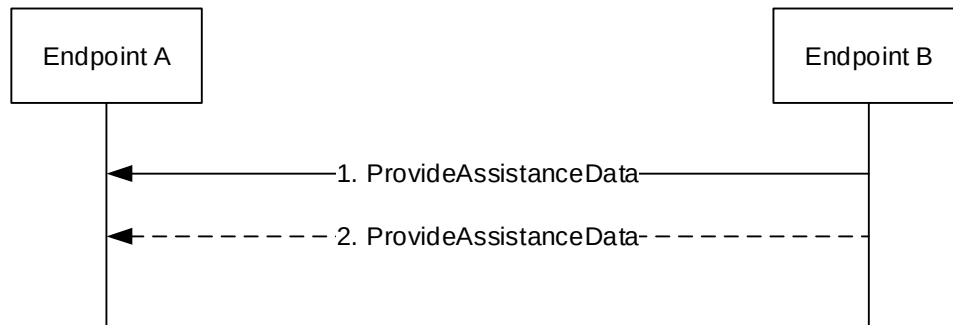


Figure 5.2.3-1: SLPP Assistance data transfer procedure

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.

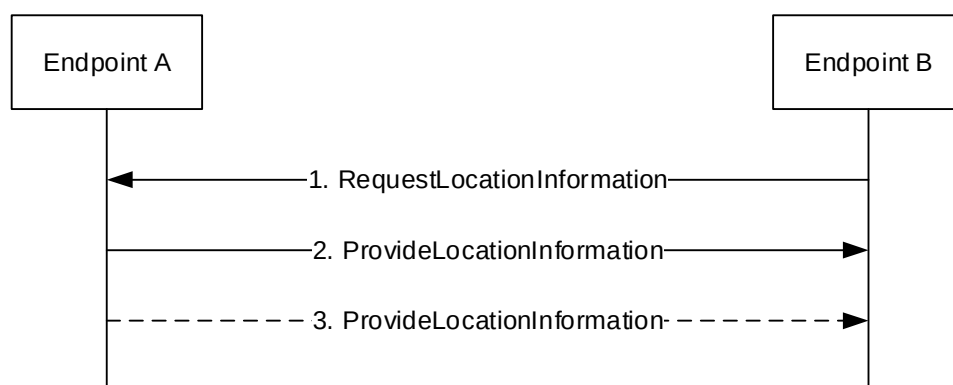


Figure 5.3.2-1: SLPP Location Information transfer procedure

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.

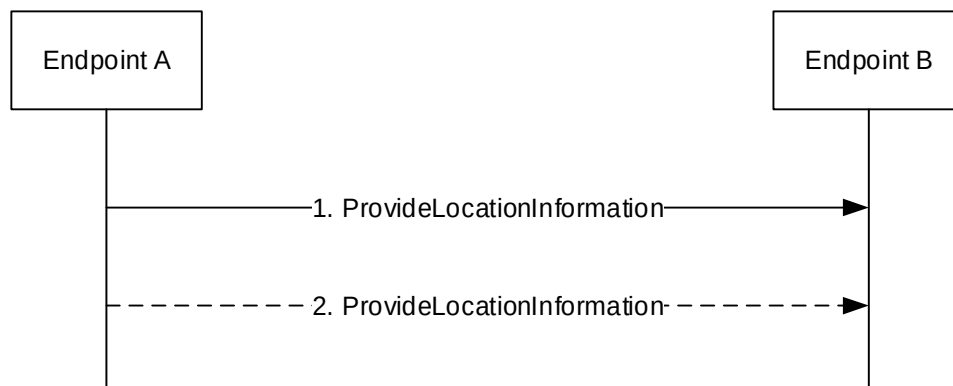


Figure 5.3.3-1: SLPP Location Information Delivery procedure

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.

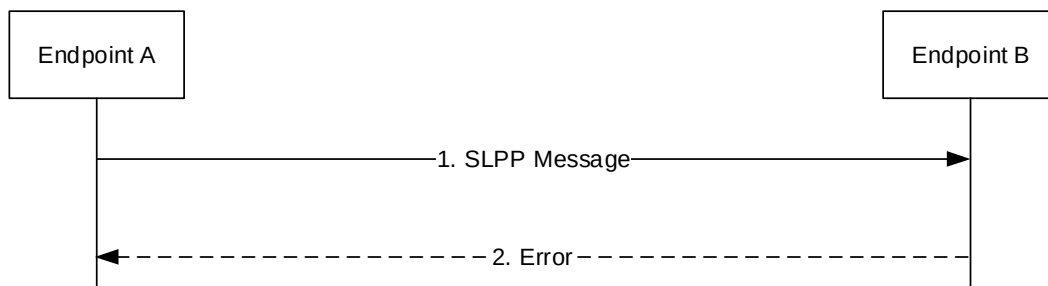


Figure 5.4.2-1: SLPP Error Indication procedure

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.

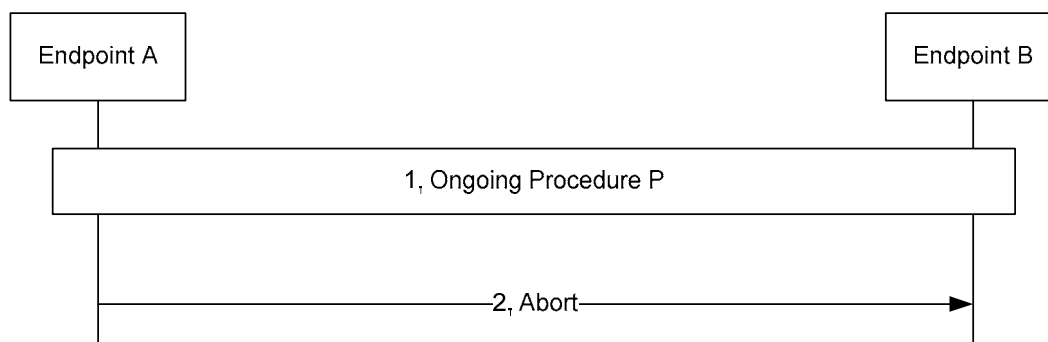


Figure 5.5.2-1: SLPP Abort procedure

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 ::=
    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

```

<i>SLPP-Message</i> 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 <i>spp-MessageBody</i> 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 <i>spp-MessageBody</i> in a transaction (TRUE) or not last (FALSE).
sequenceNumber This field may be included when an <i>spp-MessageBody</i> 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.
spp-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 <i>spp-MessageBody</i> 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 <i>SLPP-Error</i> 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 <i>spp-MessageBody</i> 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 *ProvideAssistanceData*, the UE releases the value received in previous SLPP message *ProvideAssistanceData* 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
        criticalExtensionsFuture
    }
    Error-IEs,
    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 <i>periodicalReporting</i> in the IE <i>CommonIEsRequestLocationInformation</i> .

— *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)
    }
    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
    }
}

-- 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 <i>syncSourceType</i> 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
        syncSourceType          ENUMERATED { gnss, ue}          OPTIONAL,
        applicationLayerID      OCTET STRING                    OPTIONAL,
        dfn                     INTEGER (0.. 1023),
        nr-Slot
            scs15                INTEGER (0..9),
            scs30                INTEGER (0..19),
            scs60                INTEGER (0..39),
            scs120               INTEGER (0..79)
        },
    sfn-Time
        nr-PhysCellID           NR-PhysCellID                  OPTIONAL,
        nr-ARFCN                 ARFCN-ValueNR                  OPTIONAL,
        nr-CellGlobalID          NCGI                           OPTIONAL,
        nr-SFN                   INTEGER (0..1023),
        nr-Slot
            scs15                INTEGER (0..9),
            scs30                INTEGER (0..19),
            scs60                INTEGER (0..39),
            scs120               INTEGER (0..79)
        }
}
-- ASN1END

```

```
}
-- 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 <i>nr-PhysCellID</i> , <i>nr-ARFCN</i> , or <i>nr-CellGlobalID</i> 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 <i>SL-TimingQuality</i> is provided in units of metres.
timingQualityResolution This field provides the resolution used in the <i>timingQualityValue</i> field. Enumerated values <i>mdot1</i> , <i>m1</i> , <i>m10</i> , <i>m30</i> 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	
}		
nrTime	PositioningModes	OPTIONAL,
relativeTime	PositioningModes	OPTIONAL,
}		OPTIONAL

```
-- TAG-SCHEDULEDLLOCATIONTIMESUPPORTPERMODE-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,
    SL-TimeStamp
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,
    periodicalReportingCriteria  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)
    }
}
relativeTime                INTEGER (1..1024)
}

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

```

CommonEsRequestLocationInformation field descriptions
additionalInformation This field indicates whether the UE is allowed to return additional information to that requested. If this field indicates '<i>onlyReturnInformationRequested</i>' then the UE shall not return any additional information. If this field indicates '<i>mayReturnAdditionalInformation</i>' 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-COMMONIESPROVIDELOCAATIONINFORMATION-START

CommonIEsProvideLocationInformation ::= SEQUENCE {
    locationEstimate          LocationCoordinates          OPTIONAL, -- locationTargetUe-sl-pos
    rangeAndOrDirection      RangeAndOrDirection        OPTIONAL,
    velocityEstimate          Velocity                    OPTIONAL,
    relativeLocationEstimate  RelativeLocationCoordinates OPTIONAL,
    locationError             LocationError               OPTIONAL,
    ...,
    [[
        locationTimeStamp      SL-TimeStamp              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)
            }
        transverseVelocityComponent
            SEQUENCE {
                unitsTransverseVelocity  ENUMERATED { degPerSec1, degPerSec0-1, ... },
                azimuth
                    SEQUENCE {
                        azimuthRateOfChange  INTEGER (0..1023),
                        uncertaintyAzimuthRateOfChange  INTEGER (0..255),
                    }
            }
    }
    OPTIONAL,

```

```

        confidenceUncertaintyAzimuthRateOfChange    INTEGER (0..100)
    }
    elevation          SEQUENCE {
        elevationRateOfChange          INTEGER (0..1023),
        uncertaintyElevationRateOfChange    INTEGER (0..255),
        confidenceUncertaintyElevationRateOfChange    INTEGER (0..100)
    }
}
...
[[
    azimuthRateOfChangeDirection          ENUMERATED {anticlockwise}
    elevationRateOfChangeDirection          ENUMERATED {downward}
]]
}

-- TAG-COMMONIESPROVIDELOCAIONINFORMATION-STOP
-- ASN1STOP

```

CommonEsProvideLocationInformation 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 '<i>periodicLocationMeasurementsNotAvailable</i>' shall be used by the UE if periodic location reporting was requested, but no measurements or location estimate are available when <i>the reportingInterval</i> 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 <i>locationInformationType</i> field in a Request Location Information message.
locationTimeStamp This field provides the time instance when the location information (e.g., <i>locationEstimate</i> and/or <i>rangeAndOrDirection</i> and/or <i>velocityEstimate</i>) is valid.
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 <i>rangeResult</i> and corresponds to the encoded high accuracy extended uncertainty as defined in TS 23.032 [7]. - confidence provides the confidence level for the <i>uncertainty</i> 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 <i>azimuthResult</i>. Scale factor 1 degree; range 0 to 127 degrees. - confidence provides the confidence level for the <i>uncertainty</i> 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 <i>elevationResult</i>. Scale factor 1 degree; range 0 to 63 degrees. - confidence provides the confidence level for the <i>uncertainty</i> 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".
- **azimuthRateOfChangeDirection** provides the direction of the *azimuthRateOfChange*. If this field is absent, the direction of *azimuthRateOfChange* is clockwise.
- **elevationRateOfChangeDirection** provides the direction of the *elevationRateOfChange*. If this field is absent, the direction of *elevationRateOfChange* is upward.

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,
    dummy1                          ENUMERATED {supported} OPTIONAL,
    dummy2                          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,
    ...,
    [[
    --R1 41-1-19b Report of Tx ARP-ID to LMF or another UE for the transmitted SL PRS
    sl-PRS-ReportTxARP-ID             ENUMERATED {n2, n3, n4} 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
<i>dummy1, dummy2</i> The fields are not used in the specification. If received it shall be ignored by the receiving endpoint.
<i>sl-PositioningARP-LocationProvision</i> Indicates whether UE supports provisioning of ARP location for sidelink as assistance data.
<i>sl-PRS-AdditionalPathsReport</i> 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 <i>sl-PRS-RSTD-Meas</i> , <i>sl-RTOA-Meas</i> , <i>sl-PRS-RxTxTimeDiffWithoutTxTimeStamp</i> , <i>sl-PRS-RxTxTimeDiffWithTxTimeStamp</i> , <i>sl-PRS-RSRPP-Meas</i> , or <i>sl-AoA-Meas</i> .
<i>sl-PRS-CommonProcCapabilityPerBand</i> Indicates the common SL-PRS processing capability per band, and comprises the following sub-fields: - <i>maxSL-PRS-Bandwidth</i>: Maximum SL PRS bandwidth in MHz in a resource pool for positioning, which is supported and reported by UE for SL-PRS measurement. - <i>maxNumOfActiveSL-PRS-ResourcesInOneSlot</i>: 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. - <i>maxNumOfSlotsWithActiveSL-PRS-Resources</i>: 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. - <i>minTimeAfterEndofSlotCarryActiveSL-PRS-Resources</i>: 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 <i>minTimeAfterEndofSlotCarryActiveSL-PRS-Resources</i>.
<i>sl-PRS-CommonProcCapabilityPerUE</i> Indicates the common SL-PRS processing capability, and comprises the following sub-fields: - <i>maxNumOfActiveSL-PRS-Resources</i>: 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. - <i>maxNumOfSlotsWithActiveSL-PRS-Resources</i>: 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 <i>sl-PRS-CommonProcCapabilityPerBand</i> .
<i>sl-PRS-LOS-NLOS-Indication</i> 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 <i>sl-PRS-RSTD-Meas</i> , <i>sl-RTOA-Meas</i> , <i>sl-PRS-RxTxTimeDiffWithoutTxTimeStamp</i> , <i>sl-PRS-RxTxTimeDiffWithTxTimeStamp</i> , or <i>sl-AoA-Meas</i> .
<i>sl-PRS-ReportTxARP-ID</i> Indicates the maximum number of Tx ARP-IDs that the UE supports for the transmitted SL PRS.
<i>sl-PRS-RSRP-Meas</i> 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 <i>sl-PRS-CommonProcCapabilityPerBand</i> .
<i>sl-PRS-RSRPP-Meas</i> 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 <i>sl-PRS-CommonProcCapabilityPerBand</i> .

<i>sl-PRS-RxCombMultiplexing</i> 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 <i>sl-PRS-RxInDedicatedResourcePool</i>.
<i>sl-PRS-RxForBandWithSL-CA</i> 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 <i>sl-CA-Communication-r18</i>, defined in TS 38.331 [2] and one of <i>sl-PRS-RxInSharedResourcePool</i> or <i>sl-PRS-RxInDedicatedResourcePool</i>. 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.
<i>sl-PRS-RxInDedicatedResourcePool</i> Indicates whether UE supports receiving SL-PRS in dedicated resource pool and receiving SCI format 1B. This field comprises the following sub-fields: - <i>numOfSupportedRxPSCCH-PerSlot</i>: Indicates the number of PSCCH UE can receive in a slot. value1 corresponds to floor ($N_{RB} / 10$ RBs), value2 corresponds to $2 * \text{floor}(N_{RB} / 10 \text{ RBs})$. 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. - <i>supportedCP-TypeFor60kHzSCS</i>: Indicates the supported CP type for 60 kHz SCS. UE supporting this feature shall also support <i>sl-PRS-CommonProcCapabilityPerBand</i>.
<i>sl-PRS-RxInSharedResourcePool</i> Indicates whether UE supports receiving SL-PRS in shared resource pool and receiving SCI format 2D. UE supporting this feature shall also support <i>sl-PRS-CommonProcCapabilityPerBand</i> and <i>sl-Reception-r16</i> defined in TS 38.331 [2].
<i>sl-PRS-TDM-Multiplexing</i> 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 <i>sl-PRS-RxInDedicatedResourcePool</i>.
<i>sl-PRS-TxForBandWithSL-CA</i> 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 <i>sl-CA-Communication-r18</i>, defined in TS 38.331 [2] and one of <i>sl-PRS-TxInSharedResourcePool</i>, <i>sl-PRS-TxScheme1InDedicatedResourcePool</i>, or <i>sl-PRS-TxScheme2InDedicatedResourcePool</i>. 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.
<i>sl-PRS-TxInSharedResourcePool</i> 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 <i>sl-TransmissionMode1-r16</i> and <i>sl-TransmissionMode2-r16</i> defined in TS 38.331 [2]. UE supporting this feature shall also support <i>sl-TransmissionMode1-r16</i> or <i>sl-TransmissionMode2-r16</i> defined in TS 38.331 [2], and <i>sl-PRS-RxInSharedResourcePool</i>.

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

```

<i>CommonSL-PRS-MethodsIESProvideAssistanceData</i> field descriptions
<i>anchorUE-LocationInformation</i> This field provides the location coordinates of an SL Anchor UE identified by <i>applicationLayerID</i> .
<i>arp-LocationInfo</i> This field provides the location coordinates of the ARPs of the UE identified by <i>applicationLayerID</i> .
<i>applicationLayerID</i> This field provides the application layer ID as defined in TS 23.287 [9] for which the <i>SL-PRS-AssistanceData</i> is applicable.
<i>referencePoint</i> This field provides the reference point used to define the location of ARPs provided in the <i>arp-LocationInfoList</i> . If this field is absent, the reference point is the same as in the previous entry of the <i>sl-PRS-AssistanceDataInfo</i> list.
<i>sl-PRS-ARP-ID</i> 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 <i>applicationLayerID</i> .
<i>sl-PRS-Bandwidth</i> This field provides the bandwidth of SL-PRS transmission which is used in <i>UEAssistanceInformation</i> message as defined in TS 38.331 [2] and the SL-PRS resource request MAC CE as defined in TS 38.321 [15]. Value <i>mhz5</i> corresponds to 5 MHz, value <i>mhz10</i> corresponds to 10 MHz, and so on.
<i>sl-PRS-DelayBudget</i> This field provides the SL-PRS delay budget which is used in <i>UEAssistanceInformation</i> message as defined in TS 38.331 [2] and the resource selection as defined in TS 38.321 [15].
<i>sl-PRS-Error</i> This field provides SL-PRS error reasons.
<i>sl-PRS-Periodicity</i> This field provides the periodicity of SL-PRS which is used in <i>UEAssistanceInformation</i> message as defined in TS 38.331 [2]. Value <i>ms100</i> corresponds to 100 ms, value <i>ms200</i> corresponds to 200 ms, and so on.
<i>sl-PRS-Priority</i> This field provides the priority of SL-PRS which is used in <i>UEAssistanceInformation</i> 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.
<i>sl-PRS-SequenceID</i> 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 <i>applicationLayerID</i> . 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.
<i>sl-PRS-Transmission</i> 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 <i>SL-PRS-TxInfo</i> 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-METHODSIESPROVIDELOCAATIONINFORMATION-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-METHODSIESPROVIDELOCAATIONINFORMATION-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,
    dummy                      ENUMERATED { supported }        OPTIONAL,
    ...,
    [[
    --R1 41-1-19a Report of Rx ARP-ID with SL positioning measurements
    measurementsForMultipleARP-IDs-Rx  ENUMERATED {n2, n3, n4}  OPTIONAL
    ]]
}

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

```

SL-AoA-ProvideCapabilities field descriptions
<i>dummy</i> The field is not used in the specification. If received it shall be ignored by the receiving endpoint.
<i>locationCoordinateTypes</i> 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.
<i>measurementsForMultipleARP-IDs-Rx</i> This field, if present, indicates the maximum number of Rx ARP-IDs with SL-AoA measurements that the UE supports.
<i>periodicalReporting</i> This field, if present, specifies the positioning modes for which the UE supports <i>periodicalReporting</i> . This is represented by a bit string, with a one value at the bit position means <i>periodicalReporting</i> for the positioning mode is supported; a zero value means not supported. If this field is absent, the UE does not support <i>periodicalReporting</i> in IE <i>CommonIEsRequestLocationInformation</i> .
<i>positioningModes</i> This field specifies the SL-AoA mode(s) supported by the UE.
<i>scheduledLocationRequestSupported</i> This field, if present, specifies the positioning modes for which the UE supports scheduled location requests, i.e., supports the IE <i>ScheduledLocationTime</i> in IE <i>CommonIEsRequestLocationInformation</i> 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.
<i>sl-AoA-Meas</i> 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 <i>sl-PRS-CommonProcCapabilityPerBand</i> .
<i>tenMsUnitResponseTime</i> This field, if present, specifies the positioning modes for which the UE supports the enumerated value ' <i>tenMilliseconds</i> ' in the IE <i>ResponseTime</i> in IE <i>CommonIEsRequestLocationInformation</i> . This is represented by a bit string, with a one value at the bit position means ' <i>tenMilliseconds</i> ' 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 ' <i>tenMilliseconds</i> ' response time unit in <i>CommonIEsRequestLocationInformation</i> .
<i>velocityTypes</i> 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}
    ...
}
-- 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),
        expectedSL-AzimuthAoA-Uncertainty  INTEGER (0..60)          OPTIONAL, -- expected-SL-AoA-and-Uncertainty
        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
<i>FirstElement</i>	The field is mandatory present in the first <i>SL-AoA-MeasElement</i> in IE <i>SL-AoA-MeasElementPerARP-ID-Rx</i> . 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,
  dummy          ENUMERATED { supported }          OPTIONAL,
  ...,
  [[
    --R1 41-1-19a Report of Rx ARP-ID with SL positioning measurements
    measurementsForMultipleARP-IDs-Rx          ENUMERATED {n2, n3, n4}          OPTIONAL
  ]]
}

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

```

SL-RTT-ProvideCapabilities field descriptions
<i>dummy</i> The field is not used in the specification. If received it shall be ignored by the receiving endpoint.
<i>locationCoordinateTypes</i> 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.
<i>measurementsForMultipleARP-IDs-Rx</i> This field, if present, indicates the maximum number of Rx ARP-IDs with SL-RTT measurements that the UE supports.
<i>periodicalReporting</i> This field, if present, specifies the positioning modes for which the UE supports <i>periodicalReporting</i> . This is represented by a bit string, with a one value at the bit position means <i>periodicalReporting</i> for the positioning mode is supported; a zero value means not supported. If this field is absent, the UE does not support <i>periodicalReporting</i> in IE <i>CommonIESRequestLocationInformation</i> .
<i>positioningModes</i> This field specifies the SL-RTT mode(s) supported by the UE.
<i>scheduledLocationRequestSupported</i> This field, if present, specifies the positioning modes for which the UE supports scheduled location requests, i.e., supports the IE <i>ScheduledLocationTime</i> in IE <i>CommonIESRequestLocationInformation</i> 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.
<i>sl-PRS-RxTxTimeDiffWithoutTxTimeStamp</i> 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 <i>sl-PRS-CommonProcCapabilityPerBand</i> , and at least one of <i>sl-PRS-TxInSharedResourcePool</i> , <i>sl-PRS-TxScheme1InDedicatedResourcePool</i> or <i>sl-PRS-TxScheme2InDedicatedResourcePool</i> .
<i>sl-PRS-RxTxTimeDiffWithTxTimeStamp</i> 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: - <i>numOfMeasForSameSL-PRS</i>: 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; - <i>maxMeasReportingForDiffSL-PRS</i>: 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 <i>sl-PRS-CommonProcCapabilityPerBand</i> , and at least one of <i>sl-PRS-TxInSharedResourcePool</i> , <i>sl-PRS-TxScheme1InDedicatedResourcePool</i> or <i>sl-PRS-TxScheme2InDedicatedResourcePool</i> .
<i>tenMsUnitResponseTime</i> This field, if present, specifies the positioning modes for which the UE supports the enumerated value ' <i>tenMilliSeconds</i> ' in the IE <i>ResponseTime</i> in IE <i>CommonIESRequestLocationInformation</i> . This is represented by a bit string, with a one value at the bit position means ' <i>tenMilliSeconds</i> ' 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 ' <i>tenMilliSeconds</i> ' response time unit in <i>CommonIESRequestLocationInformation</i> .
<i>velocityTypes</i> 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,
    dummy                      ENUMERATED { true }          OPTIONAL,
    multipleSL-PRS-RxTxTimeDiffRequest  SEQUENCE {
        diffSL-PRS-Receptions      ENUMERATED { n2, n3, n4 }  OPTIONAL,
        diffSL-PRS-Transmissions   ENUMERATED { n2, n3, n4 }  OPTIONAL
    }
    measurementsForMultipleARP-IDs-Rx  SEQUENCE {
        requestedARP-IDs-Rx        BIT STRING (SIZE (4))      OPTIONAL
    }
    associatedSL-PRS-TxTimeStampRequest  ENUMERATED { true }  OPTIONAL,
    ...
}
-- TAG-SL-RTT-REQUESTLOCATIONINFORMATION-STOP
-- ASN1STOP
```

<i>SL-RTT-RequestLocationInformation</i> field descriptions
<i>associatedSL-PRS-TxTimeStampRequest</i> This field, if present, indicates that the UE is requested to provide <i>tx-TimeInfo</i> .
<i>dummy</i> This field is not used in the specification. If received it shall be ignored by the UE.
<i>measurementsForMultipleARP-IDs-Rx</i> This field, if present, indicates that the UE is requested to provide the requested SL-RTT measurements for multiple SL-PRS Rx ARP-IDs.
<i>multipleSL-PRS-RxTxTimeDiffRequest</i> 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: - <i>diffSL-PRS-Receptions</i> 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. - <i>diffSL-PRS-Transmissions</i> indicates that the UE is requested to provide multiple Rx-Tx measurements for the same SL PRS reception and up to N different SL PRS transmissions.
<i>requestedARP-IDs-Rx</i> 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.
<i>sl-AdditionalPathsRequest</i> This field, if present, indicates that the UE is requested to provide <i>sl-RTT-AdditionalPathList</i> .
<i>sl-ARP-InfoRequest</i> This field, if present, indicates that the UE is requested to provide <i>sl-POS-ARP-ID-Rx</i> .
<i>sl-LOS-NLOS-IndicatorRequest</i> This field, if present, indicates that the UE is requested to provide the estimated <i>los-NLOS-Indicator</i> .
<i>sl-RSRPP-Request</i> This field, if present, indicates that the UE is requested to provide <i>sl-RSRPP</i> .
<i>sl-PRS-RSRP-Request</i> This field, if present, indicates that the UE is requested to provide <i>sl-PRS-RSRP-Result</i> .

– *SL-RTT-ProvideLocationInformation*

```

-- ASN1START
-- TAG-SL-RTT-PROVIDELOCAATIONINFORMATION-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)
    }
    sl-PRS-RSRP-Result      INTEGER (0..126)      OPTIONAL, -- sl-PRS-RxTxTimeDiff
    sl-PRS-RSRPP-Result     INTEGER (0..126)      OPTIONAL, -- sl-PRS-RSRP
    sl-RTT-AdditionalPathList SL-RTT-AdditionalPathList  OPTIONAL, -- sl-PRS-RSRPP
    sl-Timestamp            SL-Timestamp          OPTIONAL, -- sl-RTT-AdditionalPathList
    sl-TimingQuality        SL-TimingQuality      OPTIONAL, -- sl-Timestamp
    tx-TimeInfo             SL-Timestamp          OPTIONAL, -- sl-TimingQuality
    ...
}

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)
    }
    sl-PRS-AdditionalPathRSRPP-Result      INTEGER (0..126)      OPTIONAL, -- additionalPath-SL-PRS-Rx-Tx-TimeDiff
    sl-TimingQuality                      SL-TimingQuality      OPTIONAL, -- additionalPath-SL-PRS-RSRPP
    ...
}

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

```

```
-- TAG-SL-RTT-PROVIDELocationInformation-STOP
-- ASN1STOP
```

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

<i>SL-RTT-ProvideLocationInformation</i> field descriptions
<i>los-NLOS-Indicator</i> 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).
<i>sl-POS-ARP-ID-Rx</i> 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.
<i>sl-PRS-ResourceID</i> This field specifies the sidelink PRS resource ID used for SL positioning measurements.
<i>sl-PRS-RSRP-Result</i> This field specifies the sidelink PRS reference signal received power (RSRP) measurement.
<i>sl-PRS-RSRPP-Result</i> This field specifies the SL-RSRPP measurement based on first path of arrival.
<i>sl-PRS-RxTxTimeDiffResult</i> 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].
<i>sl-RTT-AdditionalPathList</i> This field specifies the sidelink PRS measurements based on additional path of arrival.
<i>sl-RTT-Error</i> This field provides SL-RTT error reasons.
<i>sl-TimeStamp</i> This field specifies the time instance at which the SL Rx-Tx time difference and SL-PRS RSRP (if included) measurement is performed.
<i>tx-TimeInfo</i> 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,
    dummy                 ENUMERATED { supported }          OPTIONAL,
    ...,
    [[
    --R1 41-1-19a Report of Rx ARP-ID with SL positioning measurements
    measurementsForMultipleARP-IDs-Rx ENUMERATED {n2, n3, n4} OPTIONAL
    ]]
}

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

<i>SL-TDOA-ProvideCapabilities</i> field descriptions
<i>dummy</i> This field is not used in the specification. If received it shall be ignored by the receiving endpoint.
<i>locationCoordinateTypes</i> 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.
<i>measurementsForMultipleARP-IDs-Rx</i> This field, if present, indicates the maximum number of Rx ARP-IDs with SL-TDOA measurements that the UE supports.
<i>periodicalReporting</i> This field, if present, specifies the positioning modes for which the UE supports <i>periodicalReporting</i> . This is represented by a bit string, with a one value at the bit position means <i>periodicalReporting</i> for the positioning mode is supported; a zero value means not supported. If this field is absent, the UE does not support <i>periodicalReporting</i> in IE <i>CommonEsRequestLocationInformation</i> .
<i>positioningModes</i> This field specifies the SL-TDOA mode(s) supported by the UE.
<i>scheduledLocationRequestSupported</i> This field, if present, specifies the positioning modes for which the UE supports scheduled location requests, i.e., supports the IE <i>ScheduledLocationTime</i> in IE <i>CommonEsRequestLocationInformation</i> 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.
<i>sl-PRS-RSTD-Meas</i> 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 <i>sl-PRS-CommonProcCapabilityPerBand</i> .
<i>tenMsUnitResponseTime</i> This field, if present, specifies the positioning modes for which the UE supports the enumerated value ' <i>tenMilliseconds</i> ' in the IE <i>ResponseTime</i> in IE <i>CommonEsRequestLocationInformation</i> . This is represented by a bit string, with a one value at the bit position means ' <i>tenMilliseconds</i> ' 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 ' <i>tenMilliseconds</i> ' response time unit in <i>CommonEsRequestLocationInformation</i> .
<i>velocityTypes</i> 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
    }
    ...
    [[
        maxNumberOfMeasurementsPerARP INTEGER (2..4)        OPTIONAL
    ]]
}

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

```
-- ASN1STOP
```

<i>SL-TDOA-RequestLocationInformation</i> field descriptions
<i>maxNumberOfMeasurementsPerARP</i> This field, if present, indicates that the UE is requested to provide the indicated maximum number of SL-TDOA measurements per ARP for different SL-PRS reception for the same pair of UEs.
<i>measurementsForMultipleARP-IDs-Rx</i> This field, if present, indicates that the UE is requested to provide the requested SL-TDOA measurements for multiple SL-PRS Rx ARP-IDs.
<i>requestedARP-IDs-Rx</i> 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.
<i>sl-AdditionalPathsRequest</i> This field, if present, indicates that the UE is requested to provide <i>sl-TDOA-AdditionalPathList</i> .
<i>sl-ARP-InfoRequest</i> This field, if present, indicates that the UE is requested to provide <i>sl-POS-ARP-ID-Rx</i> .
<i>sl-LOS-NLOS-IndicatorRequest</i> This field, if present, indicates that the UE is requested to provide the estimated <i>los-NLOS-Indicator</i> .
<i>sl-PRS-RSRP-Request</i> This field, if present, indicates that the UE is requested to provide <i>sl-PRS-RSRP-Result</i> .
<i>sl-RSRPP-Request</i> This field, if present, indicates that the UE is requested to provide <i>sl-RSRPP</i> .

– *SL-TDOA-ProvideLocationInformation*

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

SL-TDOA-ProvideLocationInformation ::= SEQUENCE {
    sl-RSTD-ReferenceUE-Info          SEQUENCE {
        applicationLayerID            OCTET STRING
    }
    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)
}
sl-TDOA-AdditionalPathList SL-TDOA-AdditionalPathList OPTIONAL, -- sl-PRS-RSTD
sl-TimeStamp             SL-TimeStamp      OPTIONAL, -- sl-Timestamp
sl-TimingQuality         SL-TimingQuality  OPTIONAL, -- sl-TimingQuality
...
[[
sl-TDOA-AdditionalMeasurements SL-TDOA-AdditionalMeasurements OPTIONAL
]]
}

SL-TDOA-AdditionalMeasurements ::= SEQUENCE (SIZE (1..3)) OF SL-TDOA-AdditionalMeasurementElement

SL-TDOA-AdditionalMeasurementElement ::= SEQUENCE {
    sl-PRS-ResourceId      INTEGER (0..16)      OPTIONAL,
    sl-PRS-RSRP-Result     INTEGER (0..126)      OPTIONAL,
    sl-PRS-RSRPP-Result    INTEGER (0..126)      OPTIONAL,
    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)
    }
    los-NLOS-Indicator     LOS-NLOS-Indicator  OPTIONAL,
    sl-TDOA-AdditionalPathList SL-TDOA-AdditionalPathList OPTIONAL,
    sl-TimeStamp           SL-TimeStamp        OPTIONAL,
    sl-TimingQuality       SL-TimingQuality    OPTIONAL,
    ...
}

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)
    }
    sl-PRS-AdditionalPathRSRPP-Result INTEGER (0..126) OPTIONAL, -- additionalPath-SL-PRS-RSTD
    sl-TimingQuality               SL-TimingQuality  OPTIONAL, -- additionalPath-SL-PRS-RSRPP
    sl-TimingQuality               SL-TimingQuality  OPTIONAL, -- sl-TimingQuality

```

```
    ...
  }

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

-- TAG-SL-TDOA-PROVIDELOCAATIONINFORMATION-STOP
-- ASN1STOP
```

Conditional presence	Explanation
FirstElement	The field is mandatory present in the first <i>SL-TDOA-MeasElement</i> in IE <i>SL-TDOA-MeasElementPerARP-ID-Rx</i> . 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. In this release, this field is always included.
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,
    dummy                          ENUMERATED { supported } OPTIONAL,
    ...,
    [[
    --R1 41-1-19a Report of Rx ARP-ID with SL positioning measurements
    measurementsForMultipleARP-IDs-Rx ENUMERATED {n2, n3, n4} OPTIONAL
    ]]
}

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

SL-TOA-ProvideCapabilities field descriptions
<i>dummy</i> This field is not used in the specification. If received it shall be ignored by the receiving endpoint.
<i>locationCoordinateTypes</i> 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.
<i>measurementsForMultipleARP-IDs-Rx</i> This field, if present, indicates the maximum number of Rx ARP-IDs with SL-TOA measurements that the UE supports.
<i>periodicalReporting</i> This field, if present, specifies the positioning modes for which the UE supports <i>periodicalReporting</i> . This is represented by a bit string, with a one value at the bit position means <i>periodicalReporting</i> for the positioning mode is supported; a zero value means not supported. If this field is absent, the UE does not support <i>periodicalReporting</i> in IE <i>CommonIEsRequestLocationInformation</i> .
<i>positioningModes</i> This field specifies the SL-TOA mode(s) supported by the UE.
<i>scheduledLocationRequestSupported</i> This field, if present, specifies the positioning modes for which the UE supports scheduled location requests, i.e., supports the IE <i>ScheduledLocationTime</i> in IE <i>CommonIEsRequestLocationInformation</i> 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.
<i>sl-RTOA-Meas</i> 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 <i>sl-PRS-CommonProcCapabilityPerBand</i> .
<i>tenMsUnitResponseTime</i> This field, if present, specifies the positioning modes for which the UE supports the enumerated value ' <i>tenMilliseconds</i> ' in the IE <i>ResponseTime</i> in IE <i>CommonIEsRequestLocationInformation</i> . This is represented by a bit string, with a one value at the bit position means ' <i>tenMilliseconds</i> ' 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 ' <i>tenMilliseconds</i> ' response time unit in <i>CommonIEsRequestLocationInformation</i> .
<i>velocityTypes</i> 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
    }
    ...,
    [[
        maxNumberOfMeasurementsPerARP  INTEGER (2..4)          OPTIONAL
    ]]
}

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

-- ASN1STOP

<i>SL-TOA-RequestLocationInformation</i> field descriptions
<i>maxNumberOfMeasurementsPerARP</i> This field, if present, indicates that the UE is requested to provide the indicated maximum number of SL-TOA measurements per ARP for different SL-PRS reception for the same pair of UEs.
<i>measurementsForMultipleARP-IDs-Rx</i> This field, if present, indicates that the UE is requested to provide the requested SL-TOA measurements for multiple SL-PRS Rx ARP-IDs.
<i>requestedARP-IDs-Rx</i> 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.
<i>sl-AdditionalPathsRequest</i> This field, if present, indicates that the UE is requested to provide <i>sl-TOA-AdditionalPathList</i> .
<i>sl-ARP-InfoRequest</i> This field, if present, indicates that the UE is requested to provide <i>sl-POS-ARP-ID-Rx</i> .
<i>sl-LOS-NLOS-IndicatorRequest</i> This field, if present, indicates that the UE is requested to provide the estimated <i>los-NLOS-Indicator</i> .
<i>sl-RSRPP-Request</i> This field, if present, indicates that the UE is requested to provide <i>sl-RSRPP</i> .
<i>sl-PRS-RSRP-Request</i> This field, if present, indicates that the UE is requested to provide <i>sl-PRS-RSRP-Result</i> .

– *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)
    }
    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-AdditionalMeasurements SL-TOA-AdditionalMeasurements OPTIONAL
]]
}

SL-TOA-AdditionalMeasurements ::= SEQUENCE (SIZE (1..3)) OF SL-TOA-AdditionalMeasurementElement

SL-TOA-AdditionalMeasurementElement ::= SEQUENCE {
    sl-PRS-ResourceId      INTEGER (0..16)      OPTIONAL,
    sl-PRS-RSRP-Result     INTEGER (0..126)      OPTIONAL,
    sl-PRS-RSRPP-Result    INTEGER (0..126)      OPTIONAL,
    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)
    }
    los-NLOS-Indicator     LOS-NLOS-Indicator  OPTIONAL,
    sl-TOA-AdditionalPathList SL-TOA-AdditionalPathList OPTIONAL,
    sl-TimeStamp           SL-TimeStamp        OPTIONAL,
    sl-TimingQuality       SL-TimingQuality    OPTIONAL,
    ...
}

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)
    }
    sl-PRS-AdditionalPathRSRPP-Result INTEGER (0..126) OPTIONAL, -- additionalPath-SL-PRS-RTOA
    sl-TimingQuality                SL-TimingQuality OPTIONAL, -- additionalPath-SL-PRS-RSRPP
    ...
}

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. In this release, this field is always included.
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 <i>ue-RoleList</i> 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
12/2024	RP-106	RP-243231	0008	4	F	Corrections of location time stamp, RSTD and RTOA report	18.4.0
	RP-106	RP-243231	0011	2	D	Miscellaneous corrections to SLPP specification	18.4.0
	RP-106	RP-243231	0012	1	F	Correction on tx timestamp request in SL-RTT	18.4.0
	RP-106	RP-243219	0013	1	F	Corrections on capabilities for FG R1 41-1-19a and 41-1-19b in IE CommonSL-PRS-MethodsIESProvideCapabilities	18.4.0
	RP-106	RP-243231	0014	2	F	Correction on SLPP	18.4.0
03/2025	RP-107	RP-250662	0009	2	F	Missing additional measurements for SL-TDOA and SL-TOA	18.5.0
06/2025	RP-108	RP-251694	0015	1	F	Missing rate of change direction of azimuth/elevation for relative velocity	18.6.0
09/2025	RP-109					Upgrade to Release 19 - no technical change	19.0.0

History

Document history		
V19.0.0	October 2025	Publication