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LTE;
Evolved Universal Terrestrial Radio Access (E-UTRA);
LTE Positioning Protocol A (LPPa)
(3GPP TS 36.455 version 17.1.0 Release 17)

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1 Scope

The present document specifies the control plane radio network layer signalling procedures between eNB and E-SMLC. LPPa supports the concerned functions by signalling procedures defined in this document. LPPa is developed in accordance with the general principles stated in TS 36.401 [2].

2 References

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

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

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

[2] 3GPP TS 36.401:"Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Architecture Description".

[3] 3GPP TS 36.413:"Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP)".

[4] ITU-T Recommendation X.691 (2002-07): "Information technology - ASN.1 encoding rules - Specification of Packed Encoding Rules (PER) ".

[5] 3GPP TS 36.104:"Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Base Station (BS) radio transmission and reception".

[6] 3GPP TS 36.211:"Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Physical Channels and Modulation".

[7] 3GPP TS 23.032:"Technical Specification Group Services and System Aspects; Universal Geographical Area Description (GAD)".

[8] 3GPP TS 36.133:"Evolved Universal Terrestrial Radio Access (E-UTRA); Requirements for support of radio resource management".

[9] 3GPP TR 25.921 (version.7.0.0): "Guidelines and principles for protocol description and error handling".

[10] 3GPP TS 36.331:"Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Resource Control (RRC); Protocol specification".

[11] IEEE Std 802.11™-2012, IEEE Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area network.

[12] 3GPP TS 36.213: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures".

[13] 3GPP TS 36.355: "Evolved Universal Terrestrial Radio Access (E-UTRA); LTE Positioning Protocol (LPP)".

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3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions 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].

Elementary Procedure: LPPa protocol consists of Elementary Procedures (EPs). An LPPa Elementary Procedure is a unit of interaction between the eNB and the E-SMLC. An EP consists of an initiating message and possibly a response message. Two kinds of EPs are used:

- **Class 1:** Elementary Procedures with response (success or failure),
- **Class 2:** Elementary Procedures without response.

Cell Portion: A geographical part of a cell. A cell portion is semi-static, and identical for both the UL and the DL. Within a cell, a cell portion is uniquely identified by its Cell Portion ID.

Transmission Point (TP): A set of geographically co-located transmit antennas for one cell, part of one cell or one PRS-only TP. Transmission Points can include base station (eNB) antennas, remote radio heads, a remote antenna of a base station, an antenna of a PRS-only TP, etc. One cell can be formed by one or multiple transmission points. For a homogeneous deployment, each transmission point may correspond to one cell.

PRS-only TP: A TP which only transmits PRS signals for PRS-based TBS positioning and is not associated with a cell.

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3.2 Symbols

For the purposes of the present document, the following symbols apply:

<symbol> <Explanation>

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3.3 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].

BSSID	Basic Service Set IDentifier
CID	Cell-ID (positioning method)
DL	Downlink
E-CID	Enhanced Cell-ID (positioning method)
eNB	E-UTRAN NodeB
EP	Elementary Procedure
EPC	Evolved Packet Core
E-SMLC	Evolved Serving Mobile Location Centre
E-UTRAN	Evolved UTRAN
GNSS	Global Navigation Satellite System
HESSID	Homogeneous Extended Service Set IDentifier
IE	Information Element
LCS	LoCation Services
LPP	LTE Positioning Protocol
LPPa	LTE Positioning Protocol Annex
MME	Mobility Management Entity
NW	Network
OTDOA	Observed Time Difference of Arrival
RSSI	Received Signal Strength Indicator
S1AP	S1 Application Protocol
SBAS	Satellite-based Augmentation System
SRS	Sounding Reference Signal

SSID	Service Set IDentifier
TP	Transmission Point
UE	User Equipment
UL	Uplink
UTDOA	Uplink Time Difference of Arrival
WLAN	Wireless Local Area Network

4 General

4.1 Procedure specification principles

The principle for specifying the procedure logic is to specify the functional behaviour of the terminating eNB exactly and completely. Any rule that specifies the behaviour of the originating eNB shall be possible to be verified with information that is visible within the system.

The following specification principles have been applied for the procedure text in clause 8:

- The procedure text discriminates between:

  1) Functionality which "shall" be executed

     The procedure text indicates that the receiving node "shall" perform a certain function Y under a certain condition. If the receiving node supports procedure X but cannot perform functionality Y requested in the initiating message of a Class 1 EP, the receiving node shall respond with the message used to report unsuccessful outcome for this procedure, containing an appropriate cause value.

  2) Functionality which "shall, if supported" be executed

     The procedure text indicates that the receiving node "shall, if supported," perform a certain function Y under a certain condition. If the receiving node supports procedure X, but does not support functionality Y, the receiving node shall proceed with the execution of the EP, possibly informing the requesting node about the not supported functionality.

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- Any required inclusion of an optional IE in a response message is explicitly indicated in the procedure text. If the procedure text does not explicitly indicate that an optional IE shall be included in a response message, the optional IE shall not be included. For requirements on including *Criticality Diagnostics* IE, see section 10.

4.2 Forwards and backwards compatibility

The forwards and backwards compatibility of the protocol is assured by a mechanism where all current and future messages, and IEs or groups of related IEs, include ID and criticality fields that are coded in a standard format that will not be changed in the future. These parts can always be decoded regardless of the standard version.

4.3 Specification notations

For the purposes of the present document, the following notations apply:

Procedure	When referring to an elementary procedure in the specification the Procedure Name is written with the first letters in each word in upper case characters followed by the word "procedure", e.g. Handover Preparation procedure.
Message	When referring to a message in the specification the MESSAGE NAME is written with all letters in upper case characters followed by the word "message", e.g. ERROR INDICATION message.
IE	When referring to an information element (IE) in the specification the *Information Element Name* is written with the first letters in each word in upper case characters and all letters in Italic font followed by the abbreviation "IE", e.g. *Cause* IE.

Value of an IE When referring to the value of an information element (IE) in the specification the "Value" is written as it is specified in sub clause 9.2 enclosed by quotation marks, e.g. "Value".

5 LPPa services

The present clause describes the services an eNB offers to the E-SMLC.

5.1 LPPa procedure modules

The procedures are divided into two modules as follows:

1. LPPa Location Information Transfer Procedures;
2. LPPa Management Procedures;

The LPPa Location Information Transfer Procedures module contains procedures used to handle the transfer of positioning related information between eNB and E-SMLC.

The Management Procedures module contains procedures that are not related specifically to positioning, i.e. error handling.

5.2 Parallel transactions

Unless explicitly indicated in the procedure specification, at any instance in time one protocol peer may have more than one ongoing LPPa procedure.

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6 Services expected from lower layer

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Within E-UTRAN, LPPa protocol uses the services provided by the S1AP protocol. An LPPa message is carried inside an S1AP message.

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S1AP signalling is described in TS 36.413 [3].

7 Functions of LPPa

The LPPa protocol provides the following functions:

- E-CID Location Information Transfer. This function allows the eNB to exchange location information with the E-SMLC for the purpose of E-CID positioning.
- OTDOA Information Transfer. This function allows the eNB to exchange information with the E-SMLC for the purpose of OTDOA positioning.
- UTDOA Information Transfer. This function allows the eNB to exchange information with the E-SMLC for the purpose of supporting UTDOA.
- Assistance Information Transfer. This function allows the E-SMLC to exchange information with the eNB for the purpose of assistance information broadcasting.
- Reporting of General Error Situations. This function allows reporting of general error situations, for which function specific error messages have not been defined.

The mapping between the above functions and LPPa EPs is shown in the table below.

Table 7-1: Mapping between LPPa functions and LPPa EPs

Function	Elementary Procedure(s)
E-CID Location Information Transfer	a) E-CID Measurement Initiation b) E-CID Measurement Failure Indication c) E-CID Measurement Report d) E-CID Measurement Termination
OTDOA Information Transfer	OTDOA Information Exchange
UTDOA Information Transfer	a) UTDOA Information Exchange b) UTDOA Information Update
Assistance Information Transfer	a) Assistance Information Control b) Assistance Information Feedback
Reporting of General Error Situations	Error Indication

8 LPPa procedures

8.1 Elementary procedures

In the following tables, all EPs are divided into Class 1 and Class 2 EPs.

Table 8.1-1: Class 1 Elementary Procedures

Elementary Procedure	Initiating Message	Successful Outcome	Unsuccessful Outcome
		Response message	Response message
E-CID Measurement Initiation	E-CID MEASUREMENT INITIATION REQUEST	E-CID MEASUREMENT INITIATION RESPONSE	E-CID MEASUREMENT INITIATION FAILURE
OTDOA Information Exchange	OTDOA INFORMATION REQUEST	OTDOA INFORMATION RESPONSE	OTDOA INFORMATION FAILURE
UTDOA Information Exchange	UTDOA INFORMATION REQUEST	UTDOA INFORMATION RESPONSE	UTDOA INFORMATION FAILURE

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Table 8.1-2: Class 2 Elementary Procedures

Elementary Procedure	Initiating Message
E-CID Measurement Failure Indication	E-CID MEASUREMENT FAILURE INDICATION
E-CID Measurement Report	E-CID MEASUREMENT REPORT
E-CID Measurement Termination	E-CID MEASUREMENT TERMINATION COMMAND
UTDOA Information Update	UTDOA INFORMATION UPDATE
Error Indication	ERROR INDICATION
Assistance Information Control	ASSISTANCE INFORMATION CONTROL
Assistance Information Feedback	ASSISTANCE INFORMATION FEEDBACK

8.2 Location Information Transfer Procedures

8.2.1 E-CID Measurement Initiation

8.2.1.1 General

The purpose of E-CID Measurement Initiation procedure is to allow the E-SMLC to request the eNB to report E-CID measurements used by E-SMLC to compute the location of the UE.

8.2.1.2 Successful Operation

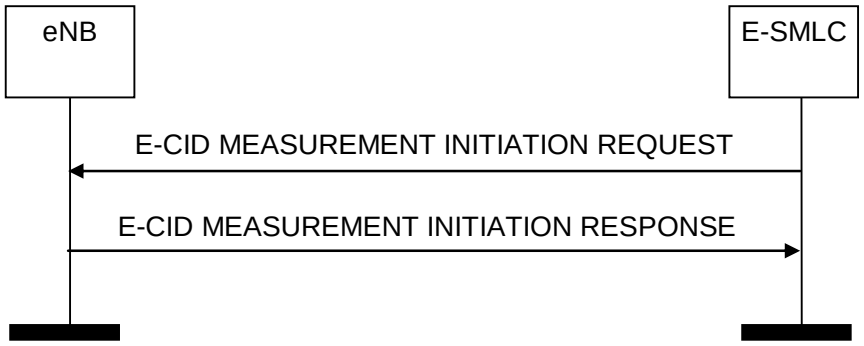

Figure 8.2.1.2-1: E-CID Measurement Initiation procedure, successful operation

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The E-SMLC initiates the procedure by sending an E-CID MEASUREMENT INITIATION REQUEST message. If the eNB is able to initiate the requested E-CID measurements, it shall reply with the E-CID MEASUREMENT INITIATION RESPONSE message.

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The *Measured Results* IE shall be included in the *E-CID Measurement Result* IE of the E-CID MEASUREMENT INITIATION RESPONSE message when measurement results other than the "Cell-ID" have been requested.

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If the *Report Characteristics* IE is set to "OnDemand", the eNB shall return the result of the measurement in the E-CID MEASUREMENT INITIATION RESPONSE message including, if available, the *E-UTRAN Access Point Position* IE in the *E-CID Measurement Result* IE, and the E-SMLC shall consider that the E-CID measurements for the UE has been terminated by the eNB. If available, the eNB shall include the *Cell Portion ID* IE in the E-CID MEASUREMENT INITIATION RESPONSE message. Upon reception of the *Cell Portion ID* IE, the E-SMLC may use the value as the cell portion for the measurement. If the *Report Characteristics* IE is set to "OnDemand" and the *Inter-RAT Measurement Quantities* IE is included in the E-CID MEASUREMENT INITIATION REQUEST message, the eNB shall, if supported, provide the corresponding measurements, if available in the eNB, in the *Inter-RAT Measurement Result* IE in E-CID MEASUREMENT INITIATION RESPONSE message. If the *Report Characteristics* IE is set to "OnDemand" and the *WLAN Measurement Quantities* IE is included in the E-CID MEASUREMENT INITIATION REQUEST message, the eNB shall, if supported, provide the corresponding measurements, if available in the eNB, in the *WLAN Measurement Result* IE in E-CID MEASUREMENT INITIATION RESPONSE message.

If the *Report Characteristics* IE is set to "Periodic", the eNB shall initiate the requested measurements and shall reply with the E-CID MEASUREMENT INITIATION RESPONSE message without including either the *E-CID Measurement Result* IE or the *Cell Portion ID* IE in this message. The eNB shall then periodically initiate the E-CID Measurement Report procedure for the measurements, with the requested reporting periodicity.

8.2.1.3 Unsuccessful Operation

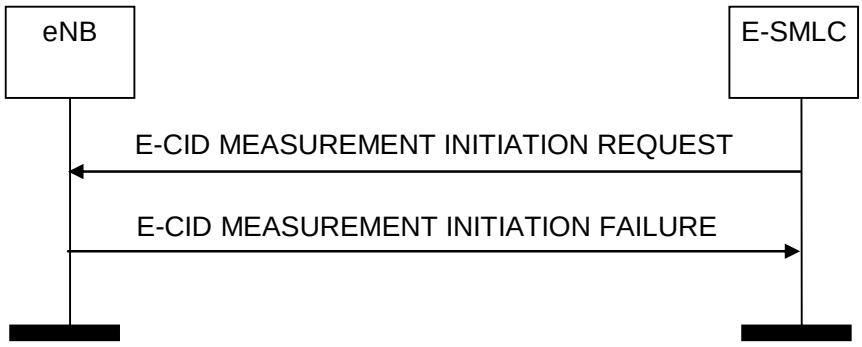

Figure 8.2.1.3-1: E-CID Measurement Initiation procedure, unsuccessful operation

If the eNB is not able to initiate at least one of the requested E-CID measurements, the eNB shall respond with an E-CID MEASUREMENT INITIATION FAILURE message.

8.2.1.4 Abnormal Conditions

Void

8.2.2 E-CID Measurement Failure Indication

8.2.2.1 General

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The purpose of the E-CID Measurement Failure Indication procedure is for the eNB to notify the E-SMLC that the E-CID measurements previously requested with the E-CID Measurement Initiation procedure can no longer be reported.

8.2.2.2 Successful Operation

ETSI TS 136 455 V17.1.0 (2023-04)
https://standards.iteh.ai/catalog/standards/sist/358ad91c-c7f6-4742-943f-8d2ff0dc7c3a/etsi-ts-136-455-v17-1-0-2023-04

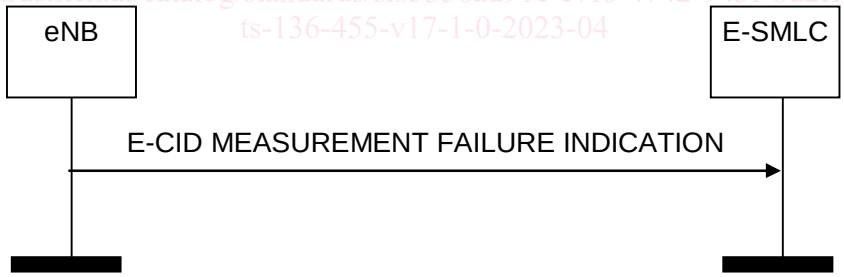

Figure 8.2.2.2-1: E-CID Measurement Failure Indication, successful operation

Upon reception of the E-CID MEASUREMENT FAILURE INDICATION message, the E-SMLC shall consider that the E-CID measurements for the UE have been terminated by the eNB.

8.2.2.3 Unsuccessful Operation

Not applicable.

8.2.2.4 Abnormal Conditions

Void.

8.2.3 E-CID Measurement Report

8.2.3.1 General

The purpose of E-CID Measurement Report procedure is for the eNB to provide the E-CID measurements for the UE to the E-SMLC.

8.2.3.2 Successful Operation

Figure 8.2.3.2-1: E-CID Measurement Report procedure, successful operation

The eNB initiates the procedure by sending an E-CID MEASUREMENT REPORT message. The E-CID MEASUREMENT REPORT message contains the E-CID measurement results according to the measurement configuration in the respective E-CID MEASUREMENT INITIATION REQUEST message.

The *Measured Results* IE shall be included in the *E-CID Measurement Result* IE of the E-CID MEASUREMENT REPORT message when measurement results other than the "Cell-ID" have been requested.

If available, the eNB shall include the *E-UTRAN Access Point Position* IE which is the configured estimated serving antenna position in the *E-CID Measurement Result* IE within the E-CID MEASUREMENT REPORT message. Upon reception of this *E-UTRAN Access Point Position* IE, the E-SMLC may use the value as the geographical position of the E-UTRAN access point.

If available, the eNB shall include the *Cell Portion ID* IE in the E-CID MEASUREMENT REPORT message. Upon reception of the *Cell Portion ID* IE, the E-SMLC may use the value as the cell portion for the measurement.

8.2.3.3 Unsuccessful Operation

Not applicable.

8.2.3.4 Abnormal Conditions

Void.

8.2.4 E-CID Measurement Termination

8.2.4.1 General

The purpose of E-CID Measurement Termination procedure is to terminate periodical E-CID measurements for the UE performed by the eNB.