ETSI TS 124 572 V18.0.0 (2024-05)

TECHNICAL SPECIFICATION

**5G;
5G System (5GS);
User plane Location Services (LCS) protocols and procedures;
Stage 3
(3GPP TS 24.572 version 18.0.0 Release 18)**

Reference

DTS/TSGC-0124572vi00

Keywords

5G

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00   Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

Important notice

The present document can be downloaded from:
https://www.etsi.org/standards-search

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or
print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any
existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI
deliverable is the one made publicly available in PDF format at www.etsi.org/deliver.

Users of the present document should be aware that the document may be subject to revision or change of status.
Information on the current status of this and other ETSI documents is available at
https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx

If you find errors in the present document, please send your comment to one of the following services:
https://portal.etsi.org/People/CommiteeSupportStaff.aspx

If you find a security vulnerability in the present document, please report it through our
Coordinated Vulnerability Disclosure Program:
https://www.etsi.org/standards/coordinated-vulnerability-disclosure

Notice of disclaimer & limitation of liability

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of
experience to understand and interpret its content in accordance with generally accepted engineering or
other professional standard and applicable regulations.
No recommendation as to products and services or vendors is made or should be implied.
No representation or warranty is made that this deliverable is technically accurate or sufficient or conforms to any law
and/or governmental rule and/or regulation and further, no representation or warranty is made of merchantability or fitness
for any particular purpose or against infringement of intellectual property rights.
In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not
limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property
rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages
for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use
of or inability to use the software.

Copyright Notification

Intellectual Property Rights

Legal Notice

Modal verbs terminology

Contents

Foreword

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

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

Version x.y.z

where:

x   the first digit:

     1   presented to TSG for information;

     2   presented to TSG for approval;

     3   or greater indicates TSG approved document under change control.

y   the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z   the third digit is incremented when editorial only changes have been incorporated in the document.

In the present document, modal verbs have the following meanings:

shall   indicates a mandatory requirement to do something

shall not   indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

should   indicates a recommendation to do something

should not   indicates a recommendation not to do something

may   indicates permission to do something

need not   indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

can   indicates that something is possible

cannot   indicates that something is impossible

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

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

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

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

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

In addition:

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

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

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

1 Scope

The present document specifies the user plane protocol to support the Location Services in the 5G System (5GS) as specified in 3GPP TS 23.273 [2] for user plane positioning between the UE and the LMF.

The present document also specifies the LCS user plane positioning connection management procedure to support the LCS secured user plane connection between the UE and the LMF.

The present document also specifies the user plane protocol to support location event reporting over an LCS secured user plane connection between the UE and the LCS client or the AF.

The present document also defines the message format, message contents, error handling and system parameters applied by the Location Services User plane protocol and LCS user plane positioning connection management for supporting Location Services in 5GS.

2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

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

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

[3] 3GPP TS 24.571: "5G System (5GS) Control plane Location Services (LCS) procedures; Stage 3".

[4] 3GPP TS 24.501: "Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3".

[5] 3GPP TS 23.271: "Functional stage 2 description of Location Services (LCS)".

[6] 3GPP TS 38.305: "Stage 2 functional specification of User Equipment (UE) positioning in NG-RAN".

[7] 3GPP TS 24.007: "Mobile radio interface signalling layer 3; General aspects".

[8] 3GPP TS 33.501: "Security architecture and procedures for 5G System".

[9] 3GPP TS 24.526: "UE policies for 5G System (5GS); Stage 3".

[10] 3GPP TS 23.003: "Numbering, addressing and identification".

[11] 3GPP TS 24.080: "Mobile radio interface layer 3 supplementary services specification; Formats and coding".

[12] 3GPP TS 23.501: "System Architecture for the 5G System; Stage 2".

3 Definitions and abbreviations

3.1 Definitions

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

LCS secured user plane connection: A connection used for LCS signaling message transport via user plane between the UE and the LMF. The LCS secured user plane connection is achieved by a TLS connection between the UE and the LMF, established over PDU connectivity service provided by a PDU session.

User plane connection information: The information provided by LMF during the user plane connection establishment procedure. The user plane connection information includes the LMF LCS-UP address.

For the purposes of the present document, the following terms and definitions given in 3GPP TS 23.501 [xx] apply:

> **PDU connectivity service**
> **PDU session**
> **PDU session type**

3.2 Abbreviations

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

FQDN	Fully Qualified Domain Name
LCS	LoCation Service
LCS-UP	Location Services User Plane
LCS-UPP	Location Services User Plane Protocol
LMF	Location Management Function
LPP	LTE Positioning Protocol
OMA	Open Mobile Alliance
SUPL	Secure User Plane Location
TLS	Transport Layer Security
UPP-CM	User Plane Positioning Connection Management
UPP-CMI	User Plane Positioning Connection Management Information

4 General

4.1 Overview

The user plane location services protocols described in the present document provide signalling connectivity between UE and LMF, LCS client or AF, for 5GS.

Main functions of user plane LCS protocols are:

- support of management of an LCS secured user plane connection for user plane positioning; and

- user plane transport procedures to provide a transport of LPP messages and location supplementary services messages.

For the support of the above functions, the following procedures are supplied within this specification:

- elementary procedures for user plane positioning connection management, UPP-CM, in clause 6; and

- elementary procedures for location services user plane protocol, LCS-UPP, in clause 7.

Security, including ciphering and integrity protection, is provided by lower layers from a user plane location services protocol perspective (see 3GPP TS 24.501 [4] for UPP-CM and clause 4.3 for LCS-UPP).

Co-existence of user plane location solutions is described in clause 5.

The UPP-CM and LCS-UPP for 5GS follow the protocol architecture model for layer 3 as described in 3GPP TS 24.007 [7].

4.2 LCS-UP positioning management

4.2.1 General

In order to ensure the transfer of location supplementary services messages and LPP messages via the user plane, the UE and the LMF shall perform the LCS user plane positioning management including:

a) PDU session management (see subclause 4.2.2);

b) user plane positioning connection management (see subclause 4.2.3).

4.2.2 PDU session management

A PDU session for the user plane positioning between the UE and the network is a prerequisite for an LCS secured user plane connection between the UE and the LMF for LCS-UPP.

The HPLMN may provide the UE with the URSP rules for the user plane positioning as defined in 3GPP TS 24.526 [9]. The UE supporting the user plane positioning can use an established PDU session or establish a PDU session for the user plane positioning based on URSP rules. The URSP rules for the user plane positioning includes:

a) the traffic descriptor containing the connection capability for user plane positioning; and

b) the route selection descriptor containing a DNN and an S-NSSAI for the user plane positioning.

During the UE requested user plane connection establishment procedure or the user plane connection establishment procedure, if there is no established PDU session for the user plane positioning, the UE shall initiate a UE-requested PDU session establishment procedure as specified in 3GPP TS 24.501 [4] to establish a new PDU session with a DNN and an S-NSSAI used for the user plane positioning.

NOTE: The appropriate QoS parameters of the PDU session for the user plane positioning are up to the operator's determination.

4.2.3 User plane positioning connection management

The user plane positioning connection management is to support the establishment and release of the LCS secured user plane connection between the UE and the LMF.

To trigger the UE to establish or re-establish an LCS secured user plane connection between the UE and the LMF, the LMF shall provide the user plane connection information to the UE. The UE can also send the USER PLANE CONNECTION ESTABLISHMENT REQUEST message to the LMF to obtain the user plane connection information. The user plane connection information includes the address of the LMF.

4.3 Security

After a successful PDU session establishment providing user plane connectivity, an LCS secured user plane connection between the UE and the LMF for LCS-UPP is protected using a TLS based mechanism as described in 3GPP TS 33.501 [8] Annex Q.2.

5   Co-existence of user plane location solutions

5.1   General

The user plane location solution as described in the present specification, i.e. LCS-UPP, may co-exist with other user plane location solutions such as OMA SUPL. The use of OMA SUPL in a 3GPP network is described in 3GPP TS 38.305 [6] and 3GPP TS 23.271 [5].

For UEs supporting another user plane location solution in addition to LCS-UPP, the following indications and parameters can be used to control which user plane location solution is used for such UEs:

    a) LCS-UPP in NAS 5GMM capability IE (see 3GPP TS 24.501 [4]);

    b) SUPL in NAS 5GMM capability IE (see 3GPP TS 24.501 [4]);

    c) LCS-UPP in NAS 5GS network feature support IE (see 3GPP TS 24.501 [4]); and

    d) SUPL in NAS 5GS network feature support IE (see 3GPP TS 24.501 [4]).

5.2   User plane location solution selection

UEs supporting one or more user plane location solution(s) shall indicate its supported user plane location solution(s) to the network using the LCS-UPP bit, the SUPL bit or both in the 5GMM capability IE during the initial registration procedure and the mobility registration update procedure as described in 3GPP TS 24.501 [4].

If the UE supports LCS-UPP, SUPL or both, the network shall indicate support of user plane location solution(s) to the UE using LCS-UPP bit, the SUPL bit or both in the 5GS network feature support IE during the initial registration procedure and the mobility registration update procedure as described in 3GPP TS 24.501 [4]. The user plane location solution(s) indicated as supported by the network to the UE is selected based on network supported solutions, UE supported solutions and operator policy.

After the UE receives the indication of the supported user plane location solution(s) by the network, and when needed, a user plane location solution supported by both the UE and the network can be initiated and used.

6   Elementary procedures for UPP-CM

6.1   Overview

6.1.1   General

This clause defines the UPP-CM procedures (clause 6.2). The format and coding of the messages and information elements are specified in clause 10.3 and 11.3 respectively.

The user plane positioning connection management is to support the management of an LCS secured user plane connection between the UE and the LMF.

The UPP-CM messages defined in this clause can be included in the UPP-CMI container of the UL NAS Transport messages and DL NAS Transport messages defined in 3GPP TS 24.501 [4].

6.1.2   Types of UPP-CM procedures

Two types of UPP-CM procedures can be distinguished:

    a) Procedures related to establishing the LCS secured user plane connection for LCS-UPP:

        1) Initiated by the network:

    i)   user plane connection establishment procedure.

  2) Initiated by the UE:

    i)   UE requested user plane connection establishment procedure.

    Upon successful completion of the UE requested user plane connection establishment procedure, the LMF shall initiate the user plane connection establishment procedure.

  b) Procedures related to releasing the LCS secured user plane connection for LCS-UPP:

  1) Initiated by the network:

    i)   user plane connection release procedure.

  2) Initiated by the UE:

    i)   UE requested user plane connection release procedure.

    Upon successful completion of the UE requested user plane connection release procedure, the LMF shall initiate the user plane connection release procedure.

6.2 UPP-CM procedures

6.2.1 Network initiated UPP-CM procedures

6.2.1.1 Network initiated user plane connection establishment procedure

6.2.1.1.1 General

The user plane connection establishment procedure enables the network to provide the user plane connection information to the UE and to trigger the UE to establish an LCS secured user plane connection towards the LMF as described in clause 6.18.1 of 3GPP TS 23.273 [2]. The user plane connection information is included in the USER PLANE CONNECTION ESTABLISHMENT COMMAND message which is encapsulated in the UPP-CMI container of the DL NAS TRANSPORT message. Acknowledgement of a received USER PLANE CONNECTION ESTABLISHMENT COMMAND message, with confirmation of the availability of the required PDU connectivity service between UE and LMF, is indicated by the USER PLANE CONNECTION ESTABLISHMENT COMPLETE message, encapsulated in the UPP-CMI container of the UL NAS TRANSPORT message as defined in 3GPP TS 24.501 [4]. Figure 6.2.1.1.1.1 illustrates an example of the signalling transport for user plane connection establishment procedure messages.

Figure 6.2.1.1.1.1: Signalling transport for user plane connection establishment procedure

6.2.1.1.2   Network initiated user plane connection establishment procedure initiation by the network

The LMF initiates the user plane connection establishment procedure by sending the USER PLANE CONNECTION ESTABLISHMENT COMMAND message to the UE and starts the T5012 timer, (see example in figure 6.2.1.1.2.1). The LMF shall:

   a) create the USER PLANE CONNECTION ESTABLISHMENT COMMAND message;

   b) send the USER PLANE CONNECTION ESTABLISHMENT COMMAND message to the UE; and

   c) start a timer T5012 upon sending the USER PLANE CONNECTION ESTABLISHMENT COMMAND message.

UE   LMF

USER PLANE CONNECTION ESTABLISHMENT COMMAND   Start T5012

USER PLANE CONNECTION ESTABLISHMENT COMPLETE   Stop T5012

OR

USER PLANE CONNECTION ESTABLISHMENT COMMAND REJECT   Stop T5012
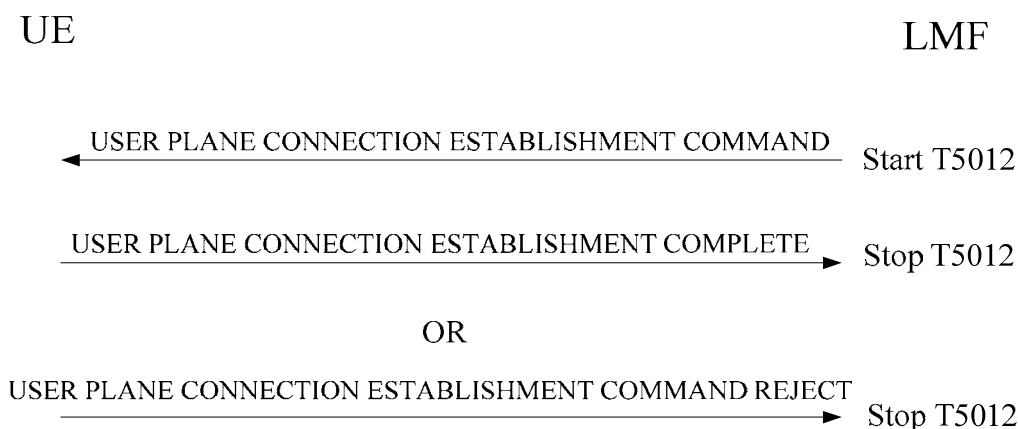
Figure 6.2.1.1.2.1: User plane connection establishment procedure

6.2.1.1.3   Network initiated user plane connection establishment procedure accepted by the UE

Upon receipt of a USER PLANE CONNECTION ESTABLISHMENT COMMAND message from the LMF, the UE shall stop the timer T5011 if running, establish a PDU session providing PDU connectivity service between UE and LMF, if not available, as described in clause 4.2.2.

If the USER PLANE CONNECTION ESTABLISHMENT COMMAND message can be accepted and the required PDU connectivity service between UE and LMF is available, the UE shall:

   a) send a USER PLANE CONNECTION ESTABLISHMENT COMPLETE message to the LMF; and

   b) establish a TLS connection between the UE and the LMF, as described in clause 4.3.

6.2.1.1.4   Network initiated user plane connection establishment procedure completion by the network

Upon receipt of a USER PLANE CONNECTION ESTABLISHMENT COMPLETE message from the UE, the LMF shall stop the timer T5012 and shall consider the PDU connectivity service between the UE and the LMF as available.

6.2.1.1.5   Network initiated user plane connection establishment procedure not accepted by the UE

If the USER PLANE CONNECTION ESTABLISHMENT COMMAND cannot be accepted, the UE shall send a USER PLANE CONNECTION ESTABLISHMENT COMMAND REJECT message.

Upon reception of a USER PLANE CONNECTION ESTABLISHMENT COMMAND REJECT message from the UE, the LMF shall stop the timer T5012 and shall consider the user plane connection between the UE and the LMF as not established.

6.2.1.1.6   Abnormal cases on the network side

The following abnormal cases can be identified:

   a) Expiry of the timer T5012.

        The network shall, on the first expiry of the timer T5012, retransmit the USER PLANE CONNECTION ESTABLISHMENT COMMAND message and shall reset and start timer T5012. This retransmission is repeated up to four times, i.e. on the fifth expiry of timer T5012, the LMF shall abort the user plane connection establishment procedure.

b) Lower layer failure before the USER PLANE CONNECTION ESTABLISHMENT COMPLETE or USER PLANE CONNECTION ESTABLISHMENT COMMAND REJECT message is received.

The network shall abort the user plane connection establishment procedure.

c) User plane connection establishment procedure and UE requested user plane connection establishment procedure collision

If the LMF receives a USER PLANE CONNECTION ESTABLISHMENT REQUEST message during the user plane connection establishment procedure, the LMF shall ignore the USER PLANE CONNECTION ESTABLISHMENT REQUEST message and proceed with the user plane connection establishment procedure.

6.2.1.1.7 Abnormal cases in the UE

The following abnormal cases can be identified:

a) Transmission failure of USER PLANE CONNECTION ESTABLISHMENT COMPLETE message or USER PLANE CONNECTION ESTABLISHMENT COMMAND REJECT message.

The user plane connection establishment procedure shall be aborted.

6.2.1.2 User plane connection release procedure

6.2.1.2.1 General

The user plane connection release procedure enables the network to release the LCS secured user plane connection between the UE and the LMF via the control plane as described in clause 6.18.3 of 3GPP TS 23.273 [2]. The USER PLANE CONNECTION RELEASE COMMAND message is encapsulated in the UPP-CMI container of the DL NAS TRANSPORT message, and the USER PLANE CONNECTION RELEASE COMPLETE message is encapsulated in the UPP-CMI container of the UL NAS TRANSPORT message. Figure 6.2.1.2.1.1 illustrates an example of the signalling transport for the user plane connection release procedure.
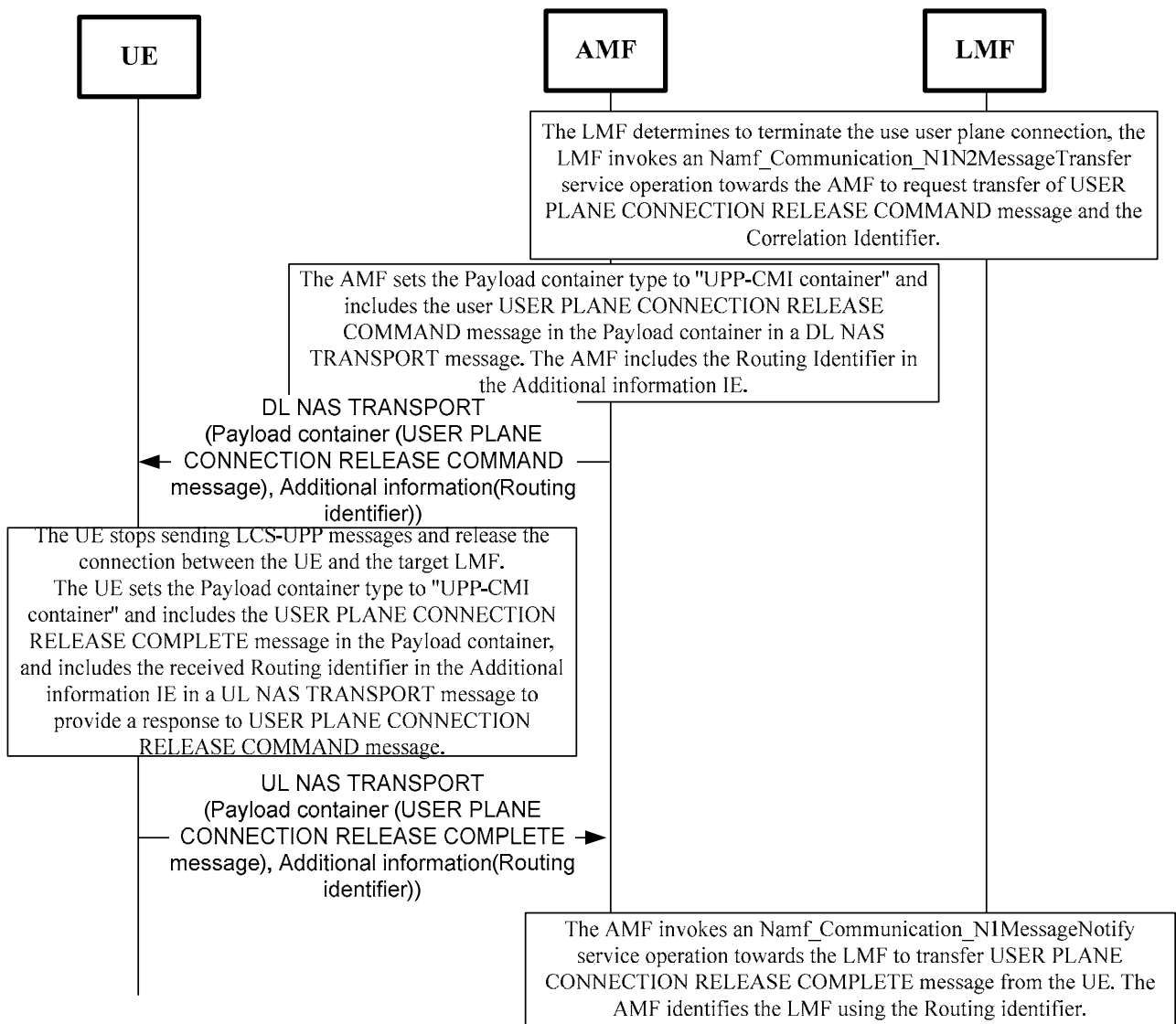
Figure 6.2.1.2.1.1: Signalling transport for user plane connection release procedure

6.2.1.2.2 User plane connection release procedure initiation by LMF

The LMF initiates the user plane connection release procedure by sending the USER PLANE CONNECTION RELEASE COMMAND message to the UE, as shown in figure 6.2.1.2.2.1, the LMF:

a) shall generate the USER PLANE CONNECTION RELEASE COMMAND message according to subclause 10.3.6;

b) shall send the USER PLANE CONNECTION RELEASE COMMAND message to the UE; and

c) shall start a timer T5010 upon sending the USER PLANE CONNECTION RELEASE COMMAND message.

UE   LMF

<-------- USER PLANE CONNECTION RELEASE COMMAND --------   Start T5010

-------- USER PLANE CONNECTION RELEASE COMPLETE -------->   Stop T5010

Figure 6.2.1.2.2.1: User plane connection release procedure

6.2.1.2.3   User plane connection release procedure accepted by UE

Upon receipt of a USER PLANE CONNECTION RELEASE COMMAND message from the LMF, the UE shall stop the timer T5013 if running, stop sending LCS-UPP messages, terminate the TLS connection, create a USER PLANE CONNECTION RELEASE COMPLETE message according to clause 10.3.7 and send it to the LMF, and consider the LCS secured user plane connection between the UE and the LMF as released.

Upon reception of a USER PLANE CONNECTION RELEASE COMPLETE message from the UE, the LMF shall stop the timer T5010 and shall consider the LCS secured user plane connection between the UE and the LMF as released.

6.2.1.2.4   Abnormal cases on the network side

The following abnormal cases can be identified:

    a) Expiry of the timer T5010

        The LMF shall, on the first expiry of the timer T5010, retransmit the USER PLANE CONNECTION RELEASE COMMAND message and shall reset and start timer T5010. This retransmission is repeated up to four times, i.e. on the fifth expiry of timer T5010, the LMF shall abort ongoing LCS-UPP procedures on this LCS secured user plane connection and locally release the LCS secured user plane connection between the UE and the LMF.

    b) User plane connection release procedure and UE requested user plane connection release procedure collision

        If the LMF receives a USER PLANE CONNECTION RELEASE REQUEST message during the user plane connection release procedure, the LMF shall ignore the USER PLANE CONNECTION RELEASE REQUEST message and proceed with the user plane connection release procedure.

6.2.2   UE initiated UPP-CM procedures

6.2.2.1   UE requested user plane connection establishment procedure

6.2.2.1.1   General

The purpose of the UE requested user plane connection establishment procedure is for a UE to request to establish a secured user plane connection between the UE and the LMF, as described in clause 6.18.2 of 3GPP TS 23.273 [2]. The UE requests establishment of an LCS secured user plane connection by sending a USER PLANE CONNECTION ESTABLISHMENT REQUEST message to the network. The USER PLANE CONNECTION ESTABLISHMENT REQUEST message is encapsulated in the UPP-CMI container of the UL NAS TRANSPORT. If accepted, the LMF initiates the user plane connection establishment procedure as specified in clause 6.2.1.1, figure 6.2.2.1.1.1 illustrates an example of the NAS signalling transport for UE requested user plane connection establishment procedure messages.
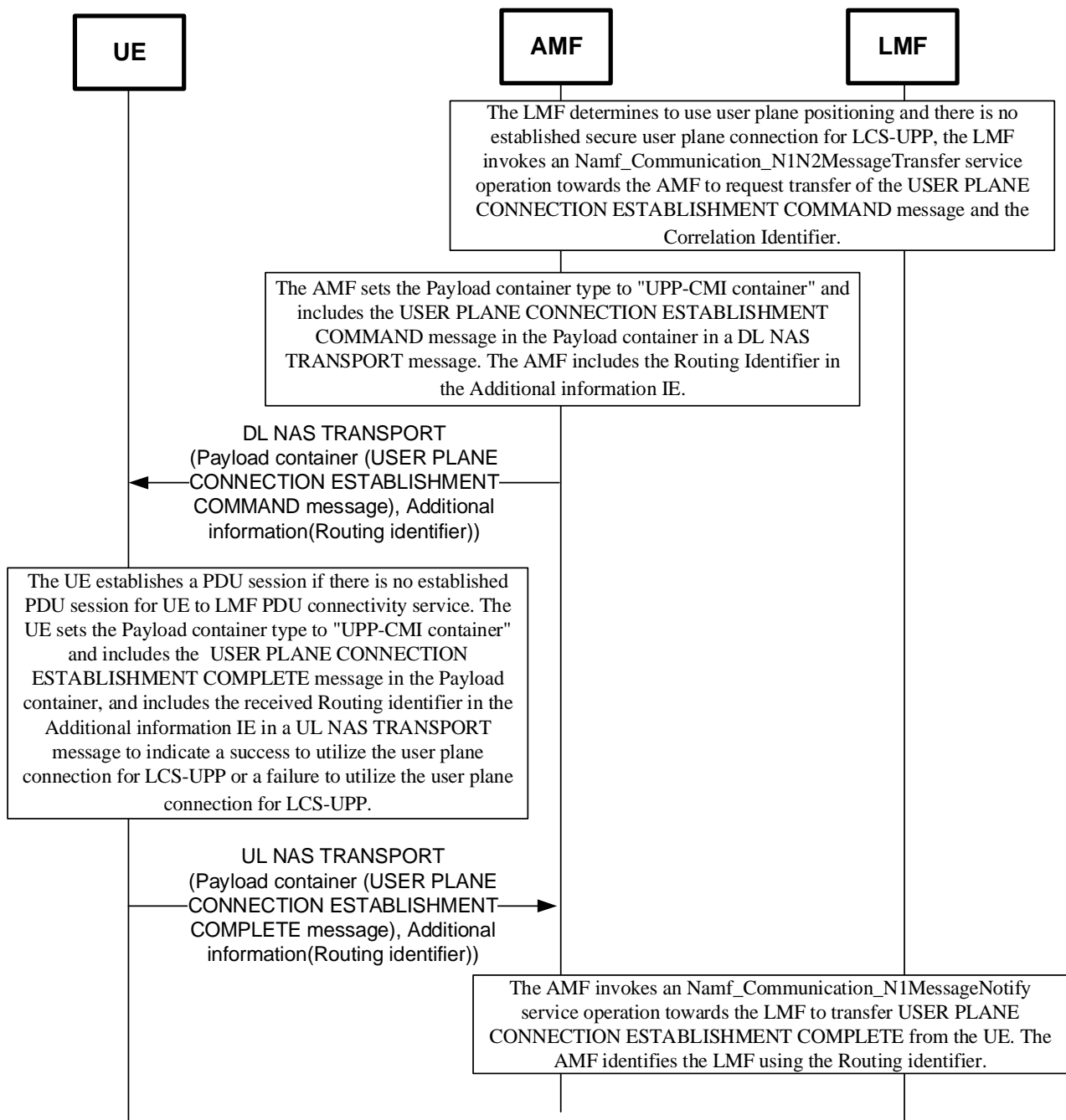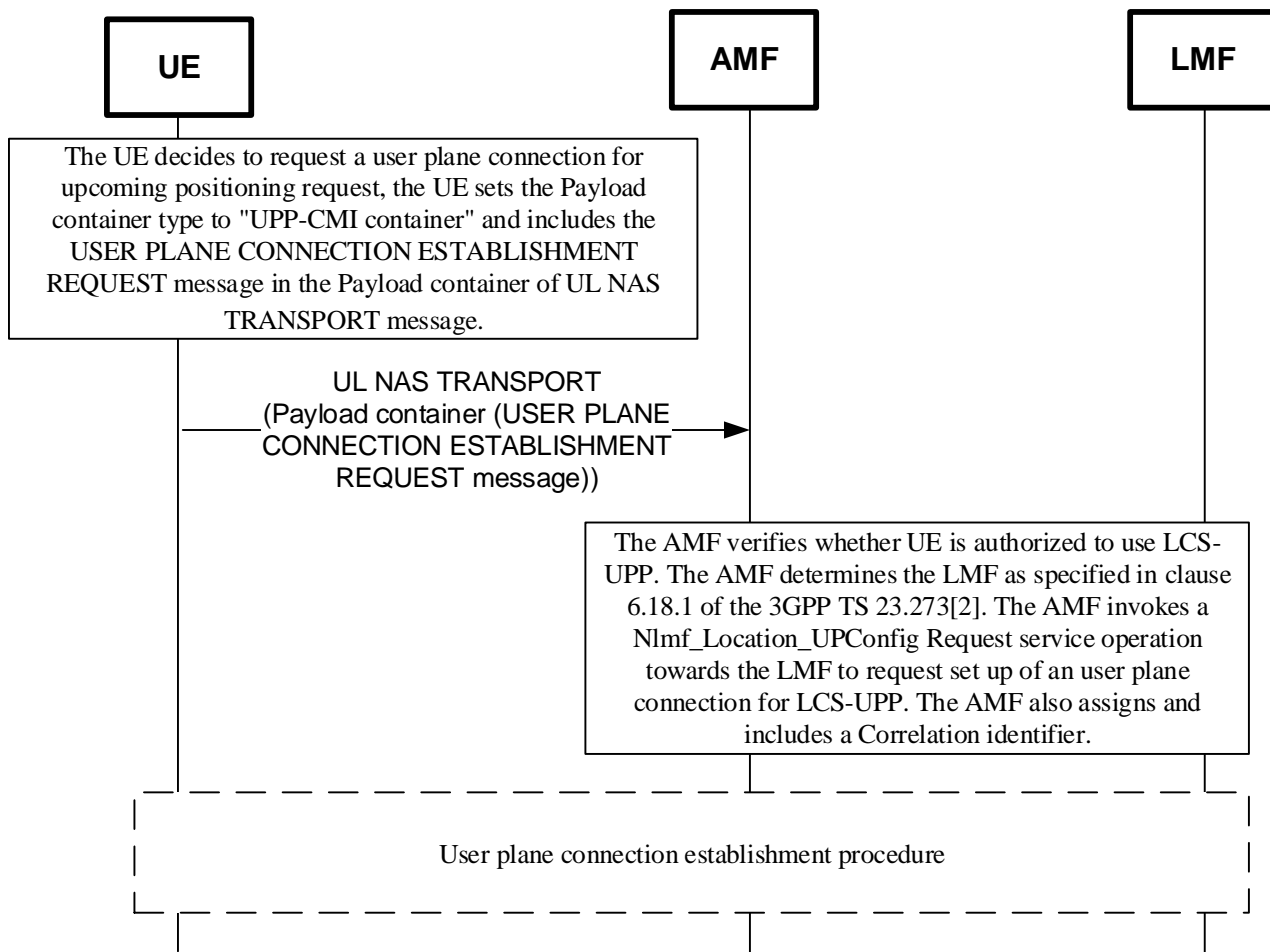
Figure 6.2.2.1.1.1: NAS signalling transport for UE requested user plane connection establishment procedure

6.2.2.1.2 UE requested user plane connection establishment procedure initiation

The UE initiates the UE requested user plane connection establishment procedure by sending the USER PLANE CONNECTION ESTABLISHMENT REQUEST message to the LMF and starts the T5011 timer, (see example in figure 6.2.2.1.2.1). The UE shall:

   a) create the USER PLANE CONNECTION ESTABLISHMENT REQUEST message;

   b) send the USER PLANE CONNECTION ESTABLISHMENT REQUEST message to the LMF using the UL NAS TRANSPORT procedure (see 3GPP TS 24.501 [4]); and

   c) start a timer T5011 upon sending the USER PLANE CONNECTION ESTABLISHMENT REQUEST message.

UE   LMF

Start T5011 ──── USER PLANE CONNECTION ESTABLISHMENT REQUEST ──────►

Stop T5011 ┌───┐
            │   User plane connection establishment procedure   │
            └───┘

OR

Stop T5011 ◄──── USER PLANE CONNECTION ESTABLISHMENT REJECT ────────
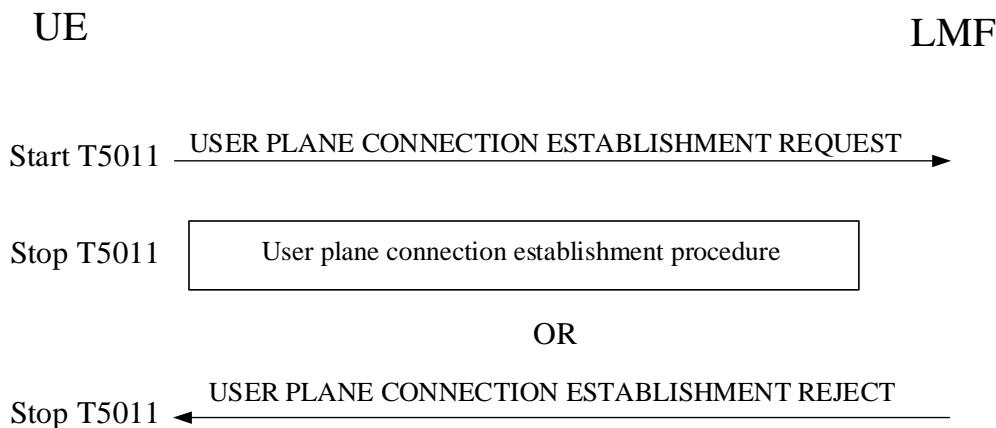
Figure 6.2.2.1.2.1: UE requested user plane connection establishment procedure

6.2.2.1.3 UE requested user plane connection establishment procedure accepted by the network

Upon receipt of a USER PLANE CONNECTION ESTABLISHMENT REQUEST message from the UE, if the LMF accepts the request to establish an LCS secured user plane connection, the LMF shall perform the user plane connection establishment procedure as specified in subclause 6.2.1.

6.2.2.1.4 UE requested user plane connection establishment procedure not accepted by the network

If the USER PLANE CONNECTION ESTABLISHMENT REQUEST cannot be accepted, the LMF shall send a USER PLANE CONNECTION ESTABLISHMENT REJECT message.

Editor's note: It is FFS if the USER PLANE CONNECTION ESTABLISHMENT REJECT message includes a Reject cause to inform of reason for reject to allow different UE handling.

Upon reception of a USER PLANE CONNECTION ESTABLISHMENT REJECT message from the LMF, the UE shall stop the timer T5011 and shall consider the requested establishment of an LCS secured user plane connection between the UE and the LMF as not accepted.

6.2.2.1.6 Abnormal cases in the UE

The following abnormal cases can be identified:

a) Expiry of the timer T5011.

   The UE shall, on the first expiry of the timer T5011, retransmit the USER PLANE CONNECTION ESTABLISHMENT REQUEST message and shall reset and start timer T5011. This retransmission is repeated up to four times, i.e. on the fifth expiry of timer T5011, the UE shall abort the UE requested user plane connection establishment procedure.

6.2.2.1.7 Abnormal cases on the network side

The following abnormal cases can be identified:

a) USER PLANE CONNECTION ESTABLISHMENT REQUEST message received after the USER PLANE CONNECTION ESTABLISHMENT COMMAND message has been sent and before the USER PLANE CONNECTION ESTABLISHMENT COMPLETE message is received

   The previously initiated user plane connection establishment procedure shall be progressed and the new initiated user plane connection establishment procedure shall be aborted.

6.2.2.2 UE requested user plane connection release procedure

6.2.2.2.1 General

The purpose of the UE requested user plane connection release procedure is for a UE to request to release the LCS secured user plane connection between the UE and the LMF via the control plane. The UE requests release of an LCS secured user plane connection by sending a USER PLANE CONNECTION RELEASE REQUEST message to the network. The USER PLANE CONNECTION RELEASE REQUEST message is encapsulated in the UPP-CMI container of the UL NAS TRANSPORT message. If accepted, the network initiates the user plane connection release procedure as specified in clause 6.2.1.2, figure 6.2.2.2.1.1 illustrates an example of the signalling transport for the UE initiated user plane connection release procedure.
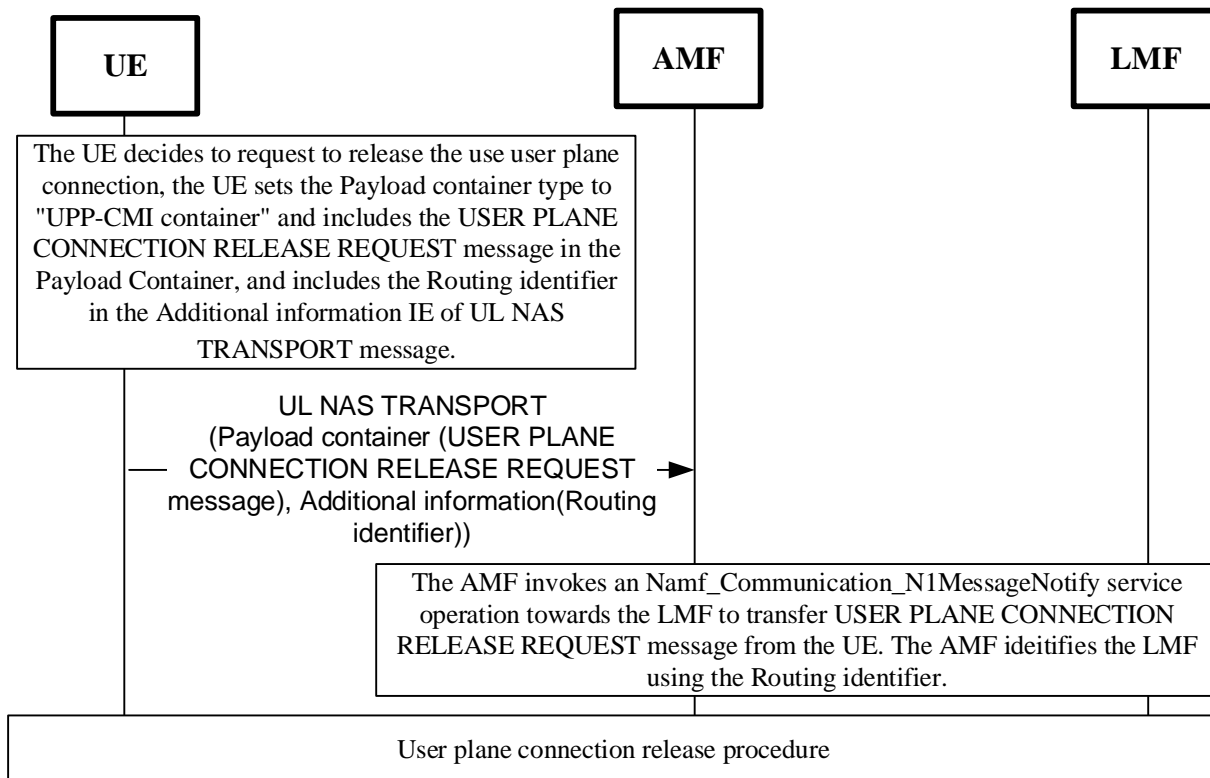
Figure 6.2.2.2.1.1: Signalling transport for UE requested user plane connection release procedure

6.2.2.2.2 UE requested user plane connection release procedure initiation by the UE

The UE initiates the user plane connection release procedure by sending the USER PLANE CONNECTION RELEASE REQUEST message to the LMF, as shown in figure 6.2.2.2.2.1, the UE:

a) shall generate the USER PLANE CONNECTION RELEASE REQUSET message according to subclause 10.3.8,

b) shall send the USER PLANE CONNECTION REELEASE REQUEST message to the LMF; and

c) shall start a timer T5013 upon sending the USER PLANE CONNECTION RELEASE REQUEST message.
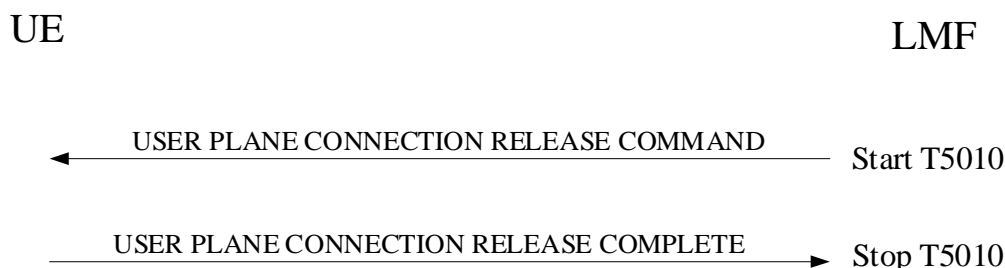
UE   LMF

Start T5013   USER PLANE CONNECTION RELEASE REQUEST   ➔

Stop T5013 | User plane connection release procedure |

Figure 6.2.2.2.2.1: UE requested user plane connection release procedure

6.2.2.2.3 UE requested user plane connection release procedure accepted by the LMF

Upon reception of a USER PLANE CONNECTION RELEASE REQUEST message from the UE, the LMF shall perform the user plane connection release procedure as specified in subclause 6.2.1.2.

6.2.2.2.4 Abnormal cases in the UE

The following abnormal cases can be identified:

a) Expiry of the timer T5013

   The UE shall, on the first expiry of the timer T5013 retransmit the USER PLANE CONNECTION RELEASE REQUEST message and shall reset and start timer T5013. This retransmission is repeated up to four times, i.e., on the fifth expiry of timer T5013, the UE shall abort ongoing LCS-UPP procedures on this LCS secured user plane connection and locally release the LCS secured user plane connection between the UE and the LMF.

7 Elementary procedures for LCS-UPP

7.1 Overview

The main function of the Location Services User Plane protocol (LCS-UPP) is to support generic transport between the UE and the LMF of messages of positioning related protocols including:

a) LPP messages; and

b) location supplementary services messages, only including:

   1) messages for EventReport operations (see 3GPP TS 24.080 [11]);

   2) messages for PeriodicTriggeredInvoke operations (see 3GPP TS 24.080 [11]); and

   3) messages for MSCancelDeferredLocation operations (see 3GPP TS 24.080 [11]).

LCS-UPP procedures are performed between a Location Services User Plane (LCS-UP) entity in a UE and an LCS-UP entity in the LMF.

The following UE-initiated LCS-UPP procedures are specified:

a) uplink LCS-UP transport procedure.

The following LMF-initiated LCS-UPP procedures are specified:

a) downlink LCS-UP transport procedure.

The uplink LCS-UP transport procedures and the downlink LCS-UP transport procedures can be performed on the LCS secured user plane connection over a PDU session via 3GPP access in 5GS as specified in clauses 4.2 and 4.3.

LCS-UPP messages are transported in an IP packet according to clause 7.2.1.

LCS-UPP is a standard L3 protocol according to 3GPP TS 24.007 [7], LCS-UPP messages are standard L3 messages according to 3GPP TS 24.007 [7] and error behaviour specified for L3 protocol according to 3GPP TS 24.007 [7] applies for LCS-UPP.

7.2 LCS-UPP message transport

7.2.1 LCS-UPP message transport in IPv4, IPv6 or IPv4v6 PDU session

In order to send an LCS-UPP message over a PDU session of IPv4, IPv6 or IPv4v6 PDU session type, the UE shall establish the TLS connection towards the LMF. The UE and the LMF shall use the TLS connection to exchange LCS-UPP messages.

7.3 LCS-UPP procedures

7.3.1 General

The main function of the LCS-UPP procedures is to provide transport of payload via an LCS secured user plane connection between the UE and the LMF.

7.3.2 Uplink LCS-UP transport procedure

7.3.2.1 General

The purpose of the uplink LCS-UP transport procedure is to provide a transport of:

  a) one or more LPP messages; or

  b) a single location supplementary services message (see clause 7.1).

7.3.2.2 Uplink LCS-UP transport procedure initiation by the UE

The UE initiates the uplink LCS-UP transport procedure by sending the UL LCS-UP TRANSPORT message to the LMF, as shown in figure 7.3.2.2.1.

In case a) in subclause 7.3.2.1, the UE shall:

  - set the LCS-UP payload type IE to "LTE Positioning Protocol (LPP) message";

  - set the LCS-UP payload IE to the LPP message(s) payload; and

  - set the LCS session identity IE to the LCS session identity received in the DL LCS-UP transport message.

In case b) in subclause 7.3.2.1, the UE shall:

  - set the LCS-UP payload type IE to "Location supplementary services message";

  - set the LCS-UP payload IE to the Location supplementary services message payload; and

  - set the LCS session identity IE to the LCS session identity if received in the DL LCS-UP transport message.

The UE shall send the UL LCS-UP TRANSPORT message to the LMF over the LCS secured user plane connection used for LCS-UPP.

UE LMF
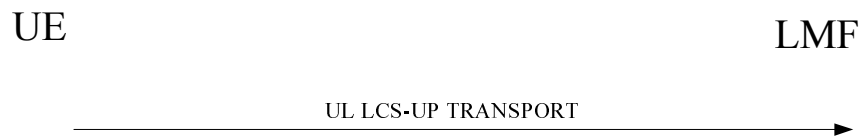
UL LCS-UP TRANSPORT →

Figure 7.3.2.2.1: Uplink LCS-UP transport procedure

7.3.2.3 Uplink LCS-UP transport procedure accepted by the LMF

Upon reception of a UL LCS-UP TRANSPORT message from the UE, if the LCS-UP payload type IE is set to:

a) "LTE Positioning Protocol (LPP) message", the LCS-UP entity of the LMF shall forward the contents of the LCS-UP payload IE to the LPP entity of the LMF; or

b) "Location supplementary services message", the LCS-UP entity of the LMF shall forward the contents of the LCS-UP payload IE to the supplementary services entity of the LMF.

7.3.2.4 Abnormal cases in the UE

The following abnormal case can be identified:

a) Lower layer indication of non-delivered UL LCS-UP TRANSPORT message.

   The UE shall abort the Uplink LCS-UP transport procedure.

7.3.3 Downlink LCS-UP transport procedure

7.3.3.1 General

The purpose of the downlink LCS-UP transport procedure is to provide a transport of:

a) one or more LPP messages; or

b) a single location supplementary services message (see clause 7.1).

7.3.3.2 Downlink LCS-UP transport procedure initiation by the LMF

The LMF initiates the downlink LCS-UP transport procedure by sending the DL LCS-UP TRANSPORT message to the UE, as shown in figure 7.3.3.2.1.

In case a) in subclause 7.3.3.1, the LMF shall:

- set the LCS-UP payload type IE to "LTE Positioning Protocol (LPP) message";

- set the LCS-UP payload IE to the LPP message(s) payload; and

- set the LCS session identity IE to the correlation identifier.

In case b) in subclause 7.3.3.1, the LMF shall:

- set the LCS-UP payload type IE to "Location supplementary services message";

- set the LCS-UP payload IE to the Location supplementary services message payload; and

- set the LCS session identity IE to the correlation identifier or the LCS session identity if received in UL LCS-UP transport message..

The LMF shall send the DL LCS-UP TRANSPORT message to the UE over the LCS secured user plane connection used for LCS-UPP.

UE		LMF
	DL LCS-UP TRANSPORT	
◄───────────────────────────────		

Figure 7.3.3.2.1: Downlink LCS-UP transport procedure

7.3.3.3 Downlink LCS-UP transport of messages accepted by the UE

Upon reception of a DL LCS-UP TRANSPORT message from the LMF, if the LCS-UP payload type IE is set to:

a) "LTE Positioning Protocol (LPP) message", the LCS-UP entity of the UE shall forward the contents of the LCS-UP payload IE to the upper layer location services application for LPP; or

b) "Location supplementary services message", the LCS-UP entity of the UE shall forward the contents of the LCS-UP payload IE to the upper layer location services application for supplementary services.

7.3.3.4 Abnormal cases on the network side

The following abnormal case can be identified:

a) Lower layer indication of non-delivered DL LCS-UP TRANSPORT message.

   The LMF shall abort the downlink LCS-UP transport procedure.

8 LCS-UPP procedures for LCS client or AF

If the LCS-UP entity is implemented both in the UE and the LCS client or the AF, LCS-UPP procedures may be performed between an LCS-UP entity in a UE and an LCS-UP entity in the LCS client or the AF in order to support the location supplementary services event report via user plane procedures as described in clause 6.16 of 3GPP TS 23.273 [2].

The UE uses the user plane connection information provisioned by the network, as specified in clause 5.2.1.3 of 3GPP TS 24.571 [3], to establish an LCS secured user plane connection with the LCS client or AF.

NOTE: How to manage an LCS secured user plane connection with the LCS client or the AF is out of scope of this specification.

The UE initiates the uplink LCS-UP transport procedure as defined in clause 7.3.2 to send the location supplementary services event report to the LCS client or AF, and the LCS client or the AF initiates the downlink LCS-UP transport procedure as defined in clause 7.3.3 to send the location supplementary services acknowledgement of event report to the UE.

9 Handling of unknown, unforeseen and erroneous protocol data

9.1 General

The procedures specified in the present document apply to those LCS-UPP messages and UPP-CM messages which pass the checks described in this clause.

This clause also specifies procedures for the handling of unknown, unforeseen and erroneous protocol data by the receiving entity. These procedures are called "error handling procedures", but in addition to providing recovery mechanisms for error situations they define a compatibility mechanism for future extensions of the protocols.

Subclauses 9.2 to 9.8 shall be applied in order of precedence.

Detailed error handling procedures in the network are implementation dependent and may vary from PLMN to PLMN. However, when extensions of this protocol are developed, networks are assumed to have the error handling which is indicated in this clause as mandatory ("shall") and that is indicated as strongly recommended ("should").

Also, the error handling of the network is only considered as mandatory or strongly recommended when certain thresholds for errors are not reached during a dedicated connection.

For definition of semantical and syntactical errors see 3GPP TS 24.007 [7], clause 11.4.2.

9.2 Message too short or too long

9.2.1 Message too short

When a message is received that is too short to contain a complete message type information element, that message shall be ignored, cf. 3GPP TS 24.007 [7].

9.2.2 Message too long

The maximum size of an LCS-UPP message or a UPP-CM message is 65535 octets.

9.3 Unknown or unforeseen message type

If the UE receives an LCS-UPP message with message type not defined for the LCS-UPP or not implemented by the receiver, it shall ignore the LCS-UPP message.

NOTE 1: A message type not defined for the LCS-UPP in the given direction is regarded by the receiver as a message type not defined for the LCS-UPP, see 3GPP TS 24.007 [7].

If the UE receives an LCS-UPP message not compatible with the LCS-UPP state, the UE shall ignore the LCS-UPP message.

If the UE receives a UPP-CM message with message type not defined for the UPP-CM or not implemented by the receiver, it shall ignore the UPP-CM message.

NOTE 2: A message type not defined for the UPP-CM in the given direction is regarded by the receiver as a message type not defined for the UPP-CM, see 3GPP TS 24.007 [7].

If the UE receives a UPP-CM message not compatible with the UPP-CM state, the UE shall ignore the UPP-CM message.

If the network receives an LCS-UPP message or a UPP-CM message not compatible with the protocol state, the network actions are implementation dependent.

9.4　Non-semantical mandatory information element errors

When on receipt of an LCS-UPP message or a UPP-CM message,

　　a)　an "imperative message part" error; or

　　b)　a "missing mandatory IE" error

is diagnosed or when a message containing:

　　a)　a syntactically incorrect mandatory IE;

　　b)　an IE unknown in the message, but encoded as "comprehension required" (see 3GPP TS 24.007 [7]); or

　　c)　an out of sequence IE encoded as "comprehension required" (see 3GPP TS 24.007 [7]) is received,

the UE shall ignore the LCS-UPP message or the UPP-CM message.

When on receipt of an LCS-UPP message or a UPP-CM message,

　　a)　an "imperative message part" error; or

　　b)　a "missing mandatory IE" error

is diagnosed or when a message containing:

　　a)　a syntactically incorrect mandatory IE;

　　b)　an IE unknown in the message, but encoded as "comprehension required" (see 3GPP TS 24.007 [7]); or

　　c)　an out of sequence IE encoded as "comprehension required" (see 3GPP TS 24.007 [7]) is received,

the network shall proceed as follows:

　　The network shall either:

　　　　1)　try to treat the message (the exact further actions are implementation dependent); or

　　　　2)　ignore the LCS-UPP message or the UPP-CM message.

9.5　Unknown and unforeseen IEs in the non-imperative message part

9.5.1　IEIs unknown in the message

The UE shall ignore all IEs unknown in a message which are not encoded as "comprehension required" (see 3GPP TS 24.007 [7]).

The network shall take the same approach.

9.5.2　Out of sequence IEs

The UE shall ignore all out of sequence IEs in a message which are not encoded as "comprehension required" (see 3GPP TS 24.007 [7]).

The network shall take the same approach.

9.5.3　Repeated IEs

If an information element with format T, TV, TLV, or TLV-E is repeated in a message in which repetition of the information element is not specified in clause 10, the UE shall handle only the contents of the information element appearing first and shall ignore all subsequent repetitions of the information element. When repetition of information elements is specified, the UE shall handle only the contents of specified repeated information elements. If the limit on

repetition of information elements is exceeded, the UE shall handle the contents of information elements appearing first up to the limit of repetitions and shall ignore all subsequent repetitions of the information element.

The network should follow the same procedures.

9.6 Non-imperative message part errors

9.6.1 General

This category includes:

    a) syntactically incorrect optional IEs; and

    b) conditional IE errors.

9.6.2 Syntactically incorrect optional IEs

The UE shall treat all optional IEs that are syntactically incorrect in a message as not present in the message.

The network shall take the same approach.

9.6.3 Conditional IE errors

When upon receipt of an LCS-UPP message, the UE diagnoses a "missing conditional IE" error or an "unexpected conditional IE" error, or when it receives an LCS-UPP message containing at least one syntactically incorrect conditional IE, the UE shall ignore the message.

When upon receipt of a UPP-CM message, the UE diagnoses a "missing conditional IE" error or an "unexpected conditional IE" error, or when it receives a UPP-CM message containing at least one syntactically incorrect conditional IE, the UE shall ignore the message.

When the network receives an LCS-UPP message or a UPP-CM message and diagnoses a "missing conditional IE" error or an "unexpected conditional IE" error or when it receives a message containing at least one syntactically incorrect conditional IE, the network shall either:

    a) try to treat the message (the exact further actions are implementation dependent); or

    b) ignore the message.

9.7 Messages with semantically incorrect contents

When a message with semantically incorrect contents is received, the UE shall perform the foreseen reactions of the procedural part of clauses 6 and 7. If, however no such reactions are specified, the UE shall ignore the message.

The network should follow the same procedure.

10 Message functional definitions and contents

10.1 Overview

This clause defines the structure of the messages of the Layer 3 (L3) protocols defined in the present document including LCS-UPP messages as defined in clause 10.2 and UPP-CM messages as defined in clause 10.3. These are standard L3 messages as defined in 3GPP TS 24.007 [7].

Each definition given in the present clause includes:

    a) a brief description of the message direction and use, including whether the message has:

1. Local significance, i.e. relevant only on the originating or terminating access;

2. Access significance, i.e. relevant in the originating and terminating access, but not in the network;

3. Dual significance, i.e. relevant in either the originating or terminating access and in the network; or

4. Global significance, i.e. relevant in the originating and terminating access and in the network.

b) a table listing the Information Elements (IE) known in the message and the order of their appearance in the message. All IEs that may be repeated are explicitly indicated (The V, LV and LV-E formatted IEs, which compose the imperative part of the message, occur before the T, TV, TLV and TLV-E formatted IEs which compose the non-imperative part of the message, see 3GPP TS 24.007 [7]). In a (maximal) sequence of consecutive IEs with half octet length, the first IE with half octet length occupies bits 1 to 4 of octet N, the second IE bits 5 to 8 of octet N, the third IE bits 1 to 4 of octet N+1 etc. Such a sequence always has an even number of elements.

For each information element the table indicates:

1. The Information Element Identifier (IEI), in hexadecimal notation, if the IE has format T, TV, TLV or TLV-E. If the IEI has half octet length, it is specified by a notation representing the IEI as a hexadecimal digit followed by a "-" (example: B-).

NOTE 1: The same IEI can be used for different information element types in different messages of the same protocol.

NOTE 2: If a message includes a Type 6 IE container information element, then the same IEI can be used for different information element types in the Type 6 IE container information element and in other parts of the same message.

2. The name of the information element (which may give an idea of the semantics of the element). The name of the information element followed by "IE" or "information element" is used in this technical report as reference to the information element within a message.

3. The name of the type of the information element (which indicates the coding of the value part of the IE), and generally, the referenced subclause of clause 11 of the present document describing the value part of the information element.

4. The presence requirement indication (M, C, or O) for the IE as defined in 3GPP TS 24.007 [7].

5. The format of the information element (T, V, TV, LV, TLV, LV-E or TLV-E) as defined in 3GPP TS 24.007 [7].

6. The length of the information element (or permissible range of lengths), in octets, in the message, where "?" means that the maximum length of the IE is only constrained by link layer protocol. This indication is non-normative.

c) subclauses specifying, where appropriate, conditions for IEs with presence requirement C or O in the relevant message which together with other conditions specified in the present document define when the information elements shall be included or not, what non-presence of such IEs means, and – for IEs with presence requirement C – the static conditions for presence or non-presence of the IEs or for both cases (see 3GPP TS 24.007 [12]).

10.2　LCS-UPP messages

10.2.1　UL LCS-UP transport

10.2.1.1　Message definition

The UL LCS-UP TRANSPORT message is sent by the UE to the LMF to transport the LPP message(s) or the location supplementary services message. See table 10.2.1.1.1.

Message type:　UL LCS-UP TRANSPORT

Significance: dual

Direction: UE to network

Table 10.2.1.1.1: UL LCS-UP TRANSPORT message content

IEI	Information Element	Type/Reference	Presence	Format	Length
	UL LCS-UP TRANSPORT message identity	Message type 11.1.3	M	V	1
	LCS-UP payload type	LCS-UP payload type 11.2.2	M	V	1/2
	Spare half octet	Spare half octet 11.3	M	V	1/2
	LCS-UP payload	LCS-UP payload 11.2.1	M	LV-E	3-65537
	LCS session identity	LCS session identity 11.2.3	M	LV	2-n

10.2.2   DL LCS-UP transport

10.2.2.1   Message definition

The DL LCS-UP TRANSPORT message is sent by the LMF to the UE to transport the LPP message(s) or the location supplementary services message(s). See table 10.2.2.1.1.

Message type: DL LCS-UP TRANSPORT

Significance: dual

Direction: network to UE

Table 10.2.2.1.1: DL LCS-UP TRANSPORT message content

IEI	Information Element	Type/Reference	Presence	Format	Length
	DL LCS-UP TRANSPORT message identity	Message type 11.1.3	M	V	1
	LCS-UP payload type	LCS-UP payload type 11.2.2	M	V	1/2
	Spare half octet	Spare half octet 11.3	M	V	1/2
	LCS-UP payload	LCS-UP payload 11.2.1	M	LV-E	3-65537
	LCS session identity	LCS session identity 11.2.3	M	LV	2-n

10.3   UPP-CM messages

10.3.1   User plane connection establishment command

10.3.1.1   Message definition

The USER PLANE CONNECTION ESTABLISHMENT COMMAND message is sent by the LMF to the UE to transport the user plane connection information and trigger the UE to establish the LCS secured user plane connection towards the LMF. See table 10.3.1.1.1.

Message type: USER PLANE CONNECTION ESTABLISHMENT COMMAND

Significance: dual

Direction: network to UE

Table 10.3.1.1.1: USER PLANE CONNECTION ESTABLISHMENT COMMAND message content

IEI	Information Element	Type/Reference	Presence	Format	Length
	USER PLANE CONNECTION ESTABLISHMENT COMMAND message identity	Message type 11.1.3	M	V	1
	LMF LCS-UP address	LMF LCS-UP address 11.3.1	M	LV	3-256

10.3.2 User plane connection establishment complete

10.3.2.1 Message definition

The USER PLANE CONNECTION ESTABLISHMENT COMPLETE message is sent by the UE to the LMF in response to a USER PLANE CONNECTION ESTABLISHMENT COMMAND message and confirms the availability of the required PDU connectivity service between UE and LMF. See table 10.3.2.1.1.

Message type: USER PLANE CONNECTION ESTABLISHMENT COMPLETE

Significance: dual

Direction: UE to network

Table 10.3.2.1.1: USER PLANE CONNECTION ESTABLISHMENT COMPLETE message content

IEI	Information Element	Type/Reference	Presence	Format	Length
	USER PLANE CONNECTION ESTABLISHMENT COMPLETE message identity	Message type 11.1.3	M	V	1

10.3.3 User plane connection establishment command reject

10.3.3.1 Message definition

The USER PLANE CONNECTION ESTABLISHMENT COMMAND REJECT message is sent by the UE to the LMF in response to a USER PLANE CONNECTION ESTABLISHMENT COMMAND message and indicates rejection for the establishment of an LCS secured user plane connection to the LMF. See table 10.3.3.1.1.

Message type: USER PLANE CONNECTION ESTABLISHMENT COMMAND REJECT

Significance: dual

Direction: UE to network

Table 10.3.3.1.1: USER PLANE CONNECTION ESTABLISHMENT COMMAND REJECT message content

IEI	Information Element	Type/Reference	Presence	Format	Length
	USER PLANE CONNECTION ESTABLISHMENT COMMAND REJECT message identity	Message type 11.1.3	M	V	1

10.3.4 User plane connection establishment request

10.3.4.1 Message definition

The USER PLANE CONNECTION ESTABLISHMENT REQUEST message is sent by the UE to the LMF to request establishment of an LCS secured user plane connection between the UE and the LMF. See table 10.3.4.1.1.

Message type: USER PLANE CONNECTION ESTABLISHMENT REQUEST

Significance: dual

Direction: UE to network

Table 10.3.4.1.1: USER PLANE CONNECTION ESTABLISHMENT REQUEST message content

IEI	Information Element	Type/Reference	Presence	Format	Length
	USER PLANE CONNECTION ESTABLISHMENT REQUESTmessage identity	Message type 11.1.3	M	V	1

10.3.5   User plane connection establishment reject

10.3.5.1   Message definition

THE USER PLANE CONNECTION ESTABLISHMENT REJECT message is sent by the LMF to reject the user plane connection establishment request received from UE. See table 10.3.5.1.1.

Message type: USER PLANE CONNECTION ESTABLISHMENT REJECT

Significance: dual

Direction: network to UE

Table 10.3.4.1.1: USER PLANE CONNECTION ESTABLISHMENT REJECT message content

IEI	Information Element	Type/Reference	Presence	Format	Length
	USER PLANE CONNECTION ESTABLISHMENT REJECT message identity	Message type 11.1.3	M	V	1

10.3.6   User plane connection release command

10.3.6.1   Message definition

The USER PLANE CONNECTION RELEASE COMMAND message is sent by the LMF to the UE to release the LCS secured user plane connection between the UE and the LMF. See table 10.3.6.1.1.

Message type: USER PLANE CONNECTION RELEASE COMMAND

Significance: dual

Direction: network to UE

Table 10.3.6.1.1: USER PLANE CONNECTION RELEASE COMMAND message content

IEI	Information Element	Type/Reference	Presence	Format	Length
	USER PLANE CONNECTION RELEASE COMMAND message identity	Message type 11.1.3	M	V	1

10.3.7 User plane connection release complete

10.3.7.1 Message definition

The USER PLANE CONNECTION RELEASE COMPLETE message is sent by the UE to the LMF in response to a USER PLANE CONNECTION RELEASE COMMAND message and indicates confirmation for the release of the LCS secured user plane connection between the UE and the LMF. See table 10.3.7.1.1.

Message type: USER PLANE CONNECTION RELEASE COMPLETE

Significance: dual

Direction: UE to network

Table 10.3.7.1.1: USER PLANE CONNECTION RELEASE COMPLETE message content

IEI	Information Element	Type/Reference	Presence	Format	Length
	USER PLANE CONNECTION RELEASE COMPLETE message identity	Message type 11.1.3	M	V	1

10.3.8 User plane connection release request

10.3.8.1 Message definition

The USER PLANE CONNECTION RELEASE REQUEST message is sent by the UE to the LMF to request to release the LCS secured user plane connection between the UE and the LMF. See table 10.3.8.1.1.

Message type: USER PLANE CONNECTION RELEASE REQUEST

Significance: dual

Direction: UE to network

Table 10.3.8.1.1: User Plane Connection Establishment Request message content

IEI	Information Element	Type/Reference	Presence	Format	Length
	USER PLANE CONNECTION RELEASE REQUEST message identity	Message type 11.1.3	M	V	1

11 Information elements coding

11.1 Overview

11.1.1 UPP-CM and LCS-UPP message format

Within the protocols defined in the present document, every UPP-CM and LCS-UPP message is a standard L3 message as defined in 3GPP TS 24.007 [11]. This means that UPP-CM and LCS-UPP messages consist of the following parts:

   1) message type; and

   2) other information elements, as required.

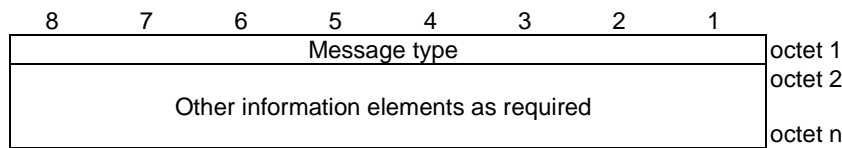The organization of UPP-CM and LCS-UPP messages is illustrated in the example shown in figure 11.1.1.1.

```
    8     7     6     5     4     3     2     1
┌─────────────────────────────────────────────────┐
│                  Message type                   │ octet 1
├─────────────────────────────────────────────────┤
│                                                 │ octet 2
│        Other information elements as required    │
│                                                 │ octet n
└─────────────────────────────────────────────────┘
```

Figure 11.1.1.1: General message organization example for UPP-CM and LCS-UPP messages

Unless specified otherwise in the message descriptions of clause 10, a particular information element shall not be present more than once in a given message.

11.1.2   Field format and mapping

When a field is contained within a single octet, the lowest numbered bit of the field represents the least significant bit.

When a field extends over more than one octet, the order of bit values progressively decreases as the octet number increases. In that part of the field contained in a given octet, the lowest numbered bit represents the least significant bit. The most significant bit of the field is represented by the highest numbered bit of the lowest numbered octet of the field. The least significant bit of the field is represented by the lowest numbered bit of the highest numbered octet of the field.

For example, a bit number can be identified as a couple (o, b) where o is the octet number and b is the relative bit number within the octet. Figure 9.1.2.1 illustrates a field that spans from bit (1, 3) to bit (2, 7). The most significant bit of the field is mapped on bit (1, 3) and the least significant bit is mapped on bit (2, 7).

```
    8     7     6     5     4     3     2     1
┌─────────────────────────────────────────────────┐
│                           │ 2⁴  │ 2³  │ 2²  │    1ˢᵗ octet of field
├──────────┬──────────┬─────────────────────────────┤
│   2¹     │   2⁰     │                             │  2ⁿᵈ octet of field
└──────────┴──────────┴─────────────────────────────┘
```
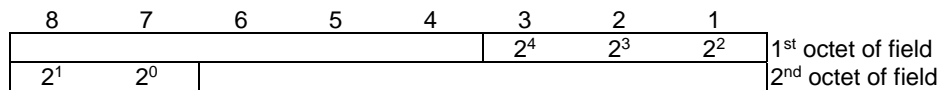
Figure 11.1.2.1: Field mapping convention

11.1.3   Message type

The Message type information element and its use are defined in 3GPP TS 24.007 [11]. Table 11.1.3.1defines the value part of the message type information element used in the LCS-UPP and table 11.1.3.2 defines the value part of the message type information element used in the UPP-CM.

The Message type is a type 3 information element, with the length of 1 octet.

Table 11.1.3.1: Message type for LCS-UPP

```
┌─────────────────────────────────────────────────────────────┐
│ Bits                                                        │
│ 8  7  6  5  4  3  2  1                                       │
│                                                             │
│ 0  1  -  -  -  -  -  -      LCS-UPP messages                 │
│                                                             │
│ 0  1  0  0  0  0  0  1      UL LCS-UP transport              │
│ 0  1  0  0  0  0  1  0      DL LCS-UP transport              │
└─────────────────────────────────────────────────────────────┘
```

Table 11.1.3.2: Message type for UPP-CM

```
Bits
8  7  6  5  4  3  2  1

1  1  -  -  -  -  -  -        UPP-CM messages

1  1  0  0  0  0  0  1        User plane connection establishment command
1  1  0  0  0  0  1  0        User plane connection establishment complete
1  1  0  0  0  0  1  1        User plane connection establishment command reject
1  1  0  0  0  1  0  0        User plane connection establishment request
1  1  0  0  0  1  0  1        User plane connection establishment reject
1  1  0  0  0  1  1  0        User plane connection release command
1  1  0  0  0  1  1  1        User plane connection release complete
1  1  0  0  1  0  0  0        User plane connection release request
```

11.2   LCS-UPP information elements

11.2.1   LCS-UP payload

The purpose of the LCS-UP payload information element is to transport LPP message(s) or supplementary services message.

The LCS-UP payload information element is coded as shown in figure 11.2.1.1, figure 11.2.1.2, figure 11.2.1.3 and table 11.2.1.1.

The LCS-UP payload information element is a type 6 information element with a minimum length of 3 octets and a maximum length of 65538 octets.

8	7	6	5	4	3	2	1	
LCS-UP payload IEI								octet 1
Length of LCS-UP payload contents								octet 2
								octet 3
LCS-UP payload contents								octet 4
								octet n

Figure 11.2.1.1: LCS-UP payload information element

8	7	6	5	4	3	2	1	
Length of LPP message 1								octet 4
								octet 5
LPP message 1								octet 6*
								octet b*
Length of LPP message 2								octet (b+1)*
								octet (b+2)*
LPP message 2								octet (b+3)*
								octet c*
…								octet (c+1)* … octet d*
Length of LPP message n								octet (d+1)*
								octet d+2*
LPP message n								octet (d+3)*
								octet n*
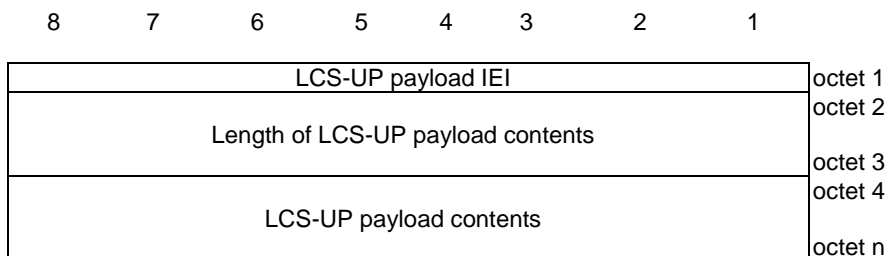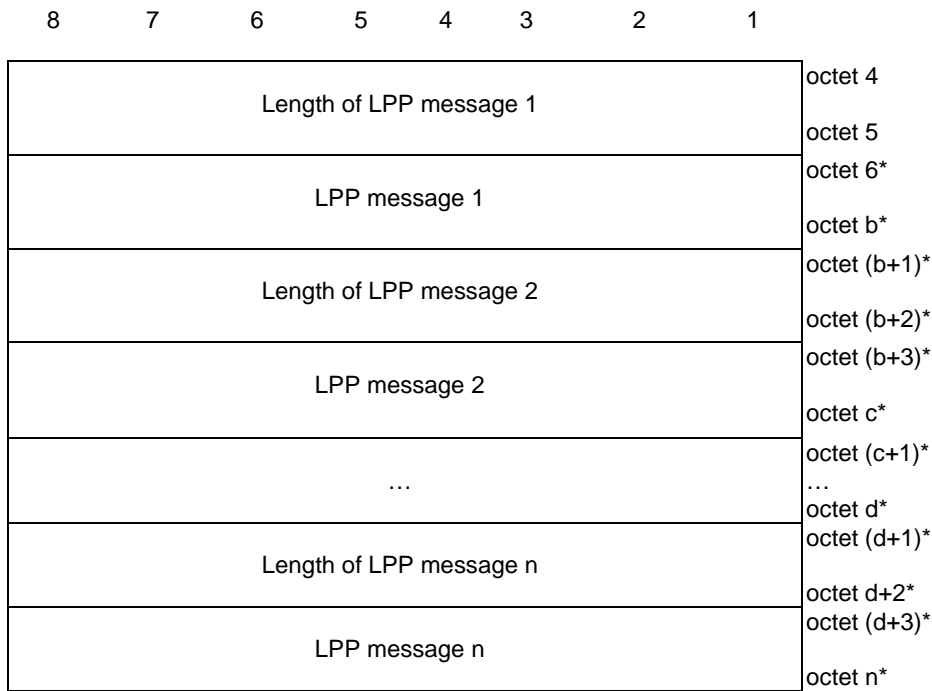
Figure 11.2.1.2: LCS-UP payload contents with LCS-UP payload type "LTE Positioning Protocol (LPP) message"

8	7	6	5	4	3	2	1	
Location supplementary services message								octet 4
								octet n

Figure 11.2.1.3: LCS-UP payload contents with LCS-UP payload type "Location supplementary services message"
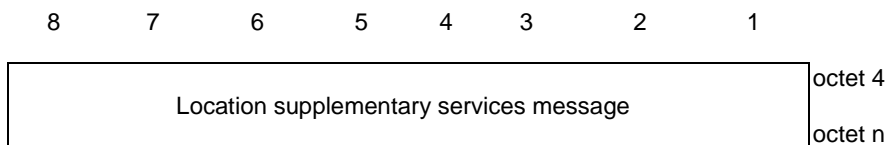
Table 11.2.1.1: LCS-UP payload information element

LCS-UP payload contents (octet 4 to octet n);

If the LCS-UP payload type is set to "LTE Positioning Protocol (LPP) message", the LCS-UP payload contents include one or more LPP message(s).

If the LCS-UP payload type is set to "Location supplementary services message", the LCS-UP payload contents include a location supplementary services message.

11.2.2 LCS-UP payload type

The purpose of the LCS-UP payload type information element indicates information type included in the LCS-UP payload information element.

The LCS-UP payload type information element is coded as shown in figure 11.2.2.1 and table 11.2.2.1

The LCS-UP payload type information element is a type 1 information element.

8	7	6	5	4	3	2	1	
LCS-UP payload type IEI				LCS-UP payload type value				octet 1

Figure 11.2.2.1: LCS-UP payload type information element

Table 11.2.2.1: LCS-UP payload type information element

LCS-UP payload type value (octet 1)
Bits
4 3 2 1
0 0 0 1   LTE Positioning Protocol (LPP) message
0 0 1 0   Location supplementary services message
All other values are reserved.

11.2.3   LCS session identity

The purpose of the LCS session identity information element is to identify the LCS session transferred in the user plane between the UE and the LMF. The LCS session identity value is set to the correlation identifier or the routing identifier for Location supplementary services messages and LPP messages.

The LCS-UP payload type information element is coded as shown in figure 11.2.3.1 and table 11.2.3.1

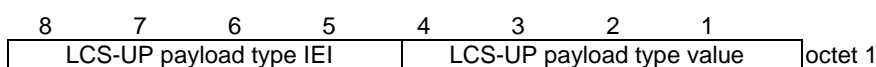The LCS-UP payload type information element is a type 4 information element with a minimum length of 3 octets.
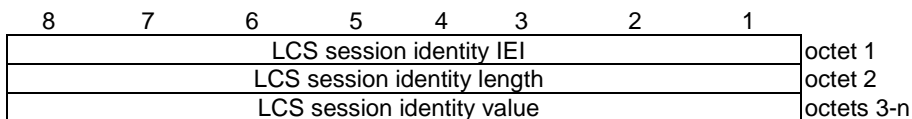
8	7	6	5	4	3	2	1	
LCS session identity IEI								octet 1
LCS session identity length								octet 2
LCS session identity value								octets 3-n

Figure 11.2.3.1: LCS session identity information element

Table 11.2.3.1: LCS session identity information element

LCS session identity value (octet 3 to octet n)
The LCS session identity value is set to the correlation identifier or routing identifier for Location supplementary services messages and LPP messages. The coding of the LCS session identity value is dependent on the LCS application.

11.3   UPP-CM information elements

11.3.1   LMF LCS-UP address

The purpose of the LMF LCS-UP address information element is to carry the user plane positioning address of the LMF.

The LMF LCS-UP address information element is coded as shown in figure 11.3.1.1 and table 11.3.1.1.

The LMF LCS-UP address information element is a type 4 information element with minimum length of 4 octets and maximum length of 257 octets.

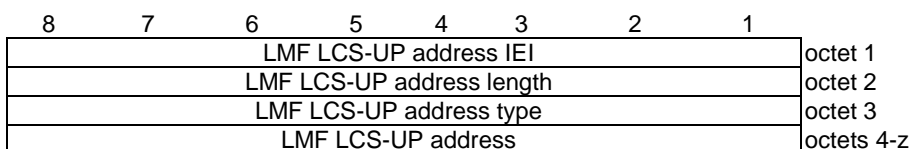| 8	7	6	5	4	3	2	1	
LMF LCS-UP address IEI								octet 1
LMF LCS-UP address length								octet 2
LMF LCS-UP address type								octet 3
LMF LCS-UP address								octets 4-z

Figure 11.3.1.1: LMF LCS-UP address information element

Table 11.3.1.1: LMF LCS-UP address information element

```
LMF LCS-UP address type (octet 3)
Bits
8   7   6   5   4   3   2   1
0   0   0   0   0   0   0   1      IPv4
0   0   0   0   0   0   1   0      IPv6
0   0   0   0   0   0   1   1      IPv4v6
0   0   0   0   0   1   0   0      FQDN
All other values are spare. If received they shall be ignored.

If the LMF LCS-UP address type indicates IPv4, then the LMF LCS-UP address field
contains an IPv4 address in octet 4 to octet 7.

If the LMF LCS-UP address type indicates IPv6, then the LMF LCS-UP address field
contains an IPv6 address in octet 4 to octet 19.

If the LMF LCS-UP address type indicates IPv4v6, then the LMF LCS-UP address field
contains two IP addresses. The first IP address is an IPv4 address in octet 4 to octet 7.
The second IP address is an IPv6 address in octet 8 to octet 23.

If the LMF LCS-UP address type indicates FQDN, octet 4 to octet z is encoded as
defined in subclause 19.4.2.1 in 3GPP TS 23.003 [10].
```

11.4   Spare half octet

This element is used in the description of LCS-UPP messages when an odd number of half octet type 1 information elements are used. This element is filled with spare bits set to zero and is placed in bits 5 to 8 of the octet unless otherwise specified.

12   List of system parameters

12.1   General

The description of timers in the tables of clause 12 should be considered a brief summary. The precise details are found in clauses 6 and 7, which should be considered the definitive descriptions.

12.2   Timers of LCS-UPP

Editor's note: This clause will contain a table of timers of LCS-UPP– UE side, if any.

Editor's note: This clause will contain a table of timers of LCS-UPP– network side, if any.

12.3   Timers of UPP-CM

Timers of UPP-CM are shown in table 12.3.1 and table 12.3.2.

Table 12.3.1: Timers of UPP-CM – UE side

TIMER NUM.	TIMER VALUE	CAUSE OF START	NORMAL STOP	ON THE 1st, 2nd, 3rd, 4th EXPIRY (NOTE 1)
T5011	16s	Transmission of USER PLANE CONNECTION ESTABLISHMENT REQUEST message	USER PLANE CONNECTION ESTABLISHMENT COMMAND message received USER PLANE CONNECTION ESTABLISHMENT REJECT message received	Retransmission of USER PLANE CONNECTION ESTABLISHMENT REQUEST message
T5013	16s	Transmission of USER PLANE CONNECTION RELEASE REQUEST message	USER PLANE CONNECTION RELEASE COMMAND message received	Retransmission of USER PLANE CONNECTION RELEASE REQUEST message
NOTE 1: Typically, the procedures are aborted on the fifth expiry of the relevant timer. Exceptions are described in the corresponding procedure description.				

Table 12.3.2: Timers of UPP-CM – LMF side

TIMER NUM.	TIMER VALUE	CAUSE OF START	NORMAL STOP	ON THE 1st, 2nd, 3rd, 4th EXPIRY (NOTE 1)
T5012	16s	Transmission of USER PLANE CONNECTION ESTABLISHMENT COMMAND message	USER PLANE CONNECTION ESTABLISHMENT COMPLETE message received USER PLANE CONNECTION ESTABLISHMENT COMMAND REJECT message received	Retransmission of USER PLANE CONNECTION ESTABLISHMENT COMMAND message
T5010	16s	Transmission of USER PLANE CONNECTION RELEASE COMMAND message	A USER PLANE CONNECTION RELEASE COMPLETE message received	Retransmission of USER PLANE CONNECTION RELEASE COMMAND message
NOTE 1: Typically, the procedures are aborted on the fifth expiry of the relevant timer. Exceptions are described in the corresponding procedure description.				

Annex <A> (informative):
Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
2023-03	CT1#140	C1-231046				Draft skeleton provided by the rapporteur.	0.0.0
2023-03	CT1#140	C1-231047				Implementing the following p-CRs agreed by CT1: C1-231047; and editorial changes from the rapporteur.	0.1.0
2023-08	CT1#143	C1-235982, C1-235982, C1-236548, C1-236450, C1-236451, C1-236454, C1-236566				Implementing the following p-CRs agreed by CT1: C1-235982, C1-235982, C1-236548, C1-236450, C1-236451, C1-236454, C1-236566; and editorial changes from the rapporteur.	0.2.0
2023-10	CT1#144	C1-237757, C1-237760, C1-237761, C1-237762, C1-237763, C1-237890, C1-237909, C1-237933, C1-237956, C1-237957, C1-237958				Implementing the following p-CRs agreed by CT1: C1-237757, C1-237760, C1-237761, C1-237762, C1-237763, C1-237890, C1-237909, C1-237933, C1-237956, C1-237957, C1-237958; and editorial changes from the rapporteur.	0.3.0
2023-11	CT1#145	C1-239250, C1-239251. C1-239252. C1-239253. C1-239650. C1-239656. C1-239258, C1-239260, C1-239261, C1-239264, C1-239380, C1-239373, C1-239651,				Implementing the following p-CRs agreed by CT1: C1-239250, C1-239251. C1-239252. C1-239253. C1-239650. C1-239656. C1-239258, C1-239260, C1-239261, C1-239264, C1-239380, C1-239373, C1-239651; and editorial changes from the rapporteur.	1.0.0
2024-01	CT1#146	C1-240021, C1-240023, C1-240029, C1-240035, C1-240144, C1-240158, C1-240324, C1-240325, C1-240326, C1-240327, C1-240328, C1-240329, C1-240330, C1-240331, C1-240332, C1-240333, C1-240334, C1-240335, C1-240336, C1-240356, C1-240357, C1-240358, C1-240359, C1-240388, C1-240389, C1-240391, C1-240393, C1-240397, C1-240398, C1-240399, C1-240425, C1-240426				Implementing the following p-CRs agreed by CT1: C1-240021, C1-240023, C1-240029, C1-240035, C1-240144, C1-240158, C1-240324, C1-240325, C1-240326, C1-240327, C1-240328, C1-240329, C1-240330, C1-240331, C1-240332, C1-240333, C1-240334, C1-240335, C1-240336, C1-240356, C1-240357, C1-240358, C1-240359, C1-240388, C1-240389, C1-240391, C1-240393, C1-240397, C1-240398, C1-240399, C1-240425, C1-240426; and editorial changes from the rapporteur.	1.1.0

2024-03	CT1#147	C1-240754, C1-241795, C1-241715, C1-241764, C1-241776, C1-240605, C1-241765, C1-241842, C1-240680, C1-240678, C1-240523, C1-240756, C1-241091, C1-241299, C1-241300, C1-241301, C1-241303, C1-241742				Implementing the following p-CRs agreed by CT1: C1-240754, C1-241795, C1-241715, C1-241764, C1-241776, C1-240605, C1-241765, C1-241842, C1-240680, C1-240678, C1-240523, C1-240756, C1-241091, C1-241299, C1-241300, C1-241301, C1-241303, C1-241742; and editorial changes from the rapporteur.	2.0.0
2024-03	CT#103					Approved in CT#103	18.0.0

History

Document history		
V18.0.0	May 2024	Publication