# ETSI TS 136 413 V8.2.0 (2008-11)

Technical Specification

**LTE;
Evolved Universal Terrestrial Radio Access (E-UTRA);
S1 Application Protocol (S1AP)
(3GPP TS 36.413 version 8.2.0 Release 8)**

Reference
DTS/TSGR-0336413v820

Keywords
LTE

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 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

Individual copies of the present document can be downloaded from:
http://www.etsi.org

The present document may be made available in more than one electronic version or in print. In any case of existing or
perceived difference in contents between such versions, the reference version is the Portable Document Format (PDF).
In case of dispute, the reference shall be the printing on ETSI printers of the PDF version kept on a specific network drive
within ETSI Secretariat.

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
http://portal.etsi.org/tb/status/status.asp

If you find errors in the present document, please send your comment to one of the following services:
http://portal.etsi.org/chaircor/ETSI_support.asp

Copyright Notification

ETSI

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://webapp.etsi.org/IPR/home.asp).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

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

The present document may refer to technical specifications or reports using their 3GPP identities, UMTS identities or GSM identities. These should be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between GSM, UMTS, 3GPP and ETSI identities can be found under http://webapp.etsi.org/key/queryform.asp.

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.

1 Scope

The present document specifies the E-UTRAN radio network layer signalling protocol for the S1 interface. The S1 Application Protocol (S1AP) supports the functions of S1 interface by signalling procedures defined in this document. S1AP is developed in accordance to the general principles stated in [2] and [3].

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: 'E-UTRAN Architecture Description'.

[3]   3GPP TS 36.410: 'S1 General Aspects and Principles'.

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

[5]   ITU-T Recommendation X.680 (07/2002): "Information technology - Abstract Syntax Notation One (ASN.1): Specification of basic notation".

[6]   ITU-T Recommendation X.681 (07/2002): "Information technology - Abstract Syntax Notation One (ASN.1): Information object specification".

[7]   3GPP TS 32.421: "Trace concepts and requirements".

[8]   3GPP TS 23.402: "Architecture enhancements for non-3GPP accesses".

[9]   3GPP TS 23.216: "Single Radio Voice Call Continuity (SRVCC)".

[10]   3GPP TS 32.422: "Trace control and configuration management".

[11]   3GPP TS 23.401: "General Packet Radio Service (GPRS) enhancements for E-UTRAN access".

[12]   3GPP TS 36.414: 'Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 data transport'.

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: S1AP consists of Elementary Procedures (EPs). An Elementary Procedure is a unit of interaction between eNBs and the EPC. These Elementary Procedures are defined separately and are intended to be used to build up complete sequences in a flexible manner. If the independence between some EPs is restricted, it is described under the relevant EP description. Unless otherwise stated by the restrictions, the EPs may be invoked independently of each other as stand alone procedures, which can be active in parallel. Examples on using several S1AP EPs together with each other and EPs from other interfaces can be found in reference [FFS].

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 and/or failure).

- **Class 2:** Elementary Procedures without response.

For Class 1 EPs, the types of responses can be as follows:

Successful:

- A signalling message explicitly indicates that the elementary procedure successfully completed with the receipt of the response.

Unsuccessful:

- A signalling message explicitly indicates that the EP failed.

- On time supervision expiry (i.e. absence of expected response).

Successful and Unsuccessful:

- One signalling message reports both successful and unsuccessful outcome for the different included requests. The response message used is the one defined for successful outcome.

Class 2 EPs are considered always successful.

eNB UE S1AP ID: according to definition in 23.401.

[Note (to be removed once captured in another TS): The eNB UE S1AP ID shall be allocated so as to uniquely identify the UE over the S1 interface within the eNB. When MME receives eNB UE S1AP ID it shall store it for the duration of the UE-associated logical S1-connection for this UE. Once known to MME his IE is included in all UE associated S1-AP signalling (UL as well as DL).]

MME UE S1AP ID: according to definition in 23.401.

[Note (to be removed once captured in another TS): The MME UE S1AP ID shall be allocated so as to uniquely identify the UE over the S1 interface within the MME. When eNB receives MME UE S1AP ID it shall store it for the duration of the UE-associated logical S1-connection for this UE. Once known to eNB this IE is included in all UE associated S1-AP signalling (UL as well as DL).]

SAE bearer: one or more Service Data Flows between a UE and EPC [*according to definition for EPS bearer 23.401*].

Note: The SAE bearer is either a default SAE bearer or a dedicated SAE bearer.

SAE bearer identity: the SAE bearer identity uniquely identifies an SAE bearer for one UE [*according to definition for EPS bearer identity in 23.401*].

Note: The SAE bearer identity remains unique for the UE even if the UE-associated logical S1-connection is released during periods of user inactivity.

SAE Radio Bearer: the SAE Radio bearer transports the packets of an SAE bearer between a UE and an eNB. There is an one-to-one mapping between the SAE bearer and the SAE Radio Bearer.

UE-associated signalling: When S1-AP messages associated to one UE uses the UE-associated logical S1-connection for association of the message to the UE in eNB and EPC.

UE-associated logical S1-connection: The UE-associated logical S1-connection uses the identities *MME UE S1AP ID* and *eNB UE S1AP ID* according to definition in [23.401]. For a received UE associated S1-AP message the MME identifies the associated UE based on the MME UE S1AP ID IE and the eNB identifies the associated UE based on the *eNB UE S1AP ID* IE. The UE-associated logical S1-connection may exist before the S1 UE context is setup in eNB.

3.2 Symbols

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

<symbol> <Explanation>

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].

<ACRONYM> <Explanation>

4 General

Editor"s Note: Section captures procedure specification principles, forward/backward compatibility issue and specification notations.

4.1 Procedure Specification Principles

The principle for specifying the procedure logic is to specify the functional behaviour of the terminating node exactly and completely. Any rule that specifies the behaviour of the originating node 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 REQUEST 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.

- 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. For examples on how to use the *Criticality Diagnostics* IE, see Annex A.2.

4.2 Forwards and Backwards Compatibility

The forwards and backwards compatibility of the protocol is assured by 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. SAE 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. MESSAGE NAME 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. *Information Element* 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 subclause 9.2 enclosed by quotation marks, e.g. "Value".

5 S1AP Services

S1AP provides the signalling service between E-UTRAN and the evolved packet core (EPC) that is required to fulfil the S1AP functions described in clause 7. S1AP services are divided into two groups:

1. Non UE-associated services: They are related to the whole S1 interface instance between the eNB and MME utilising a non UE-associated signalling connection.

2. UE-associated services: They are related to one UE. S1AP functions that provide these services are associated with a UE-associated signalling connection that is maintained for the UE in question.

6 Services Expected from Signalling Transport

The signalling connection shall provide in sequence delivery of S1AP messages. S1AP shall be notified if the signalling connection breaks.

7 Functions of S1AP

Editor"s Note: Description of S1AP functions.

S1AP protocol has the following functions:

- SAE Bearer management function: This overall functionality is responsible for setting up, modifying and releasing SAE bearers, which are triggered by the MME The release of SAE bearers may be triggered by the eNB as well.

- Initial Context Transfer function: This functionality is used to establish an S1UE context in the eNB, to setup the default IP connectivity, to setup one or more SAE bearer(s) if requested by the MME, and to transfer NAS signalling related information to the eNB if needed.

- UE Capability Info Indication function: This functionality is used to provide the UE Capability Info when received from the UE to the MME.

- Mobility Functions for UEs in LTE_ACTIVE in order to enable

  - a change of eNBs within SAE/LTE (Inter MME/Serving SAE-GW Handovers) via the S1 interface (with EPC involvement).

  - a change of RAN nodes between different RATs (Inter-3GPP-RAT Handovers) via the S1 interface (with EPC involvement).

- Paging: This functionality provides the EPC the capability to page the UE.

- S1 interface management functions comprise the:

  - Reset functionality to ensure a well defined initialisation on the S1 interface.

  - Error Indication functionality to allow a proper error reporting/handling in cases where no failure messages are defined.

  - Overload function to indicate the load situation in the control plane of the S1 interface.

  - Load balancing function to ensure equally loaded MMEs within an MME pool area

  - S1 Setup functionality for initial S1 interface setup for providing configuration information

- NAS Signalling transport function between the UE and the MME is used:

  - to transfer NAS signalling related information and to establish the S1 UE context in the eNB.

  - to transfer NAS signalling related information when the S1 UE context in the eNB is already established.

- S1 UE context Release function: This functionality is responsible to manage the release of UE specific context in the eNB and the MME.

- Status Transfer: This functionality transfers PDCP SN Status information from source eNB to target eNB in support of in-sequence delivery and duplication avoidance for intra LTE handover.

8 S1AP Procedures

8.1 List of S1AP Elementary procedures

In the following tables, all EPs are divided into Class 1 and Class 2 EPs (see subclause 3.1 for explanation of the different classes):

Table 1: Class 1 procedures

Elementary Procedure	Initiating Message	Successful Outcome Response message	Unsuccessful Outcome Response message
Handover Preparation	HANDOVER REQUIRED	HANDOVER COMMAND	HANDOVER PREPARATION FAILURE
Handover Resource Allocation	HANDOVER REQUEST	HANDOVER REQUEST ACKNOWLEDGE	HANDOVER FAILURE
Path Switch Request	PATH SWITCH REQUEST	PATH SWITCH REQUEST ACKNOWLEDGE	PATH SWITCH REQUEST FAILURE
Handover Cancellation	HANDOVER CANCEL	HANDOVER CANCEL ACKNOWLEDGE	
SAE Bearer Setup	SAE BEARER SETUP REQUEST	SAE BEARER SETUP RESPONSE	
SAE Bearer Modify	SAE BEARER MODIFY REQUEST	SAE BEARER MODIFY RESPONSE	
SAE Bearer Release	SAE BEARER RELEASE COMMAND	SAE BEARER RELEASE COMPLETE	
Initial Context Setup	INITIAL CONTEXT SETUP REQUEST	INITIAL CONTEXT SETUP RESPONSE	INITIAL CONTEXT SETUP FAILURE
Reset	RESET	RESET ACKNOWLEDGE	
S1 Setup	S1 SETUP REQUEST	S1 SETUP RESPONSE	S1 SETUP FAILURE
UE Context Release	UE CONTEXT RELEASE COMMAND	UE CONTEXT RELEASE COMPLETE	
UE Context Modification	UE CONTEXT MODIFICATION REQUEST	UE CONTEXT MODIFICATION RESPONSE	UE CONTEXT MODIFICATION FAILURE
eNB Configuration Update	ENB CONFIGURATION UPDATE	ENB UPDATE CONFIGURATION ACKNOWLEDGE	ENB CONFIGURATION UPDATE FAILURE
MME Configuration Update	MME CONFIGURATION UPDATE	MME CONFIGURAION UPDATE ACKNOWLEDGE	MME CONFIGURATION UPDATE FAILURE

Table 2: Class 2 procedures

Elementary Procedure	Message
Handover Notification	HANDOVER NOTIFY
SAE Bearer Release Request	SAE BEARER RELEASE REQUEST
Paging	PAGING
Initial UE Message	INITIAL UE MESSAGE
Downlink NAS Transport	DOWNLINK NAS TRANSPORT
Uplink NAS Transport	UPLINK NAS TRANSPORT
NAS non delivery indication	NAS NON DELIVERY INDICATION
Error Indication	ERROR INDICATION
UE Context Release Request	UE CONTEXT RELEASE REQUEST
DownlinkS1 CDMA2000 Tunneling	DOWNLINK S1 CDMA2000 TUNNELING
Uplink S1 CDMA2000 Tunneling	UPLINK S1 CDMA2000 TUNNELING
UE Capability Info Indication	UE CAPABILITY INFO INDICATION
eNB Status Transfer	eNB STATUS TRANSFER
MME Status Transfer	MME STATUS TRANSFER
Deactivate Trace	DEACTIVATE TRACE
Trace Start	TRACE START
Trace Failure Indication	TRACE FAILURE INDICATION
Location Reporting Control	LOCATION REPORTING CONTROL
Location Reporting Failure Indication	LOCATION REPORTING FAILURE INDICATION
Location Report	LOCATION REPORT

The following applies concerning interference between Elementary Procedures:

- The Reset procedure takes precedence over all other EPs.

8.2 SAE Bearer Management procedures

8.2.1 SAE Bearer Setup

8.2.1.1 General

The purpose of the SAE Bearer Setup procedure is to assign resources on Uu and S1 for one or several SAE bearers and to setup corresponding SAE Radio Bearers for a given UE. The procedure uses UE-associated signalling.

8.2.1.2 Successful Operation
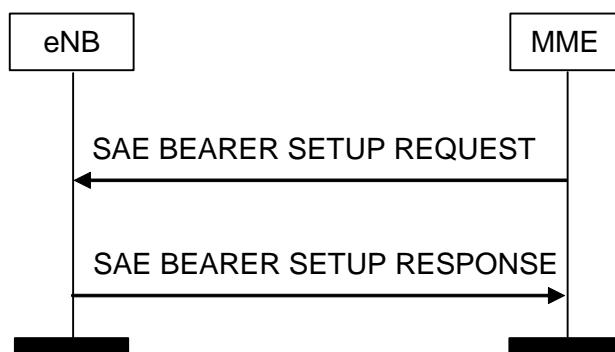
Figure 8.2.1.2-1: SAE Bearer Setup procedure. Successful operation.

The MME initiates the procedure by sending an SAE BEARER SETUP REQUEST message to the eNB. When sending the SAE BEARER SETUP REQUEST message the MME shall start the T $_{SAEBearerSetup}$ timer.

- The SAE BEARER SETUP REQUEST message shall contain the information required by the eNB to build the SAE bearer configuration consisting of at least one additional SAE bearer including for each SAE bearer to setup in the *SAE Bearer to be Setup List* IE.

Upon reception of the SAE BEARER SETUP REQUEST message, and if resources are available for the requested configuration, the eNB shall execute the requested SAE bearer configuration. For each SAE bearer and based on the *SAE Bearer level QoS parameters* IE the eNB shall establish an SAE Radio Bearer and allocate the required resources on Uu. The eNB shall pass the *NAS-PDU* IE and the value contained in the *SAE bearer identity* IE received for the SAE bearer for each established SAE Radio Bearer to the UE. The eNB shall allocate the required resources on S1 for the SAE bearers requested to be established.

The eNB shall report to the MME, in the SAE BEARER SETUP RESPONSE message, the result for all the requested SAE bearers.

A list of SAE bearers which are successfully established shall be included in the *SAE Bearer Setup List* IE.

A list of SAE bearers which failed to be established shall be included in the *SAE Bearer Failed to Setup List* IE. In case of the establishment of an SAE bearer the EPC must be prepared to receive user data before the SAE BEARER SETUP RESPONSE message has been received.

Upon reception of the SAE BEARER SETUP RESPONSE message the MME shall stop timer T $_{SAEBearerSetup}$.

Interactions with Handover Preparation procedure:

If a handover becomes necessary during SAE bearer setup, the eNB may interrupt the ongoing SAE bearer Setup procedure and initiate the Handover Preparation procedure as follows:

1. The eNB shall send the SAE BEARER SETUP RESPONSE message in which the eNB shall indicate, if necessary

   - all the SAE bearers fail with the cause "handover triggered"

2. The eNB shall trigger the handover procedure.

8.2.1.3 Unsuccessful Operation

The unsuccessful operation is specified in the successful operation section.

8.2.1.4 Abnormal Conditions

Editor"s Note: Further Assessment required.

8.2.2 SAE Bearer Modify

8.2.2.1 General

The purpose of the SAE Bearer Modify procedure is to enable modifications of already established SAE bearers for a given UE. The procedure uses UE-associated signalling.

8.2.2.2 Successful Operation
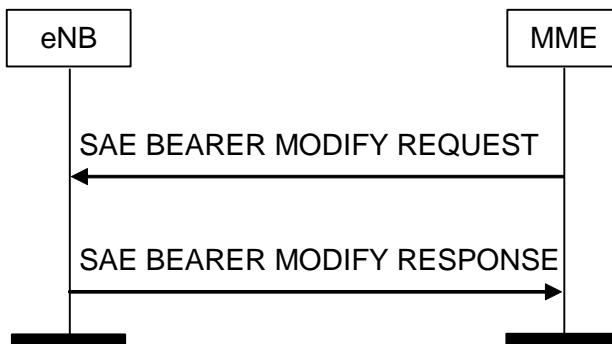
Figure 8.2.2.2-1: SAE Bearer Modify procedure. Successful operation.

The MME initiates the procedure by sending an SAE BEARER MODIFY REQUEST message to the eNB. When sending the SAE BEARER MODIFY REQUEST message the MME shall start the T $_{SAEBearerModify}$ timer.

The SAE BEARER MODIFY REQUEST message shall contain the information required by the eNB to modify one or several SAE bearers of the existing SAE Bearer configuration.

Information shall be present in the SAE BEARER MODIFY REQUEST message only when any previously set value for the SAE bearer configuration is requested to be modified.

Upon reception of the SAE BEARER MODIFY REQUEST message, and if resources are available for the requested target configuration, the eNB shall execute the modification of the requested SAE bearer configuration. For each SAE bearer that shall be modified and based on the new *SAE Bearer level QoS parameters* IE the eNB shall modify the SAE Radio Bearer configuration and change allocation of resources on Uu according to the new resource request. The eNB shall pass the *NAS-PDU* IE and the value contained in the *SAE bearer identity* IE received for the SAE bearer to the UE when modifying the SAE Radio Bearer configuration. eNB shall change allocation of resources on S1 according to the new resource request.

If the E-UTRAN failed to modify an SAE Bearer the E-UTRAN shall keep the SAE Bearer configuration as it was configured prior the SAE BEARER MODIFY REQUEST.

The eNB shall report to the MME, in the SAE BEARER MODIFY RESPONSE message, the result for all the requested SAE bearers to be modified.

A list of SAE bearers which are successfully modified shall be included in the *SAE Bearer Modify List* IE.

A list of SAE Bearers which failed to be modified shall be included in the *SAE Bearer Failed to Modify List* IE.

In case of a modification of an SAE Bearer the EPC must be prepared to receive user data according to the modified SAE bearer profile prior to the SAE BEARER MODIFY RESPONSE message.

Upon reception of the SAE BEARER MODIFY RESPONSE the MME shall stop T $_{SAEBearerModify.}$

Interactions with Handover Preparation procedure:

If a handover becomes necessary during SAE bearer modify, the eNB may interrupt the ongoing SAE bearer Modify procedure and initiate the Handover Preparation procedure as follows:

1. The eNB shall send the SAE BEARER MODIFY RESPONSE message in which the eNB shall indicate, if necessary

   - all the SAE bearers fail with the cause "handover triggered"

2. The eNB shall trigger the handover procedure.

8.2.2.3   Unsuccessful Operation

The unsuccessful operation is specified in the successful operation section.

8.2.2.4   Abnormal Conditions

Editor"s Note: Further Assessment required.

8.2.3   SAE Bearer Release

8.2.3.1   General

The purpose of the SAE Bearer Release procedure is to enable the release of already established SAE Bearers for a given UE. The procedure uses UE-associated signalling.

8.2.3.2   Successful Operation

8.2.3.2.1   SAE Bearer Release - MME initiated
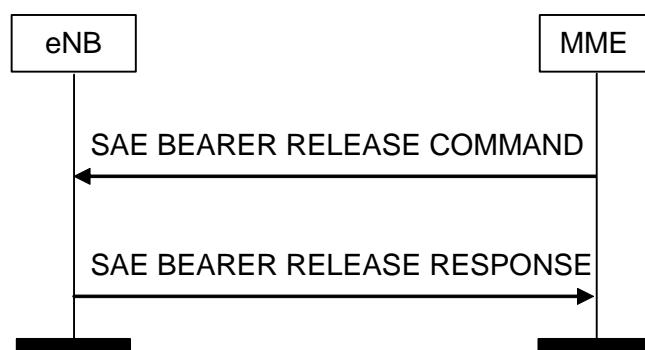
Figure 8.2.3.2.1-1: SAE Bearer Release procedure. Successful operation.

The MME initiates the procedure by sending an SAE BEARER RELEASE COMMAND message. When sending the SAE BEARER RELEASE COMMAND message, the MME shall start the T $_{SAEBEAERERRELEASE}$ timer.

The SAE BEARER RELEASE COMMAND message shall contain the information required by the eNB to release at least one SAE bearer in the *SAE Bearer To Be Released List* IE.

Upon reception of the SAE BEARER RELEASE COMMAND message the eNB shall execute the release of the requested SAE Bearers. For each SAE bearer to be released the eNB shall release the corresponding SAE Radio Bearer and release the allocated resources on Uu. The eNB shall pass the value contained in the *SAE bearer identity* IE received for the SAE bearer to the radio interface protocol for each SAE Radio Bearer to be released. eNB shall release allocate resources on S1 for the SAE bearers requested to be released.

The eNB shall report to the MME, in the SAE BEARER RELEASE RESPONSE message, the result for all the SAE bearers to be released.

A list of SAE bearers which are released successfully shall be included in the *SAE Bearer Release List* IE.

A list of SAE bearers which failed to be released shall be included in the *SAE Bearer Failed to Release List* IE.,

The eNB shall be prepared to receive an SAE BEARER RELEASE COMMAND message on an established UE-associated logical S1-connection containing an *SAE Bearer Release List* IE at any time and shall always reply to it with an SAE BEARER RELEASE RESPONSE message.

After sending an SAE BEARER RELEASE RESPONSE message containing an SAE Bearer identity within the *SAE Bearer Release List* IE , the eNB shall be prepared to receive an SAE BEARER SETUP REQUEST message requesting establishment of an SAE bearer with this SAE bearer identity.

8.2.3.2.2 SAE Bearer Release Request - eNB initiated


Figure 8.2.3.2.2-1: SAE Bearer Release Request procedure. Successful operation.

The eNB initiates the procedure by sending an SAE BEARER RELEASE REQUEST message towards the MME.

The SAE BEARER RELEASE REQUEST message shall contain at least one SAE bearers requested to be released, in the *SAE Bearer To Be Released List* IE.

Upon reception of the SAE BEARER RELEASE REQUEST message the MME should normally initiate the appropriate release procedure for the SAE bearers identified in the SAE BEARER RELEASE REQUEST message as defined in the **Interaction with SAE Bearer Release** paragraph below. It is up to the MME to decide how to react to the request.

Interaction with UE Context Release procedure:

If no SAE bearers will remain according to the SAE bearer RELEASE REQUEST message, the MME may initiate the UE Context Release Command procedure if it does not want to keep the UE-associated logical S1-connection.

Editor"s Note: whether this is allowed at all (default bearer handling) needs to be checked, see open issue list.

Interaction with SAE bearer Release procedure (MME initiated):

If the EPC decides to release some or all indicated SAE bearers, the MME shall invoke the SAE BEARER RELEASE COMMAND procedure (release SAE bearer) to this effect.

8.2.3.3 Abnormal Conditions

Editor"s Note: Further Assessment required.

8.3 Context Management procedures

8.3.1 Initial Context Setup

8.3.1.1 General

The purpose of the Initial Context Setup procedure is to establish the necessary overall initial UE Context including SAE Bearer context, Security context, Handover Restriction List, UE capability information, NAS-PDU etc. The procedure uses UE-associated signalling.

8.3.1.2 Successful Operation
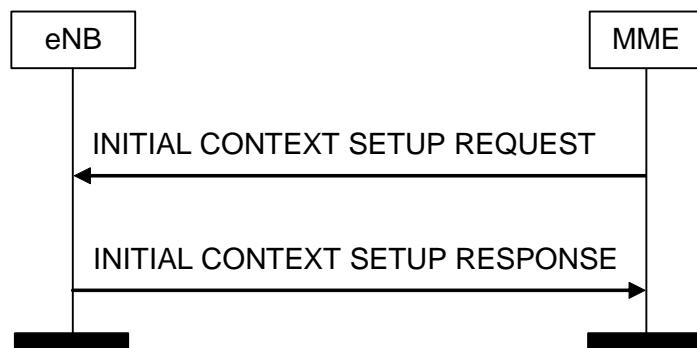
Figure 8.3.1.2-1: Initial Context Setup procedure. Successful operation.

In case of the establishment of an SAE Bearer the MME must be prepared to receive user data before the INITIAL CONTEXT SETUP RESPONSE message has been received.

When sending the INITIAL CONTEXT SETUP REQUEST message, the MME shall start the T $_{InitialContextSetup}$ timer.

The INITIAL CONTEXT SETUP REQUEST message shall contain within the *SAE Bearer to be Setup List* IE the information required by the eNB to build the new SAE Bearer configuration consisting of at least one additional SAE Bearer.

The *SAE Bearer to be Setup List* IE may contain:

- the SAE Bearer level QoS parameters IE

The INITIAL CONTEXT SETUP REQUEST message may contain

- the *Handover Restriction List* IE, which may contain roaming, area or access restrictions

- the *NAS-PDU* IE (FFS)

- Security (FFS)

- the *UE Radio Capability* IE.

Upon receipt of the INITIAL CONTEXT SETUP REQUEST the eNB shall

- attempt to execute the requested SAE Bearer configuration.

- pass the value contained in the *SAE Bearer ID* IE to the radio interface protocol for each SAE Bearer requested to be established.

- not interpret or modify the information contained in the *NAS-PDU* IE. The content of the NAS-PDU is outside the scope of this specification.

- store the Handover restriction List in the UE context.

- store the received UE Radio Capabilities in the UE context.

The eNB should use the information in *Handover Restriction List* IE to determine a target cell for handover. If the *Handover Restriction List* IE is not contained in the INITIAL CONTEXT SETUP REQUEST message, the target eNB shall consider that no access restriction applies to the UE.

If the *Trace activation* IE is included in the INITIAL CONTEXT SETUP REQUEST message then eNB should initiate the requested trace function as described in [10].

The eNB shall report to the MME, in the INITIAL CONTEXT SETUP RESPONSE message, the successful establishment of the security procedures with the UE, and, the result for all the requested SAE Bearers in the following way:

A list of SAE Bearers which are successfully established shall be included in the *SAE Bearer Setup List* IE

A list of SAE Bearers which failed to be established shall be included in the *SAE Bearer Failed to Setup List* IE.

After sending the INITIAL CONTEXT SETUP RESPONSE message, the procedure is terminated in the eNB.

Upon reception of the INITIAL CONTEXT SETUP RESPONSE message the MME shall stop timer T $_{InitialContextSetup.}$

8.3.1.3 Unsuccessful Operation
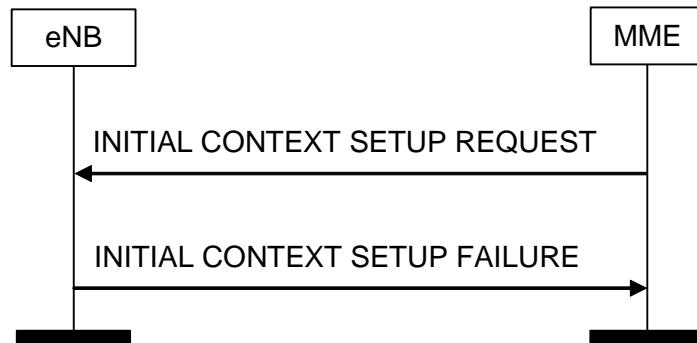
Figure 8.3.1.3-1: Initial Context Setup procedure. Unsuccessful operation.

8.3.1.4 Abnormal Conditions

Editor"s Note: Further Assessment required.

8.3.2 UE Context Release Request - eNB initiated

8.3.2.1 General

The purpose of the UE Context Release Request procedure is to enable the eNB to request the MME to release the UE-associated logical S1-connection due to EUTRAN generated reason (e.g. 'TX2$_{RELOCOverall}$ Expiry'). The procedure uses UE-associated signalling.

8.3.2.2 Successful Operation
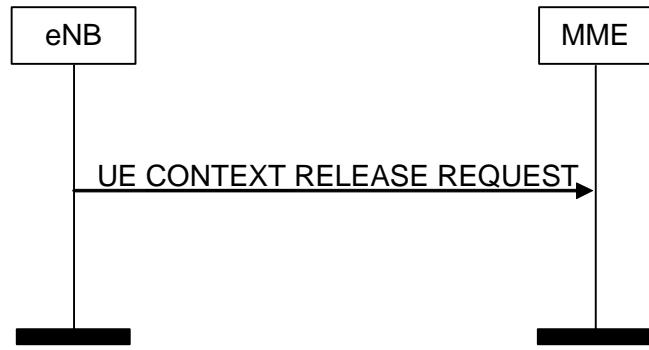
Figure 8.3.2.2-1: UE Context Release Request procedure. Successful operation.

The eNB controlling a UE-associated logical S1-connection initiates the procedure by generating an UE CONTEXT RELEASE REQUEST message towards the affected MME node.

The UE CONTEXT RELEASE REQUEST message shall indicate the appropriate cause value for the requested UE-associated logical S1-connection release.

8.3.3 UE Context Release (MME initiated)

8.3.3.1 General

The purpose of the UE Context Release procedure is to enable to MME to order the release of the UE-associated logical connection due to various reasons, for example completion of a transaction between the UE and the EPC or completion of successful handover or completion of handover cancellation. The MME initiated UE Context Release procedure may be initiated in response to the eNB initiated UE Context Release Request procedure. The procedure uses UE-associated signalling.

Editor"s Note:The usage of this procedure to handle detection of two UE-associated logical connections towards one UE is FFS.

8.3.3.2 Successful Operation
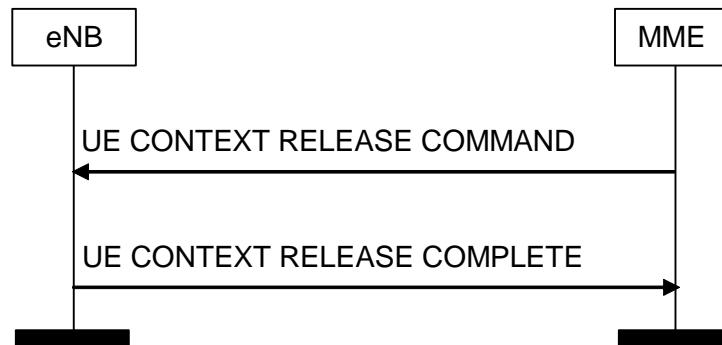
Figure 8.3.3.2-1: UE Context Release procedure. Successful operation.

The MME initiates the procedure by sending the UE CONTEXT RELEASE COMMAND message to the eNB.
The UE CONTEXT RELEASE COMMAND message shall contain the *MME UE S1AP ID* IE and eNB UE S1AP ID if available.

Upon reception of the UE CONTEXT RELEASE COMMAND message, the eNB shall release all related signalling and user data transport resources and reply with the UE CONTEXT RELEASE COMPLETE message.

8.3.4 UE Context Modification

8.3.4.1 General

The purpose of the UE Context Modification procedure is to modify the established UE Context partly (e.g. with security information). The procedure uses UE-associated signalling.

8.3.4.2 Successful Operation
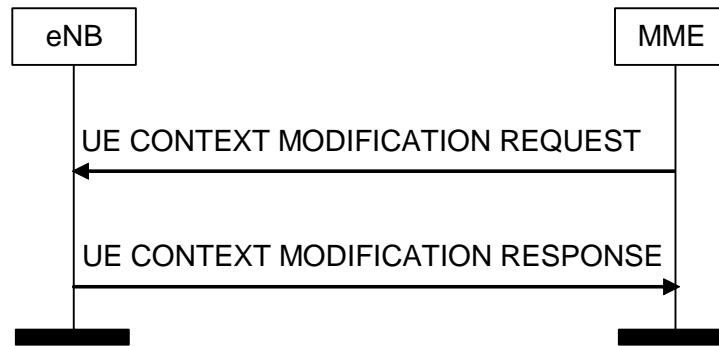
Figure 8.3.4.2-1: UE Context Modification procedure. Successful operation.

The UE CONTEXT MODIFICATION REQUEST message may contain

- the *security information* IE (includes the AS security key)

Upon receipt of the UE CONTEXT MODIFICATION REQUEST the eNB shall

- store the received *security information* IE and take it into use.

The eNB shall report, in the UE CONTEXT MODIFICATION RESPONSE message to the MME, the successful update of the UE context:

After sending the UE CONTEXT MODIFICATION RESPONSE message, the procedure is terminated in the eNB.

8.3.4.3 Unsuccessful Operation
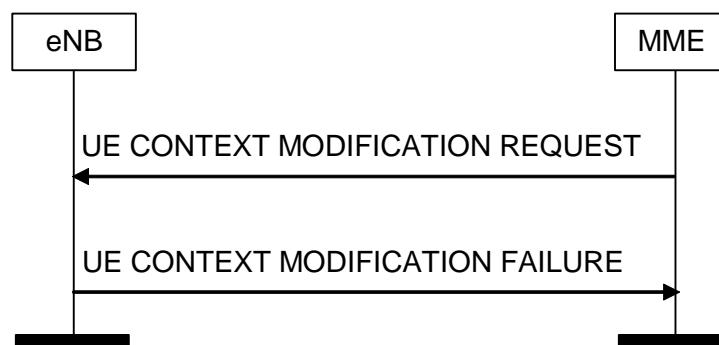
Figure 8.3.4.3-1: UE Context Modification procedure. Unsuccessful operation.

In case the UE context update cannot be performed successfully the eNB shall respond with the UE CONTEXT MODIFICATION FAILURE message to the MME with an appropriate cause value in the *Cause* IE.

8.4 Handover Signalling

8.4.1 Handover Preparation

8.4.1.1 General

The purpose of the Handover Preparation procedure is to request the preparation of resources at the target side via the EPC.

> Editor"s Note: It is FFS whether the eNodeB is allowed to initiate this procedure in case there is an already prepared handover for this particular UE either on S1or on any of its X2 interfaces.

8.4.1.2 Successful Operation
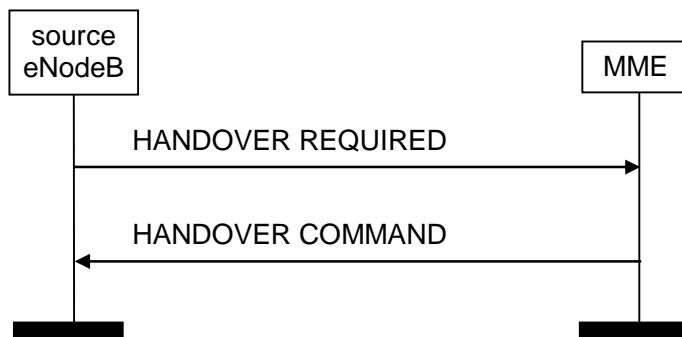
Figure 8.4.1.2-1: Handover preparation: successful operation

The source eNodeB initiates the handover preparation by sending the HANDOVER REQUIRED message to the serving MME.

> Editor"s note: How to handle and control data forwarding is FFS.

When the preparation, including the reservation of resources at the target side is ready, the MME responds with the HANDOVER COMMAND message to the source eNodeB.

If the *Target eNodeB to Source eNodeB Transparent Container* IE or the *Target RNC To Source RNC Transparent Container* IE or the *Target BSS to Source BSS Transparent Container* IE has been received by the MME from the handover target then the transparent container shall be included in the HANDOVER COMMAND message.

If there are any SAE bearers that could not be admitted in the target, they shall be indicated in the *SAE Bearers to Release List* IE.

If the *DL forwarding* IE is included within the *Source eNodeB to Target eNodeB Transparent Container* IE of the HANDOVER REQUIRED message and it is set to 'DL forwarding proposed', it indicates that the source eNodeB proposes forwarding of downlink data.

The source eNodeB may include the *Direct Forwarding Path Availability* IE in the HANDOVER REQUIRED message if a direct data path is available.

If the HANDOVER REQUIRED message does not contain the *Direct Forwarding Path Availability* IE then indirect forwarding may be applied, if available.

Interactions with SAE Bearer Management procedures:

If, after a HANDOVER REQUIRED message is sent and before the Handover Preparation procedure is terminated, the source eNB receives a MME initiated SAE Bearer Management procedure on the same UE associated signaling connection, the source eNB shall either:

1. cancel the Handover Preparation procedure by executing the Handover Cancel procedure with an appropriate cause value "Interaction with other procedure'. After successful completion of the Handover Cancel procedure, the source eNB shall continue the MME initiated SAE Bearer Management procedure

or

2. terminate the MME initiated SAE Bearer Management procedure by sending the appropriate response message with the cause value 'Handover Triggered' to the MME and then the source eNB shall continue with the handover procedure.

8.4.1.3   Unsuccessful Operation
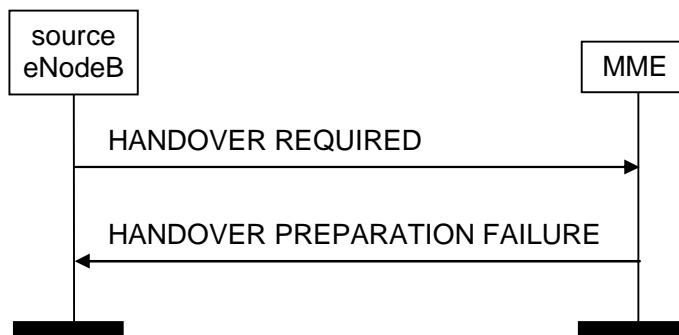
Figure 8.4.1.3-1: Handover preparation: unsuccessful operation

If the EPC or the target system is not able to accept any of the bearers or a failure occurs during the Handover Preparation, the MME sends the HANDOVER PREPARATION FAILURE message with an appropriate cause value to the source eNodeB.

8.4.1.4   Abnormal Conditions

8.4.2   Handover Resource Allocation

8.4.2.1   General

The purpose of the Handover Resource Allocation procedure is to reserve resources at the target eNodeB for the handover of a UE.

8.4.2.2   Successful Operation
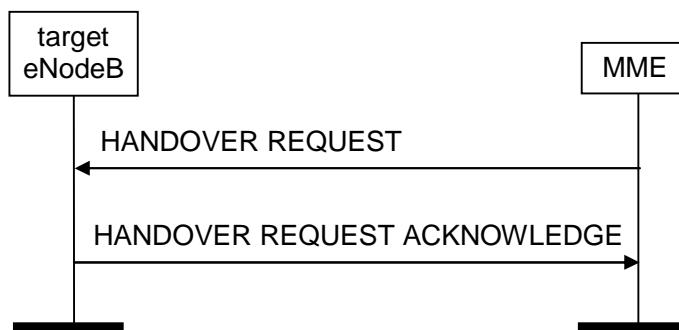
Figure 8.4.2.2-1: Handover resource allocation: successful operation

The MME initiates the procedure by sending the HANDOVER REQUEST message to the target eNodeB. If the *Source eNodeB to Target eNodeB Transparent Container* IE or the *Source RNC to Target RNC Transparent Container* IE or

the *Source BSS to Target BSS Transparent Container* IE has been received by the MME from the source side the MME includes the transparent container in the HANDOVER REQUEST message.

The HANDOVER REQUEST message may contain the *Handover Restriction List* IE, which may contain roaming area or access restrictions.

If the *Handover Restriction List* IE is contained in the HANDOVER REQUEST message, the target eNB shall store this information in the UE context.

The eNB should use the information in *Handover Restriction List* IE to determine a target cell for handover. If the *Handover Restriction List* IE is not contained in the HANDOVER REQUEST message, the target eNB shall consider that no access restriction applies to the UE.

If the *Trace activation* IE is included in the HANDOVER REQUEST message, the target eNB shall initiate the requested trace function as described in [10].

After all necessary resources for the admitted SAE Bearers have been allocated the target eNodeB generates the HANDOVER REQUEST ACKNOWLEDGE message. The target eNodeB shall include in the *SAE Bearers Admitted List* IE the SAE Bearers for which resources have been prepared at the target cell. The SAE bearers that have not been admitted in the target cell shall be included in the *SAE Bearers Failed to Setup List* IE.

For each bearer that target eNB has decided to admit and for which *DL forwarding* IE is set to 'DL forwarding proposed', the target eNB may include the *DL GTP Tunnel endpoint* IE within the *SAE Bearers Admitted List IEs* IE of the HANDOVER REQUEST ACKNOWLEDGE message indicating that it accepts the proposed forwarding of downlink data for this bearer.

8.4.2.3 Unsuccessful Operation
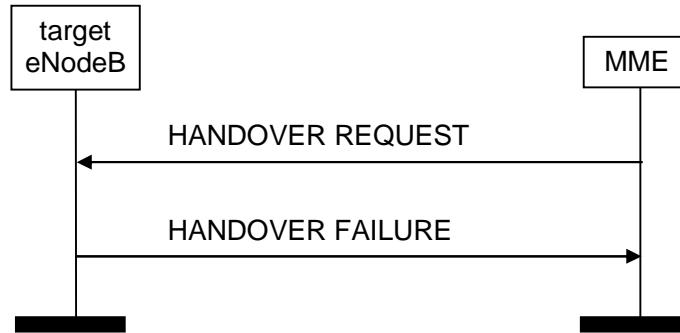
Figure 8.4.2.3-1: Handover resource allocation: unsuccessful operation

If the target eNodeB is not able to admit any of the SAE Bearers or a failure occurs during the Handover Preparation, it shall send the HANDOVER REQUEST FAILURE message to the MME with an appropriate cause value.

8.4.2.4 Abnormal Conditions

8.4.3 Handover Notification

8.4.3.1 General

The purpose of the Handover Notification procedure is to indicate to the MME that the UE has arrived to the target cell and the S1 handover has been successfully completed.

8.4.3.2 Successful Operation

Figure 8.4.3.2-1: Handover notification

The target eNodeB shall send the HANDOVER NOTIFY message to the MME when the UE has been identified in the target cell and the S1 handover has been successfully completed.

8.4.3.3   Abnormal Conditions

8.4.4   Path Switch Request

8.4.4.1   General

The purpose of the Path Switch Request procedure is to request the switch of a downlink GTP tunnel towards a new GTP tunnel endpoint.

8.4.4.2   Successful Operation
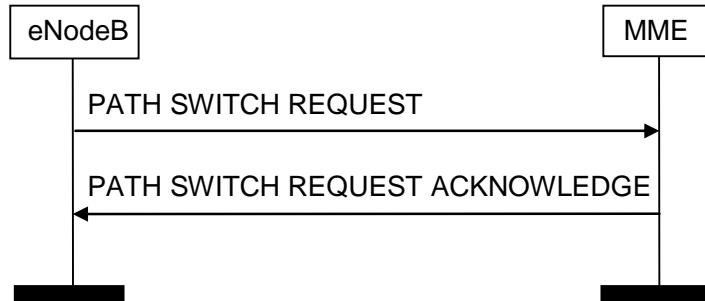
Figure 8.4.4.2-1: Path switch request: successful operation

The eNodeB initiates the procedure by sending the PATH SWITCH REQUEST message to the MME.

If the *SAE Bearer To Be Switched in Downlink List* IE in the PATH SWITCH REQUEST message does not include all SAE bearers previously included in the Ue Context, the MME shall consider the non included SAE bearers as implicitly released by the eNB.

After all necessary updates including the UP path switch have been successfully completed in the EPC, the MME shall send the PATH SWITCH REQUEST ACKNOWLEDGE message to the eNodeB and the procedure ends.

In case the EPC decides to change the uplink termination point of the tunnels it may include the *SAE Bearer To Be Switched in Uplink List* IE in the PATH SWITCH REQUEST ACKNOWLEDGE message to specify a new uplink transport layer address and uplink GTP-TEID for each respective SAE bearer for which it wants to change the uplink tunnel termination point.

When the eNodeB receives the PATH SWITCH REQUEST ACKNOWLEDGE message and if this message includes the *SAE Bearer To Be Switched in Uplink List* IE, the eNodeB shall start delivering the uplink packets of the concerned SAE bearers to the new uplink tunnel endpoints as indicated in the message.

If the *Handover Restriction List* IE is contained in the PATH SWITCH REQUEST ACKNOWLEDGE message, the eNB shall store this information in the UE context and the information shall replace any previously received Handover restriction information.

The eNB should use the information in *Handover Restriction List* IE to determine a target cell for handover. If the *Handover Restriction List* IE is not contained in the PATH SWITCH REQUEST ACKNOWLEDGE message and there is no previously stored Handover restriction information, the target eNB shall consider that no access restriction applies to the UE.

Editor"s Note: The procedure text above (and for the failure cases) needs to cover the case where no, all, or some bearers are successfully switched, i.e. when to use the ACK and when to use the FAILURE response messages.

8.4.4.3 Unsuccessful Operation
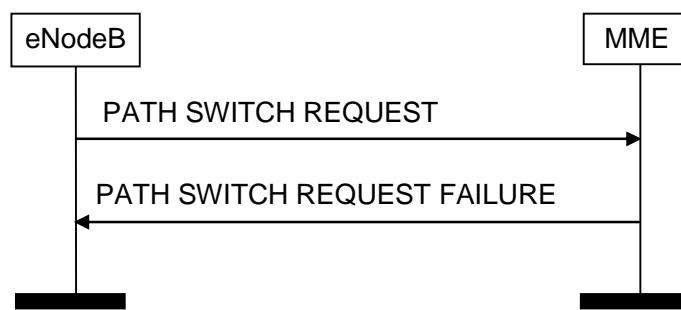
Figure 8.4.4.3-1: Path switch request: unsuccessful operation

If a failure occurs in the EPC during the execution of the Path Switch Request procedure, the MME shall send the PATH SWITCH REQUEST FAILURE message to the eNodeB with an appropriate cause value.

8.4.4.4 Abnormal Conditions

8.4.5 Handover Cancellation

8.4.5.1 General

The purpose of the Handover Cancel procedure is to enable a source eNB to cancel an ongoing handover. The Handover Cancel procedure may not be initiated by the source eNB during the Handover Preparation procedure after

- the source eNB has initiated the execution of the handover via the Uu interface

except if

- the UE has returned to the source eNB by transmitting an RRC message which indicates that the UE considers the source eNB as its serving eNB

The procedure uses UE-associated logical S1-connection.

8.4.5.2 Successful Operation
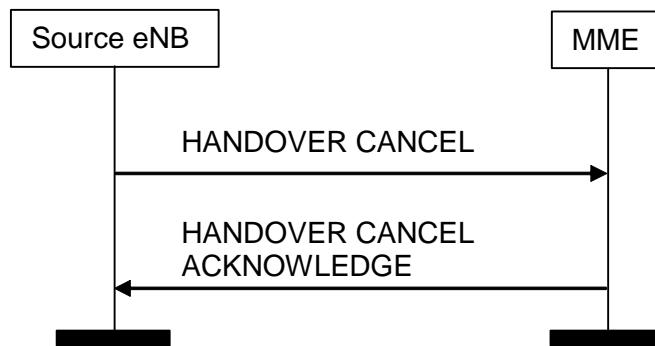
Figure 8.4.5.2-1: Handover Cancel procedure. Successful operation.

Editor"s Note: Whether a HANDOVER CANCEL ACKNOWLEDGE message is needed is FFS.

The source eNB initiates the procedure by sending a HANDOVER CANCEL message to the EPC.

The HANDOVER CANCEL message shall indicate the reason for cancelling the handover by the appropriate value of the *Cause* IE

Upon reception of a HANDOVER CANCEL message, the EPC shall terminate the ongoing Handover Preparation procedure, release any resources associated with the handover preparation and send a HANDOVER CANCEL ACKNOWLEDGE message to the source eNB.

Transmission and reception of a HANDOVER CANCEL ACKNOWLEDGE message terminate the procedure in the EPC and in the source eNB. After this, the source eNB does not have a prepared handover for that UE-associated logical S1-connection.

8.4.5.3 Unsuccessful Operation

Not applicable.

8.4.5.4 Abnormal Conditions

Not applicable.

8.4.6 eNB Status Transfer

8.4.6.1 General

The purpose of the eNB Status Transfer procedure is to transfer the uplink PDCP-SN receiver status and the downlink PDCP-SN transmitter status from the source to the target eNodeB via the MME during an intra LTE S1 handover for each respective SAE bearer for which PDCP SN status preservation applies.

8.4.6.2 Successful Operation

Figure 8.4.6.2-1: eNB Status Transfer procedure

The source eNodeB initiates the procedure by stop assigning PDCP SNs to downlink SDUs and sending the eNB STATUS TRANSFER message to the MME at the time point when it considers the transmitter/receiver status to be freezed.

At that point of time, the source eNodeB either:

- discard the uplink packets received out of sequence for a bearer and include the bearer in the *SAE Bearers Subject to Status Transfer List* IE to indicate that PDCP SN status preservation applies for the bearer,

- send the uplink packets received out of sequence to the EPC for each bearer for which the PDCP SN status preservation doesn"t apply.

8.4.6.3 Unsuccessful Operation

Not applicable.

8.4.6.4 Abnormal Conditions

Editor"s Note: Further Assessment required.

8.4.7 MME Status Transfer

8.4.7.1 General

The purpose of the MME Status Transfer procedure is to transfer the uplink PDCP-SN receiver status and the downlink PDCP-SN transmitter status from the source to the target eNodeB via the MME during an S1 handover for each respective SAE bearer for which PDCP SN status preservation applies.

8.4.7.2 Successful Operation
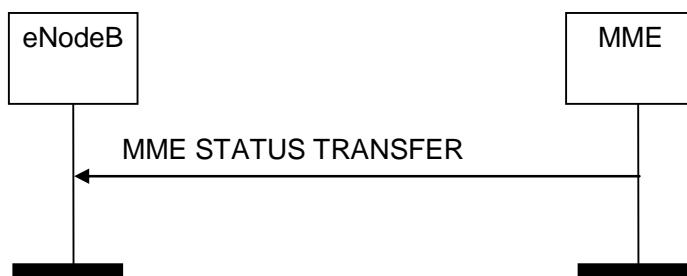
Figure 8.4.7.2-1: MME Status Transfer procedure

The MME initiates the procedure by sending the MME STATUS TRANSFER message to the eNB.

For each bearer within the *SAE Bearers Subject to Status Transfer List* IE within the *eNB Status Transfer Transparent Container* IE for which the *UL COUNT value* IE is received in the STATUS TRANSFER message, the target eNodeB shall use it and not deliver any uplink packet which has a PDCP SN lower than the value contained in the *PDCP SN* IE of this IE.

For each bearer in *SAE Bearers Subject to Status Transfer List* IE within the *eNB Status Transfer Transparent Container* IE received in the STATUS TRANSFER message, the target eNodeB shall use *DL COUNT value* IE for the first downlink packet for which there is no PDCP SN yet assigned.

8.4.7.3 Unsuccessful Operation

Not applicable.

8.4.7.4 Abnormal Conditions

If the target eNodeB receives this message for a UE for which no prepared handover exists at the target eNodeB, the target eNodeB shall ignore the message.

8.5 Paging

8.5.1 General

The purpose of the Paging procedure is to enable the MME to page a UE in the specific eNB.

8.5.2 Successful Operation
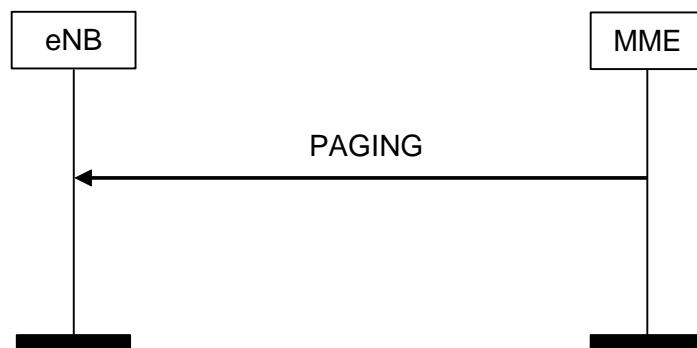
Figure 8.5.2-1: Paging procedure

The MME initiates the paging procedure by sending the PAGING message to the eNB.

At the reception of the PAGING message, the eNB shall perform paging of the UE in cells which belong to tracking areas as indicated in the *List of TAIs* IE. The *Paging Cause IE* shall be transferred transparently to the UE.

For each cell that belongs to any of the TA indicated in the *List of TAIs* IE, the eNodeB shall generate one page on the radio interface.

8.5.3 Unsuccessful Operation

Not applicable.

8.5.4 Abnormal Conditions

Not applicable.

8.6 NAS transport

8.6.1 General

The purpose of the NAS Transport procedure is to carry UE – MME signalling over the S1 Interface. The NAS messages are not interpreted by the eNB, and their content is outside the scope of this specification. The procedure may use an existing UE-associated logical S1-connection. If no UE-associated logical S1-connection exists, the establishment of the UE-associated logical S1-connection is initiated (and may be established) as part of the procedure.

The NAS messages are transported in an IE of the INITIAL UE MESSAGE, DOWNLINK NAS TRANSPORT or UPLINK NAS TRANSPORT messages.

8.6.2   Successful Operations

8.6.2.1   Initial UE Message
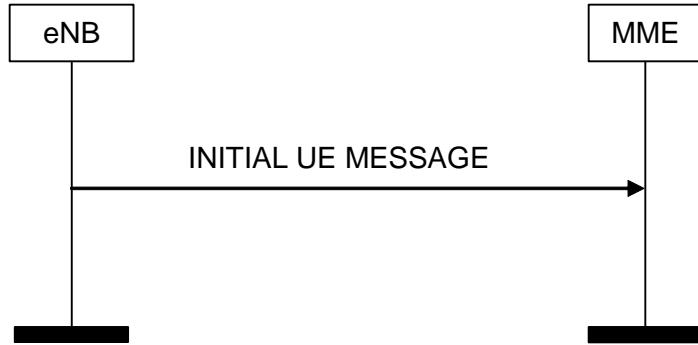
Figure 8.6.2.1-1: Initial UE Message procedure

When the eNB has received from the radio interface a NAS message to be forwarded to an MME to which no UE-associated logical S1-connection for the UE exists, the eNB shall invoke the NAS Transport procedure and send the INITIAL UE MESSAGE to the MME including the NAS message as a *NAS-PDU* IE. The eNB shall allocate a unique eNB S1-AP UE Identity to be used for the UE and the eNB shall include this identity in the INITIAL UE MESSAGE message. In case of network sharing, the selected PLMN is indicated by the PLMN ID part of the *TAI* IE included in the INITIAL UE MESSAGE message. When the eNB has received from the radio interface the *S-TMSI* IE, it shall include it in the INITIAL UE MESSAGE message.

8.6.2.2   DOWNLINK NAS TRANSPORT

Figure 8.6.2.2-1: DOWNLINK NAS Transport Procedure

If a NAS message shall be sent from the MME to the UE and a UE-associated logical S1-connection exists for the UE or if the MME have received the *eNB S1-AP UE Identity* IE in an INITIAL UE MESSAGE message, the MME shall send a DOWNLINK NAS TRANSPORT message to the eNB including the NAS message as a *NAS-PDU* IE. If the UE-associated logical S1-connection is not established the MME shall allocate a unique MME S1-AP UE Identity to be used for the UE and include that in the DOWNLINK NAS TRANSPORT message. By the reception of *MME S1-AP UE Identity* IE in eNB the UE-associated logical S1-connection is established.

The *NAS-PDU* IE contains an MME – UE message that is transferred without interpretation in the eNB.

The DOWNLINK NAS TRANSPORT message may contain the *Handover Restriction List* IE, which may contain roaming area or access restrictions.

If the *Handover Restriction List* IE is contained in the DOWNLINK NAS TRANSPORT message, the target eNB shall store this information in the UE context.

The eNB should use the information in *Handover Restriction List* IE to determine a target cell for handover. If the *Handover Restriction List* IE is not contained in the DOWNLINK NAS TRANSPORT message and there is no previously stored Handover restriction information, the target eNB shall consider that no access restriction applies to the UE.

8.6.2.3 UPLINK NAS TRANSPORT

Figure 8.6.2.3-1: UPLINK NAS TRANSPORT Procedure

When the eNB has received from the radio interface a NAS message to be forwarded to the MME to which an UE-associated logical S1-connection for the UE exists, the eNB shall send the UPLINK NAS TRANSPORT message to the MME including the NAS message as a *NAS-PDU* IE.

The *NAS-PDU* IE contains an UE - MME message that is transferred without interpretation in the eNB.

8.6.2.4 NAS NON DELIVERY INDICATION

Figure 8.6.2.4-1: NAS NON DELIVERY INDICATION Procedure

When the eNB decides to not start the delivery of a NAS message that has been received over an UE-associated logical S1-connection or the eNB is unable to ensure that the message has been received by the UE, it shall report the non-delivery of this NAS message by sending a NAS NON DELIVERY INDICATION message to the MME including the non-delivered NAS message within the *NAS-PDU* IE and an appropriate cause value within the *Cause* IE e.g. handover triggered'.

8.6.3 Unsuccessful Operation

Not applicable

8.6.4 Abnormal Conditions

If the S-TMSI is not received by the MME in the INITIAL UE MESSAGE message whereas expected, the MME shall consider the procedure as failed.

8.7 Management procedures

Editor"s Note: Placeholder for a procedure description of common procedures as defined in TS 36.300

8.7.1 Reset

8.7.1.1 General

The purpose of the Reset procedure is to initialise or re-initialise the E-UTRAN, or part of E-UTRAN S1AP UE-related contexts, in the event of a failure in the EPC or vice versa. . This procedure doesn"t affect the application level configuration data exchanged during the S1 Setup procedure.

The procedure uses non-UE associated signalling.

8.7.1.2 Successful Operation

8.7.1.2.1 Reset Procedure Initiated from the MME
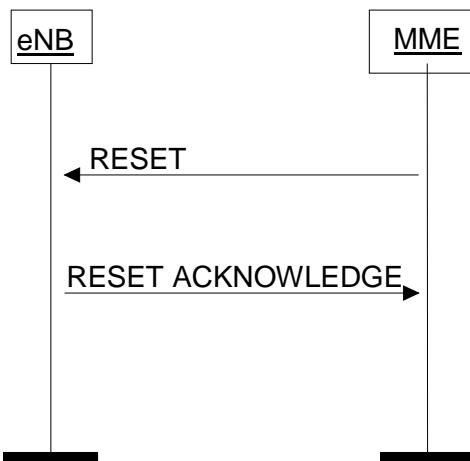
Figure 8.7.1.2.1-1: Reset procedure initiated from the MME. Successful operation.

In the event of a failure at the MME, which has resulted in the loss of some or all transaction reference information, a RESET message shall be sent to the eNB.

At reception of RESET message the eNB shall release all allocated resources on S1 and Uu related to the UE association(s) indicated explicitly or implicitly in the RESET message and remove the indicated UE contexts including S1AP ID.

After the eNB has released all assigned S1 resources and the UE S1AP IDs for all indicated UE associations can be used for new UE-associated logical S1-connections over the S1 interface, the eNB shall respond with the RESET ACKNOWLEDGE message. The eNB does not need to wait for the release of radio resources to be completed before returning the RESET ACKNOWLEDGE message.

If the RESET message contains the *UE-associated logical S1-connection list* IE, then:

- The eNB shall use the *MME UE S1AP ID* IE and/or the *eNB UE S1AP ID* IE to explicitly identify the UE association(s) to be reset.

- The eNB shall in the RESET ACKNOWLEDGE message include, for each UE association to reset, the *UE-associated logical S1-connection Item* IE in the *UE-associated logical S1-connection list* IE. The *UE-associated logical S1-connection Item* IEs shall be in the same order as received in the RESET message and shall include also unknown UE-associated logical S1-connections. Empty *UE-associated logical S1-connection Item* IEs, received in the RESET message, may be omitted in the RESET ACKNOWLEDGE message.

- If the *MME UE S1AP ID* IE is included in the *UE-associated logical S1-connection Item* IE for a UE association, the eNB shall include the *MME UE S1AP ID* IE in the corresponding *UE-associated logical S1-connection Item* IE in the RESET ACKNOWLEDGE message.

- If the *eNB UE S1AP ID* IE is included in the *UE-associated logical S1-connection Item* IE for a UE association, the eNB shall include the *eNB UE S1AP ID* IE in the corresponding *UE-associated logical S1-connection Item* IE in the RESET ACKNOWLEDGE message.

Interactions with other procedures:

If the RESET message is received, any other ongoing procedure (except another Reset procedure) on the same S1 interface related to a UE association, indicated explicitly or implicitly in the RESET message, shall be aborted.

8.7.1.2.2 Reset Procedure Initiated from the E-UTRAN
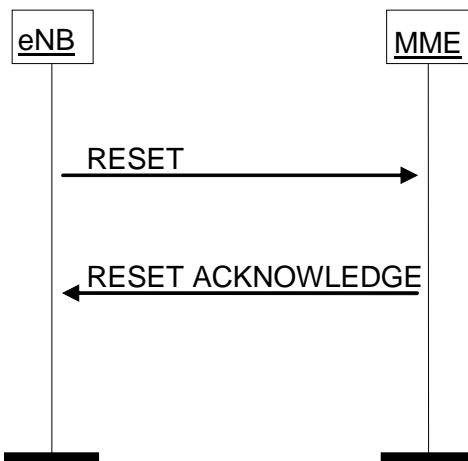
Figure 8.7.1.2.2-1: Reset procedure initiated from the E-UTRAN. Successful operation.

In the event of a failure at the eNB, which has resulted in the loss of some or all transaction reference information, a RESET message shall be sent to the MME.

At reception of RESET message the MME shall release all allocated resources on S1 related to the UE association(s) indicated explicitly or implicitly in the RESET message and remove the S1AP ID for the indicated UE associations.

After the MME has released all assigned S1 resources and the UE S1AP IDs for all indicated UE associations can be used for new UE-associated logical S1-connections over the S1 interface, the MME shall respond with the RESET ACKNOWLEDGE message.

If the RESET message contains the *UE-associated logical S1-connection list* IE, then:

- The MME shall use the *MME UE S1AP ID* IE and/or the *eNB UE S1AP ID* IE to explicitly identify the UE association(s) to be reset.

- The MME shall in the RESET ACKNOWLEDGE message include, for each UE association to reset, the *UE-associated logical S1-connection Item* IE in the *UE-associated logical S1-connection list* IE. The *UE-associated logical S1-connection Item* IEs shall be in the same order as received in the RESET message and shall include also unknown UE-associated logical S1-connections. Empty *UE-associated logical S1-connection Item* IEs, received in the RESET message, may be omitted in the RESET ACKNOWLEDGE message.

- If the *MME UE S1AP ID* IE is included in the *UE-associated logical S1-connection Item* IE for a UE association, the MME shall include the *MME UE S1AP ID* IE in the corresponding *UE-associated logical S1-connection Item* IE in the RESET ACKNOWLEDGE message.

- If the *eNB UE S1AP ID* IE is included in a *UE-associated logical S1-connection Item* IE for a UE association, the MME shall include the eNB *UE S1AP ID* IE in the corresponding *UE-associated logical S1-connection Item* IE in the RESET ACKNOWLEDGE message.

Interactions with other procedures:

If the RESET message is received, any other ongoing procedure (except another Reset procedure) on the same S1 interface related to a UE association, indicated explicitly or implicitly in the RESET message, shall be aborted.

8.7.1.3 Abnormal Conditions

8.7.1.3.1 Abnormal Condition at the EPC

If the RESET message includes the *UE-associated logical S1-connection list* IE, but neither the *MME UE S1AP ID* IE nor the *eNB UE S1AP ID* IE is present for a *UE-associated logical S1-connection Item* IE, then the MME shall ignore the *UE-associated logical S1-connection Item* IE. The MME may return the empty *UE-associated logical S1-connection Item* IE in the *UE-associated logical S1-connection list* IE in the RESET ACKNOWLEDGE message.

8.7.1.3.2 Abnormal Condition at the E-UTRAN

If the RESET message includes the *UE-associated logical S1-connection list* IE, but neither the *MME UE S1AP ID* IE nor the *eNB UE S1AP ID* IE is present for a *UE-associated logical S1-connection Item* IE, then the eNB shall ignore the *UE-associated logical S1-connection Item* IE. The eNB may return the empty *UE-associated logical S1-connection Item* IE in the *UE-associated logical S1-connection list* IE in the RESET ACKNOWLEDGE message.

8.7.1.3.3 Crossing of Reset Messages

If Reset procedure is ongoing in eNB and the eNB receives a RESET message from the peer entity on the same S1 interface related to one or several UE associations previously requested to be reset, indicated explicitly or implicitly in the received RESET message, the eNB shall respond with RESET ACKNOWLEDGE message as described in 8.7.1.2.1.

If Reset procedure is ongoing in MME and the MME receives a RESET message from the peer entity on the same S1 interface related to one or several UE associations previously requested to be reset, indicated explicitly or implicitly in the received RESET message, the MME shall respond with RESET ACKNOWLEDGE message as described in 8.7.1.2.2.

8.7.2 Error Indication

8.7.2.1 General

The Error Indication procedure is initiated by a node to report detected errors in one incoming message, provided they cannot be reported by an appropriate failure message.

If the error situation arises due to reception of a message utilising UE associated signalling, then the Error Indication procedure uses UE associated signalling. Otherwise the procedure uses non-UE associated signalling.

8.7.2.2 Successful Operation

Figure 8.7.2.2-1: Error Indication procedure, MME originated. Successful operation.

Figure 8.7.2.2-2: Error Indication procedure, eNB originated. Successful operation.

When the conditions defined in clause 10 are fulfilled, the Error Indication procedure is initiated by an ERROR INDICATION message sent from the receiving node.

The ERROR INDICATION message shall contain at least either the *Cause* IE or the *Criticality Diagnostics* IE.

In case the Error Indication procedure is triggered by utilising UE associated signalling the *MME UE S1AP ID* IE and the *eNB UE S1AP* IE shall be included in the ERROR INDICATION message. If one or both of *MME UE S1AP ID* IE and the *eNB UE S1AP* IE are not correct, the cause shall be set to appropriate value e.g. "Unknown MME UE S1AP ID", "Unknown eNB UE S1AP" or "Unknown pair of UE S1AP ID".

8.7.2.3   Abnormal Conditions

Not applicable.

8.7.3   S1 Setup

8.7.3.1   General

The purpose of the S1 Setup procedure is to exchange application level data needed for the eNodeB and MME to interoperate correctly on the S1 interface. This procedure shall be the first S1AP procedure triggered after the TNL association has become operational. This procedure erases any existing application level configuration data in the two nodes and replaces it by the one received. This procedure also re-initialises the E-UTRAN S1AP UE-related contexts (if any) and erases all related signalling connections in the two nodes like a Reset procedure would do.

8.7.3.2   Successful Operation
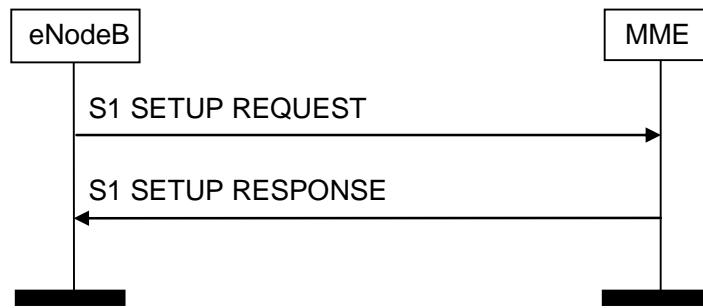
Figure 8.7.3.2-1: S1 Setup procedure: Successful Operation.

The eNodeB initiates the procedure by sending a S1 SETUP REQUEST message including the appropriate data to the MME. The MME responds with S1 SETUP RESPONSE including the appropriate data.

The exchanged data shall be stored in respective node and used for the duration of the TNL association. When this procedure is finished S1 interface is operational and other S1 messages can be exchanged.

8.7.3.3 Unsuccessful Operation
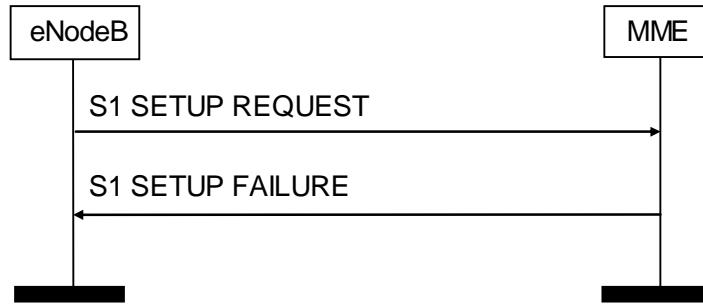
Figure 8.7.3.3-1: S1 Setup procedure: Unsuccessful Operation.

If the MME can not accept the setup it should respond with a S1 SETUP FAILURE and appropriate cause value.

If the S1 SETUP FAILURE messages include the *Time To Wait* IE the eNodeB shall wait at least for the indicated time before reinitiating the S1 setup towards the same MME.

8.7.3.4 Abnormal Conditions

If the eNB initiates the procedure by sending a S1 SETUP REQUEST message including the *PLMN Identity* IEs and the MME is not able to identify at least one of the PLMN provided by the eNB, then the MME shall reject the eNB S1 Setup Request procedure with the appropriate cause value e.g "Unknown PLMN".

8.7.4 eNB Configuration Update

8.7.4.1 General

The purpose of the eNB Configuration Update procedure is to update application level configuration data needed for the eNB and MME to interoperate correctly on the S1 interface. This procedure doesn"t affect existing UE-related contexts, if any.

8.7.4.2 Successful Operation
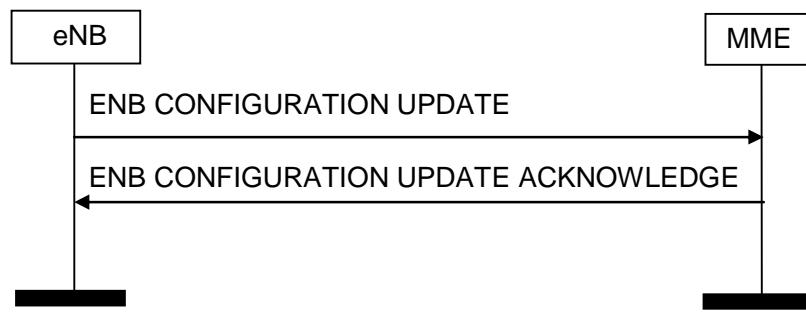
Figure 8.7.4.2-1: NB Configuration Update procedure: Successful Operation.

The eNB initiates the procedure by sending an ENB CONFIGURATION UPDATE message including the appropriate updated configuration data to the MME. The MME responds with ENB CONFIGURATION UPDATE ACKNOWLEDGE to acknowledge that it successfully updated the configuration data. If information element(s) is/are not included in the ENB CONFIGURATION UPDATE message, the MME shall interpret that the corresponding configuration data is/are not changed and shall continue to operate the S1 with the existing related configuration data.

If the supported TA(s) is(are) to be updated, the whole list of supported TAs including those are not to be updated shall be included in the *Supported TAs* IE. The MME shall overwrite the whole list of the TAs.

The updated configuration data shall be stored in respective node and used for the duration of the TNL association or until any further update is performed from the eNB.

8.7.4.3 Unsuccessful Operation
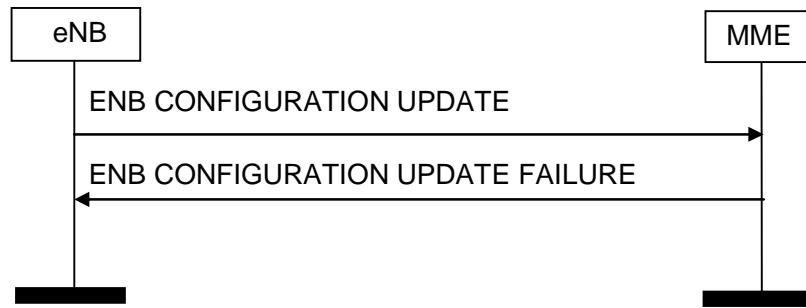
Figure 8.7.4.3-1: NB Configuration Update procedure: Unsuccessful Operation.

If the MME can not accept the update it shall respond with an ENB CONFIGURATION UPDATE FAILURE message and appropriate cause value.

If the ENB CONFIGURATION UPDATE FAILURE messages includes the *Time To Wait* IE the eNB shall wait at least for the indicated time before reinitiating the NB Configuration Update procedure towards the same MME. Both nodes shall continue to operate the S1 with the existing configuration data.

8.7.4.4 Abnormal Conditions

8.7.5 MME Configuration Update

8.7.5.1 General

The purpose of the MME Configuration Update procedure is to update application level configuration data needed for the eNB and MME to interoperate correctly on the S1 interface. This procedure doesn"t affect existing UE-related contexts, if any.

8.7.5.2 Successful Operation
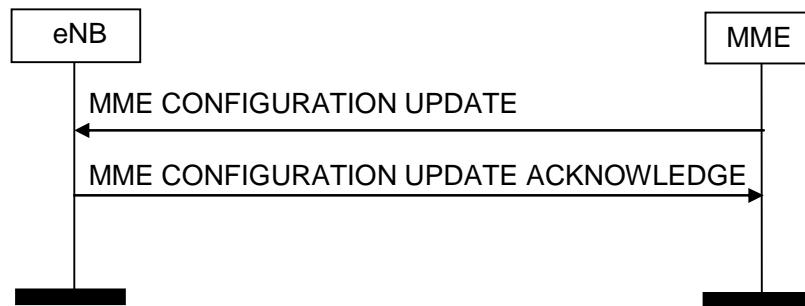
Figure 8.7.5.2-1: MME Configuration Update procedure: Successful Operation.

The MME initiates the procedure by sending an MME CONFIGURATION UPDATE message including the appropriate updated configuration data to the eNB. The eNB responds with MME CONFIGURATION UPDATE ACKNOWLEDGE to acknowledge that it successfully updated the configuration data. If information element(s) is/are not included in the MME CONFIGURATION UPDATE message, the eNB shall interpret that the corresponding configuration data is/are not changed and shall continue to operate the S1 with the existing related configuration data.

The updated configuration data shall be stored in respective node and used for the duration of the TNL association or until any further update is performed from the MME.

8.7.5.3 Unsuccessful Operation
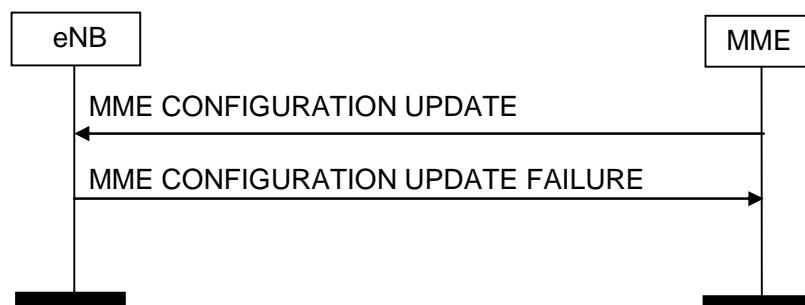
Figure 8.7.5.3-1: MME Configuration Update: Unsuccessful Operation.

If the eNB can not accept the update it shall respond with an MME CONFIGURATION UPDATE FAILURE message and appropriate cause value.

If the MME CONFIGURATION UPDATE FAILURE message includes the *Time To Wait* IE the MME shall wait at least for the indicated time before reinitiating the MME Configuration Update procedure towards the same eNB. Both nodes shall continue to operate the S1 with the existing configuration data.

8.7.5.4 Abnormal Conditions

8.8 S1 CDMA2000 Tunneling Procedures

8.8.1 General

The purpose of S1 CDMA2000 Tunneling procedures is to carry CDMA2000 signalling between UE and CDMA2000 RAT over the S1 Interface. This includes signalling for pre-registration of UE with CDMA2000 HRPD network, signalling for handover preparation for handover from E-UTRAN to CDMA2000 HRPD/1xRTT. The CDMA2000 messages are not interpreted by the eNB, and their content is outside the scope of this specification, however, additional information may be sent along with the tunnelled CDMA2000 message to assist the eNodeB and MME in the tunneling procedure. These procedures use an established UE-associated logical S1-connection.

The CDMA2000 messages are transported in an IE of the DOWNLINK S1 CDMA2000 TUNNELING or UPLINK S1 CDMA2000 TUNNELING messages.

8.8.2 Successful Operations

8.8.2.1 Downlink S1 CDMA2000 Tunneling
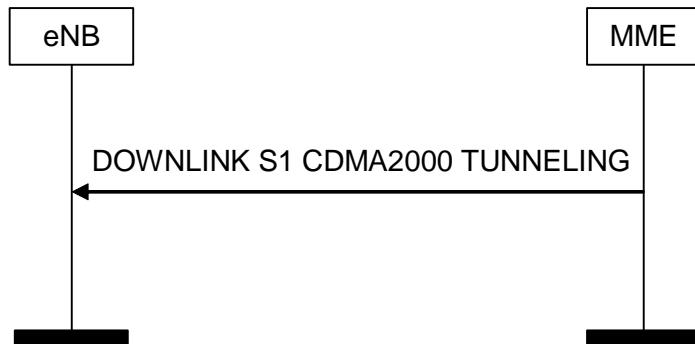
Figure 8.8.2.1-1: Downlink S1 CDMA2000 Tunneling Procedure

If a CDMA2000 message shall be sent from the MME to the UE and a UE-associated logical S1-connection exists for the UE the MME should send a DOWNLINK S1 CDMA2000 TUNNELING message to the eNB including the CDMA2000 message in the *CDMA2000-PDU* IE. The eNB forwards the received *CDMA2000-PDU* IE and *CDMA2000 RAT Type* IE to the UE.

If the MME receives handover status information along with the tunnelled downlink CDMA2000 message the MME should include the handover status information in *CDMA2000 HO Status* IE in the DOWNLINK S1 CDMA2000 TUNNELING message.

If the DOWNLINK S1 CDMA2000 TUNNELING message contains the *SAE Bearers Subject to Forwarding List* IE it indicates that DL forwarding is available for the indicated SAE Bearers towards the tunnel endpoint identified by the *DL GTP TEID* IE for those SAE Bearers.

Editor"s Note: The DL data forwarding behaviour of the eNB for handover to CDMA2000 HRPD/1xRTT should be aligned to the DL data forwarding behaviour of eNB for 3GPP inter-RAT handover.

8.8.2.2 Uplink S1 CDMA2000 Tunneling
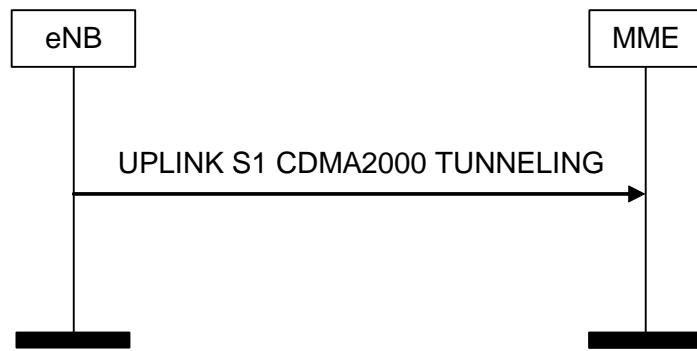
Figure 8.8.2.2-1: Uplink S1 CDMA2000 Tunneling Procedure

When the eNB has received from the radio interface a CDMA2000 message to be forwarded to the MME to which an UE-associated logical S1-connection for the UE exists, the eNB shall send the UPLINK S1 CDMA2000 TUNNELING message to the MME including the CDMA2000 message in the *CDMA2000-PDU* IE.

If the MME receives the *CDMA2000 HO Required Indication* IE set to "true" in UPLINK S1 CDMA2000 TUNNELING message the MME should send the necessary handover preparation information to the CDMA2000 target RAT.

If the MME receives the *CDMA2000 1xRTT MEID* IE and *CDMA2000 1xRTT RAND* IE in the UPLINK S1 CDMA2000 TUNNELING message the MME should forward the received MEID and RAND information to the CDMA2000 1xRTT RAT.

   Editor"s Note: It is FFS if band class information is needed to be sent along with tunnelled CDMA2000 message

Interactions with SAE Bearer Management procedures:

If, after an UPLINK S1 CDMA2000 TUNNELING message with *CDMA2000 HO Required Indication* IE set to 'true' is sent but before the DOWNLINK S1 CDMA2000 TUNNELING message with *CDMA2000 HO Status* IE is received, the source eNB receives a MME initiated SAE Bearer Management procedure on the same UE associated signaling connection, the source eNB shall terminate the MME initiated SAE Bearer Management procedure by sending the appropriate response message with the cause value 'Handover Triggered' to the MME.

8.8.3   Unsuccessful Operation

Not applicable

8.8.4   Abnormal Conditions

   Editor"s Note: Further Assessment required.

8.9   UE Capability Info Indication

8.9.1   General

The purpose of the UE Capability Info Indication procedure is used to enable the eNB to provide this information and relevant updates of this information within the eNB that took place without MME notice within the E-UTRAN to the MME.

8.9.2   Successful Operation
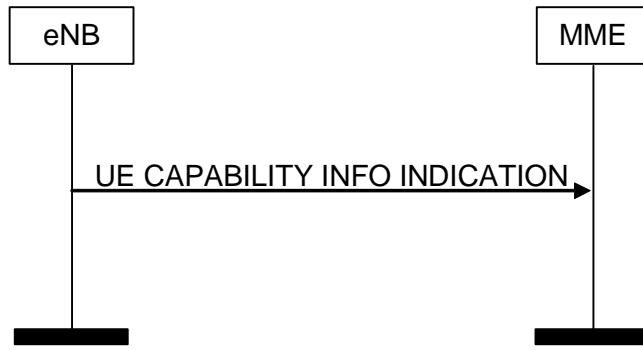
Figure 8.9.2-1: UE Capability Info Indication procedure. Successful operation.

The eNB controlling a UE-associated logical S1-connection initiates the procedure by generating an UE CAPABILITY INFO INDICATION message towards the affected MME node including UE capability information. The UE capability information provided to the MME should overwrite respective UE capability related information stored in the MME.

8.9 Trace Procedures

8.9.1 Trace Start

8.9.1.1 General

The Trace Start procedure is initiated by a MME in order to start a trace recording for a UE in LTE_ACTIVE. The procedure uses UE-associated signalling.

8.9.1.2 Successful Operation

Figure 8.9.1.2-1: Trace Start procedure.

On receipt of a TRACE START message the eNB should initiate the requested trace function as described in [10].

8.9.2 Trace Failure Indication

8.9.2.1 General

The Trace Start Failure Indication procedure is initiated by an eNB in order to inform the MME that a Trace Start procedure or a Deactivate Trace procedure has failed. The procedure uses UE-associated signalling.

8.9.2.2 Successful Operation

Figure 8.9.2.2-1: Trace Failure Indication procedure.

Upon reception of the TRACE FAILRE INDICATION message the MME shall based on the failure reason indicated by the *Cause* IE take appropriate action.

8.9.3 Deactivate Trace

8.9.3.1 General

The purpose of the Deactivate Trace procedure is to inform the eNB to stop the trace session, for the indicated trace reference.

8.9.3.2 Successful Operation

Figure 8.9.3.2-1: Deactivate Trace procedure. Successful operation.

The MME invokes the Deactivate Trace procedure by sending a DEACTIVATE TRACE message to the eNB.

The eNB shall stop the trace session for the indicated trace reference in the *Trace Reference* IE.

8.10 Location Reporting Procedures

8.10.1 Location Reporting Control

8.10.1.1 General

The purpose of Location Reporting Control procedure is to allow the MME to request the eNB to report where the UE is currently located. The procedure uses UE-associated signalling.

8.10.1.2 Successful Operation

Figure 8.10.1.2-1: Location Reporting Control procedure. Successful operation.

The MME initiates the procedure by sending a LOCATION REPORTING CONTROL message. On receipt of a LOCATION REPORTING CONTROL message the eNB shall perform the requested location reporting control action for the UE.

The *Request Type* IE indicates to the eNB whether:

- to report directly;

- to report upon change of serving cell, or

- to stop reporting at change of serving cell.

If reporting upon change of serving cell is requested, the eNB shall report whenever the UE change the serving cell.

The *Request Type* IE also indicates what type of location information the eNB shall report. The location information is E-UTRAN CGI.

8.10.1.3 Abnormal Conditions

Not applicable.

8.10.2 Location Report Failure Indication

8.10.2.1 General

The Location Report Failure Indication procedure is initiated by an eNB in order to inform the MME that a Location Reporting Control procedure has failed. The procedure uses UE-associated signalling.

8.10.2.2 Successful Operation

Figure 8.10.2.2-1: Location Report Failure Indication procedure.

Upon reception of the LOCATION REPORT FAILRE INDICATION message the MME shall based on the failure reason indicated by the *Cause* IE take appropriate action.

8.10.3 Location Report

8.10.3.1 General

The purpose of Location Report procedure is to provide the UE's current location to the MME. The procedure uses UE-associated signalling.

8.10.3.2 Successful Operation

Figure 8.10.3.2-1: Location Report procedure. Successful operation.

The eNB initiates the procedure by generating a LOCATION REPORT message. The LOCATION REPORT message may be used as a response to a LOCATION REPORTING CONTROL message.

8.10.3.3 Abnormal Conditions

Not applicable.

9 Elements for S1AP Communication

9.1 Message Functional Definition and Content

Editor"s Note: Description of functional definition and content.

Editor"s note: Tabular format tables content (e.g. semantic description, criticality assignment, etc.) will be updated in forthcoming meetings.

9.1.1 General

9.1.2 Message Contents

9.1.2.1 Presence

All information elements in the message descriptions below are marked mandatory, optional or conditional according to table 4.

Table 4: Meaning of abbreviations used in S1AP messages

Abbreviation	Meaning
M	IEs marked as Mandatory (M) shall always be included in the message.
O	IEs marked as Optional (O) may or may not be included in the message.
C	IEs marked as Conditional (C) shall be included in a message only if the condition is satisfied. Otherwise the IE shall not be included.

9.1.2.2 Criticality

Each Information Element or Group of Information Elements may have criticality information applied to it. Following cases are possible:

Table 5: Meaning of content within 'Criticality' column

Abbreviation	Meaning
–	No criticality information is applied explicitly.
YES	Criticality information is applied. This is usable only for non-repeatable IEs
GLOBAL	The IE and all its repetitions together have one common criticality information. This is usable only for repeatable IEs.
EACH	Each repetition of the IE has its own criticality information. It is not allowed to assign different criticality values to the repetitions. This is usable only for repeatable IEs.

9.1.2.3 Range

The Range column indicates the allowed number of copies of repetitive IEs/IE groups.

9.1.2.4 Assigned Criticality

This column provides the actual criticality information as defined in subclause 10.3.2, if applicable.

9.1.3 SAE Bearer Management Messages

9.1.3.1 SAE BEARER SETUP REQUEST

This message is sent by the MME and is used for request the eNB to assign resources on Uu and S1 for one or several SAE bearers.

Direction: MME → eNB

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
SAE Bearer to be Setup List	M				YES	reject
>SAE Bearer To Be Setup Item IEs		1 to <maxnoof SAEbearers>			EACH	reject
>> SAE Bearer ID	M		9.2.1.2	a value for *SAE bearer identity* shall only be present once in *SAE Bearer to be Setup List* IE	-	
>> SAE Bearer Level QoS parameters	M		9.2.1.15	Includes necessary QoS parameters	-	
>> Transport Layer Address	M		9.2.2.1		-	
>> GTP-TEID	M		9.2.2.2	note: EPC TEID, UDP port	-	
NAS-PDU	M		9.2.3.5		YES	reject

Range bound	Explanation
maxnoofSAEbearers	Maximum no. of SAE bearer allowed towards one UE, the maximum value is 256. (FFS)

9.1.3.2 SAE BEARER SETUP RESPONSE

This message is sent by the eNB and is used to report the outcome of the request from the SAE BEARER SETUP REQUEST message.

Direction: eNB → MME

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
SAE Bearer Setup List	O				YES	reject
>SAE Bearer Setup Item IEs		1 to <maxnoof SAEbearers>			EACH	reject
>> SAE Bearer ID	M			a value for *SAE bearer identity* shall only be present once in *SAE Bearer Setup List* IE	-	
>> Transport Layer Address	M		9.2.2.1		-	
>> GTP-TEID	M		9.2.2.2	note: eNB TEID, UDP port	-	
SAE Bearer Failed to Setup List	O				YES	ignore
>SAE Bearer Failed To Setup Item IEs		1 to <maxnoof SAEbearers>			EACH	ignore
>> SAE Bearer ID	M		9.2.1.2	a value for *SAE bearer identity* shall only be present once in *SAE Bearer Failed to Setup List* IE	-	
>> Cause	M		9.2.1.3		-	
NAS-PDU	M		9.2.3.5		YES	ignore
Criticality Diagnostics	O		9.2.1.21		YES	ignore

Range bound	Explanation
maxnoofSAEbearers	Maximum no. of SAE bearer allowed towards one UE, the maximum value is 256. (FFS)

9.1.3.3 SAE BEARER MODIFY REQUEST

This message is sent by the MME and is used to request the eNB to modify the SAE Radio Bearers and the allocated resources on Uu and S1 for one or several SAE bearers.

Direction: MME → eNB

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
SAE Bearer to be Modified List	M				YES	reject
>SAE Bearer To Be Modified Item IEs		1 to <maxnoof SAEbearers>			EACH	reject
>> SAE Bearer ID	M		9.2.1.2	a value for *SAE bearer identity* shall only be present once in *SAE Bearer to be Modified List* IE	-	
>> SAE Bearer Level QoS Parameters	M		9.2.1.15	Includes necessary QoS parameters	-	
NAS-PDU	M		9.2.3.5		YES	ignore

Range bound	Explanation
maxnoofSAEbearers	Maximum no. of SAE bearer allowed towards one UE, the maximum value is 256. (FFS)

9.1.3.4 SAE BEARER MODIFY RESPONSE

This message is sent by the eNB and is used to report the outcome of the request from the SAE BEARER MODIFY REQUEST message.

Direction: eNB → MME

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
SAE Bearer Modify List	O				YES	reject
>SAE Bearer Modify Item IEs		1 to <maxnoof SAEbearers>			EACH	reject
>> SAE BearerID	M		9.2.1.2	a value for *SAE bearer identity* shall only be present once in *SAE Bearer Modifiy List* IE + *SAE Bearer Failed to Modify List*	-	
SAE Bearer Failed to Modify List	O				YES	ignore
>SAE Bearer Failed To Modify Item IEs		1 to <maxnoof SAEbearers>			EACH	ignore
>> SAE Bearer ID	M		9.2.1.2	a value for *SAE bearer identity* shall only be present once in *SAE Bearer Modifiy List* IE + *SAE Bearer Failed to Modify List*	-	
>> Cause	M		9.2.1.3		-	
NAS-PDU	M		9.2.3.5		YES	ignore
Criticality Diagnostics	O		9.2.1.21		YES	ignore

Range bound	Explanation
maxnoofSAEbearers	Maximum no. of SAE bearer allowed towards one UE, the maximum value is 256. (FFS)

9.1.3.5 SAE BEARER RELEASE COMMAND

This message is sent by the MME and is used to request the eNB to release allocated resources on Uu and S1 for one or several SAE bearers..

Direction: MME → eNB

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
SAE Bearer To Be Released List	M				YES	ignore
>SAE Bearer To Be Released Item IEs		1 to <maxnoof SAEbearers>			EACH	ignore
>> SAE bearer ID	M		9.2.1.2	a value for SAE bearer identity shall only be present once in SAE Bearer To Be Released List IE	-	
>> Cause	M		9.2.1.3		-	

Range bound	Explanation
maxnoofSAEbearers	Maximum no. of SAE bearer allowed towards one UE, the maximum value is 256. (FFS)

9.1.3.6 SAE BEARER RELEASE RESPONSE

This message is sent by the eNB and is used to report the outcome of the request from the SAE BEARER RELEASE COMMAND message.

Direction: eNB → MME

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
SAE Bearer Release List	O				YES	ignore
>SAE Bearer Release Item IEs		1 to <maxnoof SAEbearers>			EACH	ignore
>> SAE bearer ID	M		9.2.1.2	a value for *SAE bearer identity* shall only be present once in *SAE Bearer Release List* IE + *SAE Bearer Failed to Release List* IE	-	
SAE Bearer Failed to Release List	O				YES	ignore
>SAE Bearer Failed To Release Item IEs		1 to <maxnoof SAEbearers>			EACH	ignore
>> SAE bearer ID	M		9.2.1.2	a value for *SAE bearer identity* shall only be present once in *SAE Bearer Release List* IE + *SAE Bearer Failed to Release List* IE	-	
>> Cause	M		9.2.1.3		-	
Criticality Diagnostics	O		9.2.1.21		YES	ignore

Range bound	Explanation
maxnoofSAEbearers	Maximum no. of SAE bearer allowed towards one UE, the maximum value is 256. (FFS)

9.1.3.7 SAE BEARER RELEASE REQUEST

This message is sent by the eNB and is used to request the MME to release one or several SAE Bearers for one UE.

Direction: eNB → MME

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
SAE Bearer To Be Released List	M				YES	ignore
>SAE Bearer To Be Released Item IEs		1 to <maxnoof SAEbearers>			EACH	reject
>> SAE bearer ID	M		9.2.1.2	a value for *SAE bearer identity* shall only be present once in *SAE Bearer To Be Released List* IE	-	
>> Cause	M		9.2.1.3		-	

Range bound	Explanation
maxnoofSAEbearers	Maximum no. of SAE bearer allowed towards one UE, the maximum value is 256. (FFS)

9.1.4 Context Management Messages

9.1.4.1 INITIAL CONTEXT SETUP REQUEST

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
Aggregate Maximum Bit Rate	M		9.2.1.20	FFS: AMBR for several APNs	YES	reject
SAE Bearer to Be Setup List	M				YES	ignore
> SAE Bearer to Be Setup Item IEs		1 to <maxnoofSAEbea rers>			EACH	reject
>>SAE Bearer ID	M		9.2.1.2		-	
>>SAE Bearer Level QoS Parameters	M		9.2.1.15	Includes necessary QoS parameters	-	
>>Transport Layer Address	M		9.2.2.1		-	
>> GTP TEID	M		9.2.2.2		-	
Security	M		FFS	FFS	YES	reject
Trace Activation	O		9.2.1.4		YES	ignore
Handover Restriction List	O		9.2.1.22		YES	ignore
NAS-PDU	O		9.2.3.5	FFS	YES	ignore
UE Radio Capability	O		9.2.1.27		YES	ignore

Range bound	Explanation
maxnoofSAEbearers	Maximum no. of SAE bearer allowed towards one UE, the maximum value is 256. (FFS)

9.1.4.2 INITIAL CONTEXT SETUP RESPONSE

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
SAE Bearer Setup List	O				YES	ignore
> SAE Bearer Setup Item IEs		1 to <maxnoofSAEbearers>			EACH	reject
>>SAE Bearer Identity	M		9.2.1.2		-	
>>Transport Layer Address	M		9.2.2.1		-	
>>GTP TEID	M		9.2.2.2		-	
SAE Bearer Failed to Setup List	O				YES	ignore
> SAE Bearer Failed to Setup Item IEs		1 to <maxnoofSAEbearers>			EACH	ignore
>>SAE Bearer ID	M		9.2.1.2		-	
>>Cause	M		9.2.1.3			
Criticality Diagnostics	O		9.2.1.21		YES	ignore

Range bound	Explanation
maxnoofSAEbearers	Maximum no. of SAE bearer allowed towards one UE, the maximum value is 256. (FFS)

9.1.4.4 INITIAL CONTEXT SETUP FAILURE

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
Cause	M		9.2.1.3		YES	ignore
Criticality Diagnostics	O		9.2.1.21		YES	ignore

9.1.4.5 UE CONTEXT RELEASE REQUEST

This message is sent by the eNB to request the release of the UE-associated S1-logical connection over the S1 interface.

Direction: eNB → MME

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	ignore
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
Cause	M		9.2.1.3		YES	ignore

9.1.4.6 UE CONTEXT RELEASE COMMAND

This message is sent by the MME to request the release of the UE-associated S1-logical connection over the S1 interface.

Direction: MME → eNB

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
CHOICE *UE S1 AP IDs*	M				YES	reject
>UE S1 AP ID pair	M		9.2.3.18			
>MME UE S1AP ID	M		9.2.3.3			
>eNB UE S1AP ID	M		9.2.3.4			
Cause	M		9.2.1.3		YES	ignore

9.1.4.7 UE CONTEXT RELEASE COMPLETE

This message is sent by the eNB to confirm the release of the UE-associated S1-logical connection over the S1 interface.

Direction: eNB → MME

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
Criticality Diagnostics	O		9.2.1.21		YES	ignore

9.1.4.8 UE CONTEXT MODIFICATION REQUEST

This message is sent by the MME to provide UE Context information changes to the eNB.

Direction: MME → eNB

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
Security Information	O		9.2.1.26		YES	reject

9.1.4.9 UE CONTEXT MODIFICATION RESPONSE

This message is sent by the eNB to confirm the performed UE context updates.

Direction: eNB → MME

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
Criticality Diagnostics	O		9.2.1.21		YES	ignore

9.1.4.10   UE CONTEXT MODIFICATION FAILURE

This message is sent by the eNB in case the performed UE context update is not successful.

Direction: eNB → MME

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
Cause	M		9.1.2.3		YES	reject
Criticality Diagnostics	O		9.2.1.21		YES	ignore

9.1.5 Handover Signalling Messages

9.1.5.1 HANDOVER REQUIRED

This message is sent by the source eNodeB to the MME to request the preparation of resources at the target.

Direction: eNodeB → MME.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
Handover Type	M	<IntraLTE, LTEtoUTRAN, LTEtoGERAN>	9.2.1.13		YES	reject
Cause	M		9.2.1.3		YES	ignore
Source ID	M		9.2.1.5		YES	reject
Target ID	M		9.2.1.6		YES	reject
Direct Forwarding Path Availability	O		9.2.3.15		YES	ignore
Intra-LTE HO Information ListRequest	C-ifIntraLTE				YES	reject
> Source eNodeB to Target eNodeB Transparent Container	M		9.2.1.7	It includes the UE RAN context		
LTE to UTRAN HO Information ListRequest	C- ifILTEto UTRAN				YES	reject
> Source RNC To Target RNC Transparent Container	M		9.2.1.9	FFS if this is mandatory and needed		
LTE to GERAN HO Information ListRequest	C- ifILTEto GERAN				YES	reject
> Source BSS To Target BSS Transparent Container	M		9.2.1.11	FFS if this is mandatory and needed		

Condition	Explanation
ifIntraLTE	This IE shall be present if the *Handover Type* IE is set to the 'Value' IntraLTE.
ifLTEtoUTRAN	This IE shall be present if the *Handover Type* IE is set to the 'Value' LTEtoUTRAN.
ifLTEtoGERAN	This IE shall be present if the *Handover Type* IE is set to the 'Value' LTEtoGERAN.

9.1.5.2 HANDOVER COMMAND

This message is sent by the MME to inform the source eNodeB that resources for the handover have been prepared at the target side.

Direction: MME → eNodeB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
Handover Type	M	<IntraLTE, LTEtoUTRAN, LTEtoGERAN>	9.2.1.13		YES	reject
SAE Bearers Subject to Forwarding List	O				YES	ignore
>SAE Bearers Subject to Forwarding Item IEs		1 to <maxnoof SAEbearers>			EACH	ignore
>> SAE Bearer ID	M		9.2.1.2		-	
>> DL Transport Layer Address	M		9.2.2.1		-	
>> DL GTP TEID	M		9.2.2.2	To deliver forwarded DL PDCP SDUs	-	
SAE Bearers to Release List	O				YES	ignore
>SAE Bearers to Release Item IEs		1 to <maxnoof SAEbearers>			EACH	ignore
>> SAE Bearer ID	M		9.2.1.2		-	
Intra-LTE HO Information ListResponse	C-ifIntraLTE				YES	reject
> Target eNodeB to Source eNodeB Transparent Container	M		9.2.1.8			
LTE to UTRAN HO Information ListResponse	C- ifILTEto UTRAN				YES	reject
> Target RNC to Source RNC Transparent Container	M		9.2.1.10	FFS if this is mandatory and needed		
LTE to GERAN HO Information ListResponse	C- ifILTEto GERAN				YES	reject
> Target BSS to Source BSS Transparent Container	M		9.2.1.12	FFS if this is mandatory and needed		
Criticality Diagnostics	O		9.2.1.21		YES	ignore

Editor"s Note: How to handle and control data forwarding is FFS. This means that the existence of, and the definition of the SAE Bearers Subject to Forwarding List IE is FFS.

Condition	Explanation
ifIntraLTE	This IE shall be present if the *Handover Type* IE is set to the 'Value' IntraLTE.
ifLTEtoUTRAN	This IE shall be present if the *Handover Type* IE is set to the 'Value' LTEtoUTRAN.
ifLTEtoGERAN	This IE shall be present if the *Handover Type* IE is set to the 'Value' LTEtoGERAN.

Range bound	Explanation
maxnoofSAEbearers	Maximum no. of SAE Bearers for one UE. Value is 256.

9.1.5.3 HANDOVER PREPARATION FAILURE

This message is sent by the MME to inform the source eNodeB that the Handover Preparation has failed.

Direction: MME → eNodeB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
Cause	M		9.2.1.3		YES	ignore
Criticality Diagnostics	O		9.2.1.21		YES	ignore

9.1.5.4 HANDOVER REQUEST

This message is sent by the MME to the target eNodeB to request the preparation of resources.

Direction: MME → eNodeB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
Handover Type	M	<IntraLTE, UTRANtoLTE, GERANtoLTE>	9.2.1.13		YES	reject
Cause	M		9.2.1.3		YES	ignore
Aggregate Maximum Bit Rate	M		9.2.1.20		YES	reject
SAE Bearers To Be Setup List	M				YES	ignore
>SAE Bearers To Be Setup Item IEs		1 to <maxnoof SAEbearers>			EACH	reject
>> SAE Bearer ID	M		9.2.1.2		-	
>> Transport Layer Address	M		9.2.2.1		-	
>> GTP TEID	M		9.2.2.2	To deliver UL PDUs	-	
>> SAE Bearer Level QoS Parameters	M		9.2.1.15	Includes necessary QoS parameters	-	
Intra-LTE HO Information ListRequest	C-ifIntraLTE				YES	reject
> Source eNodeB to Target eNodeB Transparent Container	M		9.2.1.7			
UTRAN to LTE HO Information ListRequest	C- if UTRAN toLTE				YES	reject
> Source RNC to Target RNC Transparent Container	M		9.2.1.9	FFS if this is mandatory and needed		
to GERAN to LTE HO Information ListRequest	C- if GERAN toLTE				YES	reject
> Source BSS to Target BSS Transparent Container	M		9.2.1.11	FFS if this is mandatory and needed		
Handover Restriction List	O		9.2.1.22		YES	ignore
Trace Activation	O		9.2.1.4		YES	ignore

Editor"s Note: The details of required IEs to indicate security parameters in the message (e.g., encryption and integrity protection information) are FFS.

Condition	Explanation
IfIntraLTE	This IE shall be present if the *Handover Type* IE is set to the 'Value' IntraLTE.
ifUTRANtoLTE	This IE shall be present if the *Handover Type* IE is set to the 'Value' UTRANtoLTE.
ifGERANtoLTE	This IE shall be present if the *Handover Type* IE is set to the 'Value' GERANtoLTE.

Range bound	Explanation
maxnoofSAEbearers	Maximum no. of SAE Bearers for one UE. Value is 256.

9.1.5.5 HANDOVER REQUEST ACKNOWLEDGE

This message is sent by the target eNodeB to inform the MME about the prepared resources at the target.

Direction: eNodeB → MME.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4	allocated at the target eNodeB	YES	reject
Handover Type	M	<IntraLTE, UTRANtoLTE, GERANtoLTE>	9.2.1.13		YES	reject
SAE Bearers Admitted List	O				YES	ignore
>SAE Bearers Admitted Item IEs		1 to <maxnoof SAEbearers>			EACH	reject
>> SAE Bearer ID	M		9.2.1.2		-	
>> Transport Layer Address	M		9.2.2.1		-	
>> GTP TEID	M		9.2.2.2	To deliver DL PDUs	-	
>> DL Transport Layer Address	O		9.2.2.1		-	
>> DL GTP TEID	O		9.2.2.2	To deliver forwarded DL PDCP SDUs.	-	
SAE Bearers Failed to Setup List	O				YES	ignore
>SAE Bearers Failed to Setup Item IEs		1 to <maxnoof SAEbearers>			EACH	ignore
>>SAE Bearer ID	M		9.2.1.2		-	
>>Cause	M		9.2.1.3		-	
Intra-LTE HO Information ListResponse	C-ifIntraLTE				YES	reject
> Target eNodeB to Source eNodeB Transparent Container	M		9.2.1.8	It includes HO Command info for the UE		
UTRAN to LTE HO Information ListResponse	C- if UTRANtoLTE				YES	reject
> Target RNC to Source RNC Transparent Container	M		9.2.1.10	FFS if this is mandatory and needed		
GERAN to LTE HO Information ListResponse	C- if GERANtoLTE				YES	reject
> Target BSS to Source BSS Transparent Container	M		9.2.1.12	FFS if this is mandatory and needed		
Criticality Diagnostics	O		9.2.1.21		YES	ignore

Condition	Explanation
ifIntraLTE	This IE shall be present if the *Handover Type* IE is set to the 'Value' IntraLTE.
ifUTRANtoLTE	This IE shall be present if the *Handover Type* IE is set to the 'Value' UTRANtoLTE.
ifGERANtoLTE	This IE shall be present if the *Handover Type* IE is set to the 'Value' GERANtoLTE.

Range bound	Explanation
maxnoofSAEbearers	Maximum no. of SAE Bearers for one UE. Value is 256.

9.1.5.6   HANDOVER FAILURE

This message is sent by the target eNodeB to inform the MME that the preparation of resources has failed.

Direction: eNodeB → MME.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
Cause	M		9.2.1.3		YES	ignore
Criticality Diagnostics	O		9.2.1.21		YES	ignore

9.1.5.7   HANDOVER NOTIFY

This message is sent by the target eNodeB to inform the MME that the UE has been identified in the target cell and the S1 handover has been completed.

Direction: eNodeB → MME.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	ignore
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject

9.1.5.8 PATH SWITCH REQUEST

This message is sent by the eNodeB to request the MME to switch DL GTP tunnel termination point(s) from one end-point to another.

Direction: eNodeB → MME.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
SAE Bearer To Be Switched in Downlink List	M				YES	ignore
>SAE Bearers Switched in Downlink Item IEs		1 to <maxnoof SAEbearers>			EACH	reject
>> SAE bearer Identity	M		9.2.1.2		-	
>> Transport layer address	M		9.2.2.1		-	
>> GTP TEID	M		9.2.2.2	To deliver DL PDUs	-	
Source MME UE S1AP ID	M		9.2.3.3		YES	reject

Range bound	Explanation
maxnoofSAEbearers	Maximum no. of SAE Bearers for one UE. Value is 256.

9.1.5.9 PATH SWITCH REQUEST ACKNOWLEDGE

This message is sent by the MME to inform the eNodeB that the path switch has been successfully completed in the EPC.

Direction: MME → eNodeB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
SAE Bearer To Be Switched in Uplink List	O				YES	ignore
> SAE Bearers Switched in Uplink Item IEs		1 to <maxnoof SAEbearers>			EACH	ignore
>> SAE bearer Identity	M		9.2.1.2		-	
>> Transport layer address	M		9.2.2.1		-	
>> GTP TEID	M		9.2.2.2		-	
Handover Restriction List	O		9.2.1.22		YES	ignore
Criticality Diagnostics	O		9.2.1.21		YES	ignore

Range bound	Explanation
maxnoofSAEbearers	Maximum no. of SAE Bearers for one UE. Value is 256.

9.1.5.10   PATH SWITCH REQUEST FAILURE

This message is sent by the MME to inform the eNodeB that a failure has occurred in the EPC during the Path switch request procedure.

Direction: MME → eNodeB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
Cause	M		9.2.1.3		YES	ignore
Criticality Diagnostics	O		9.2.1.21		YES	ignore

9.1.5.11   HANDOVER CANCEL

This message is sent by the source eNodeB to the MME to request the cancellation of an ongoing handover.

Direction: eNodeB → MME.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
Cause	M		9.2.1.3		YES	ignore

9.1.5.12   HANDOVER CANCEL ACKNOWLEDGE

This message is sent by the MME to the source eNodeB to confirm that the ongoing handover was cancelled.

Direction: MME → eNodeB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
Criticality Diagnostics	O		9.2.1.21		YES	ignore

9.1.5.13   eNB STATUS TRANSFER

This message is sent by the source eNodeB to transfer the PDCP SN receiver and transmitter status.

Direction: eNodeB → MME.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.11		YES	ignore
MME S1-AP UE Identity	M		9.2.3.3		YES	reject
eNB S1-AP UE Identity	M		9.2.3.4		YES	reject
eNB Status Transfer Transparent Container	M		9.2.1.31		YES	reject

Editor"s note: it is FFS if the procedure may be triggered more than once time during the handover preparation.

9.1.5.14   MME STATUS TRANSFER

This message is sent by the MME to transfer the PDCP SN receiver and transmitter status.

Direction: MME → eNodeB

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.15		YES	ignore
MME S1-AP UE Identity	M		INTEGER (0..4095)	eNB UE X2AP ID allocated at the old eNodeB	YES	reject
eNB S1-AP UE Identity	M		INTEGER (0..4095)	eNB UE X2AP ID allocated at the new eNodeB	YES	reject
eNB Status Transfer Transparent Container	M		9.2.1.31		YES	reject

9.1.6   PAGING

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	ignore
UE Identity Index value	M		9.2.3.10		YES	ignore
UE Paging ID	M		9.2.3.13		YES	ignore
Paging DRX	M		9.2.1.16		YES	ignore
Paging Cause	M		9.2.1.17		YES	ignore
List of TAIs					YES	ignore
>TAI List Item		1 to < maxnoofTAI >			EACH	ignore
>>TAI	M		9.2.3.16		-	

Range bound	Explanation
maxnoofTAI	Maximum no. of TAI Identity for one UE. Value is FFS.

9.1.7 NAS Transport Messages

9.1.7.1 INITIAL UE MESSAGE

This message is sent by the eNB to transfer the initial layer 3 message to the MME over the S1 interface.

Direction: eNB → MME

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	ignore
eNB UE S1AP ID	M		9.2.3.4		YES	reject
NAS-PDU	M		9.2.3.5		YES	reject
TAI	M		9.2.3.16	Indicating the Tracking Area from which the UE has sent the NAS message.	YES	reject
S-TMSI	O		9.2.3.6		YES	reject

9.1.7.2 DOWNLINK NAS TRANSPORT

This message is sent by the MME and is used for carrying NAS information over the S1 interface.

Direction: MME → eNB

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	ignore
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
NAS-PDU	M		9.2.3.5		YES	reject
Handover Restriction List	O		9.2.1.22		YES	ignore

9.1.7.3 UPLINK NAS TRANSPORT

This message is sent by the eNB and is used for carrying NAS information over the S1 interface.

Direction: eNB → MME

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	ignore
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
NAS-PDU	M		9.2.3.5		YES	reject

9.1.7.4 NAS NON DELIVERY INDICATION

This message is sent by the eNB and is used for reporting the non delivery of a NAS PDU previously received within a DOWNLINK NAS TRANSPORT message over the S1 interface.

Direction: eNB → MME

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	ignore
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
NAS-PDU	M		9.2.3.5		YES	ignore
Cause	M		9.2.1.3		YES	ignore

9.1.8 Management messages

9.1.8.1 RESET

This message is sent by both the MME and the eNB and is used to request that the S1 interface, or parts of the S1 interface, to be reset.

Direction: MME → eNB and eNB → MME

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
Cause	M		9.2.1.3		YES	ignore
Choice **Reset Type**	M				YES	reject
>S1 interface						
>> Reset All	M		ENUMERAT ED (Reset all,…)		–	–
>Part of S1 interface						
>> UE-associated logical S1-connection list	M				–	–
>>>UE-associated logical S1-connection Item		1 to < maxnoofIndividual S1ConnectionsTo Reset >			EACH	reject
>>>> MME UE S1AP ID	O		9.2.3.3		–	–
>>>> eNB UE S1AP ID	O		9.2.3.4		–	–

Range bound	Explanation
maxnoofIndividualS1ConnectionsToReset	Maximum no. of UE-associated logical S1-connections allowed to reset in one message. Value is 256.

9.1.8.2 RESET ACKNOWLEDGE

This message is sent by both the MME and the eNB as a response to a RESET message.

Direction: eNB → MME and MME → eNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
UE-associated logical S1-connection list	O				YES	ignore
>UE-associated logical S1-connection Item		1 to < maxnoofIndividual S1ConnectionsTo Reset >			EACH	ignore
>>MME UE S1AP ID	O		9.2.3.3		–	–
>>eNB UE S1AP ID	O		9.2.3.4		–	–
Criticality Diagnostics	O		9.2.1.21		YES	ignore

Range bound	Explanation
maxnoofIndividualS1ConnectionsToReset	Maximum no. of UE-associated logical S1-connections allowed to reset in one message. Value is 256.

9.1.8.3 ERROR INDICATION

This message is sent by both the MME and the eNB and is used to indicate that some error has been detected in the node.

Direction: MME → eNB and eNB → MME

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	ignore
MME UE S1AP ID	O		9.2.3.3		YES	ignore
eNB UE S1AP ID	O		9.2.3.4		YES	ignore
Cause	O		9.2.1.3		YES	ignore
Criticality Diagnostics	O		9.2.1.21		YES	ignore

9.1.8.4 S1 SETUP REQUEST

This message is sent by the eNB to transfer information for a TNL association.

Direction: eNB → MME

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
eNB Global ID	M		OCTET STRING	Coding FFS	YES	reject
eNB Name	M		OCTET STRING	FSS if IE is optional	YES	ignore
Supported TAs		1..<maxnoofTACs>		Supported TAs in the eNB	GLOBAL	reject
>TAC	M		9.2.3.7	Broadcast TAC	-	
>Broadcast PLMNs		1..<maxnoofBPLMNs>		Broadcast PLMNs	-	
>>PLMN Identity	M		9.2.3.8		-	

Range bound	Explanation
maxnoofTACs	Maximum no. of TACs. Value is FFS.

Range bound	Explanation
maxnoofBPLMNs	Maximum no. of Broadcasted PLMNs. Value is FFS.

9.1.8.5 S1 SETUP RESPONSE

This message is sent by the MME to transfer information for a TNL association.

Direction: MME → eNB

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME Name	M		OCTET STRING	FSS if IE is optional	YES	ignore
Served PLMNs		1..<maxnoofPLMNsPer			GLOBAL	reject

			MME>			
>PLMN Identity	M		9.2.3.8		-	
GUMMEI	M		9.2.3.9		YES	reject
Relative MME Capacity	M		9.2.3.17		YES	reject
Criticality Diagnostics	O		9.2.1.21		YES	ignore

Range bound	Explanation
maxnoofPLMNsPer MME	Maximum no. of PLMNs per MME. Value is FFS.

9.1.8.6   S1 SETUP FAILURE

This message is sent by the MME to indicate S1 Setup failure.

Direction: MME → eNB

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
Cause	M		9.2.1.3		YES	ignore
Time to wait	O		OCTET STRING		YES	ignore
Criticality Diagnostics	O		9.2.1.21		YES	ignore

9.1.8.7   ENB CONFIGURATION UPDATE

This message is sent by the eNB to transfer updated information for a TNL association.

Direction: eNB → MME

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
eNB Name	O		OCTET STRING	FSS if IE is optional	YES	ignore
Supported TAs		0..<maxnoofTACs>		Supported TAs in the eNB	GLOBAL	reject
>TAC	M		9.2.3.7	Broadcasted TAC	-	
>Broadcast PLMNs		1..<maxnoofBPLMNs>		Broadcast PLMNs	-	
>>PLMN Identity	M		9.2.3.8		-	

Range bound	Explanation
maxnoofTACs	Maximum no. of TACs. Value is FFS.
maxnoofBPLMNs	Maximum no. of Broadcasted PLMNs. Value is FFS.

9.1.8.8   ENB CONFIGURATION UPDATE ACKNOWLEDGE

This message is sent by the MME to acknowledge the eNB transfer updated information for a TNL association.

Direction: MME → eNB

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
Criticality Diagnostics	O		9.2.1.21		YES	ignore

9.1.8.9   ENB CONFIGURATION UPDATE FAILURE

This message is sent by the MME to indicate S1 eNB Configuration Update failure.

Direction: MME → eNB

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
Cause	M		9.2.1.3		YES	ignore
Time to wait	O		OCTET STRING		YES	ignore
Criticality Diagnostics	O		9.2.1.21		YES	ignore

9.1.8.10   MME CONFIGURATION UPDATE

This message is sent by the MME to transfer updated information for a TNL association.

Direction: MME → eNB

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
MME Name	O		OCTET STRING	FSS if IE is optional	YES	ignore
Served PLMNs		0..<maxnoofPLMNsPerMME>			GLOBAL	reject
>PLMN Identity	M		9.2.3.8		-	
GUMMEI	O		9.2.3.9		YES	reject
Relative MME Capacity	O		9.2.3.17		YES	reject

Range bound	Explanation
maxnoofPLMNsPer MME	Maximum no. of PLMNs per MME. Value is FFS.

9.1.8.11   MME CONFIGURATION UPDATE ACKNOWLEDGE

This message is sent by the eNB to acknowledge the MME transfer updated information for a TNL association.

Direction: eNB → MME

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
Criticality Diagnostics	O		9.2.1.21		YES	ignore

9.1.8.12   MME CONFIGURATION UPDATE FAILURE

This message is sent by the eNB to indicate S1 MME Configuration Update failure.

Direction: eNB → MME

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	reject
Cause	M		9.2.1.3		YES	ignore
Time to wait	O		OCTET STRING		YES	ignore
Criticality Diagnostics	O		9.2.1.21		YES	ignore

9.1.9 S1 CDMA2000 Tunneling Messages

9.1.9.1 DOWNLINK S1 CDMA2000 TUNNELING

This message is sent by the MME and is used for carrying CDMA2000 information over the S1 interface.

Direction: MME → eNB

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	ignore
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
SAE Bearers Subject to Forwarding List	O				YES	ignore
>SAE Bearers Subject to Forwarding Item IEs		1 to <maxnoof SAEbearers>			EACH	ignore
>> SAE Bearer ID	M		9.2.1.2		-	
>> DL Transport Layer Address	M		9.2.2.1		-	
>> DL GTP TEID	M		9.2.2.2	This IE indicates the tunnel endpoint for forwarding of DL data.	-	
CDMA2000 HO Status	O		9.2.1.28		YES	ignore
CDMA2000 RAT Type	M		9.2.1.24		YES	reject
CDMA2000-PDU	M		9.2.1.23		YES	reject

9.1.9.2 UPLINK S1 CDMA2000 TUNNELING

This message is sent by the eNB and is used for carrying CDMA2000 information over the S1 interface.

Direction: eNB → MME

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	ignore
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
CDMA2000 RAT Type	M		9.2.1.24		YES	reject
CDMA2000 Sector ID	M		9.2.1.25		YES	reject
CDMA2000 HO Required Indication	O		9.2.1.29		YES	ignore
CDMA2000 1xRTT MEID	O		9.2.1.30		YES	ignore
CDMA2000 1xRTT RAND	O		9.2.1.33		YES	ignore
CDMA2000-PDU	M		9.2.1.23		YES	reject

9.1.10 UE CAPABILITY INFO INDICATION

This message is sent by the eNB to provide UE Radio Capability information to the MME.

Direction: eNB → MME

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	ignore
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
UE Radio Capability	M		9.2.1.27		YES	ignore

9.1.11 Trace Messages

9.1.11.1 TRACE START

This message is sent by the MME to initiate trace recording for a UE.

Direction: MME → eNB

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	ignore
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
Trace Activation	M		9.2.1.4		YES	ignore

9.1.11.2 TRACE FAILURE INDICATION

This message is sent by the eNB to indicate that a Trace Start procedure or a Deactivate Trace procedure has failed for a UE.

Direction: eNB → MME

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	ignore
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
Trace Reference	M		OCTET STRING (8)		YES	ignore
Cause	M		9.2.1.3		YES	ignore

9.1.11.3 DEACTIVATE TRACE

This message is sent by the MME to deactivate trace.

Direction: MME → eNB

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	ignore
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
Trace Reference	M		OCTET STRING (8)		YES	ignore

9.1.12 Location Reporting Messages

9.1.12.1 LOCATION REPORTING CONTROL

This message is sent by the MME and is used to request the eNB to report where the UE is currently located.

Direction: MME → eNB

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	ignore
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
Request Type	M		9.2.1.34		YES	ignore

9.1.12.2 LOCATION REPORT FAILURE INDICATION

This message is sent by the eNB and is used to indicate the failure of location report.

Direction: eNB → MME

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	ignore
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
Cause	O		9.2.1.3		YES	ignore

9.1.12.3 LOCATION REPORT

This message is sent by the eNB and is used to provide the UE's location to the MME.

Direction: eNB → MME

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.1.1		YES	ignore
MME UE S1AP ID	M		9.2.3.3		YES	reject
eNB UE S1AP ID	M		9.2.3.4		YES	reject
E-UTRAN CGI	M		FFS		YES	ignore
Request Type	M		9.2.1.34		YES	ignore

9.2 Information Element Definitions

Editor"s Note: Information element definitions.

9.2.0 General

Subclause 9.2 presents the S1AP IE definitions in tabular format. The corresponding ASN.1 definition is presented in subclause 9.3. In case there is contradiction between the tabular format in subclause 9.2 and the ASN.1 definition, the ASN.1 shall take precedence, except for the definition of conditions for the presence of conditional elements, where the tabular format shall take precedence.

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

- The first bit (leftmost bit) contains the most significant bit (MSB);

- The last bit (rightmost bit) contains the least significant bit (LSB);

- When importing bitstrings from other specifications, the first bit of the bitstring contains the first bit of the concerned information;

9.2.1 Radio Network Layer Related IEs

9.2.1.1 Message Type

The *Message Type* IE uniquely identifies the message being sent. It is mandatory for all messages.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Message Type				Assumed max no of messages is 256.
>Procedure Code	M		(Handover Preparation, Handover Resource Allocation, Handover Notification, Patch Switch Request, Handover Cancel, SAE Bearer Setup, SAE Bearer Modify, SAE Bearer Release, SAE Bearer Release Request, Initial Context Setup, Paging, Downlink NAS transport, Initial UE Message, Uplink NAS transport, Reset, Error Indication, NAS Non Delivery Indication, S1 Setup, UE Context Release Request , UE Context Release, Downlink S1 CDMA2000 Tunneling, Uplink S1 CDMA2000 Tunneling; UE Context Modification, UE Capability Info Indication, eNB Status Transfer, MME Status Transfer, Deactivate Trace, Trace Start, Trace Failure Indication, eNB Configuraton Update, MME Configuration Update, Location Reporting Control, Location Reporting Failure Indication, Location Report, …)	
>Type of Message	M		CHOICE (Initiating Message, Successful Outcome, Unsuccessful Outcome, …)	

9.2.1.2   SAE Bearer ID

This element uniquely identifies a radio access bearer for a specific CN domain for a particular UE, which makes the SAE Bearer ID unique over one S1 connection. The SAE Bearer ID shall remain the same for the duration of the SAE Bearer even if the UE-associated logical S1-connection is released or moved using S1 handover

IE/Group Name	Presence	Range	IE type and reference	Semantics description
SAE Bearer ID	M		BIT STRING (8)	To be checked (FFS)

9.2.1.3   Cause

The purpose of the *Cause* IE is to indicate the reason for a particular event for the S1AP protocol.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
CHOICE **Cause Group**	M			
>Radio Network Layer				
>>Radio Network Layer Cause	M		ENUMERATED (Unspecified, Handover triggered, TX2$_{RELOCOverall}$ Expiry, Successful Handover, Release due to E-UTRAN Generated Reason, Handover Cancelled, Partial Handover, Handover Failure In Target EPC/eNB Or Target System, Handover Target not allowed, TS1$_{RELOCoverall}$ Expiry, TS1$_{RELOCprep}$ Expiry, Cell not available,, Unknown Target ID, No Radio Resources Available in Target Cell, Unknown MME UE S1AP ID, Unknown eNB UE S1AP ID, Unknown pair of UE S1AP ID, …)	
>Transport Layer				
>>Transport Layer Cause	M		ENUMERATED (Transport Resource Unavailable, Unspecified, ...)	
> NAS				
>> NAS Cause	M		ENUMERATED (Normal Release, Authentication failure, Detach, Unspecified, …)	
>Protocol				
>>Protocol Cause	M		ENUMERATED (Transfer Syntax Error, Abstract Syntax Error (Reject), Abstract Syntax Error (Ignore and Notify), Message not Compatible with Receiver State, Semantic Error, Abstract Syntax Error (Falsely Constructed Message), Unspecified,...)	
>Misc				
>>Miscellaneous Cause	M		ENUMERATED (Control Processing Overload, Not enough User Plane Processing Resources, Hardware Failure, O&M Intervention, Unspecified, Unknown PLMN, ...)	

The meaning of the different cause values is described in the following table. In general, "not supported" cause values indicate that the related capability is missing. On the other hand, "not available" cause values indicate that the related capability is present, but insufficient resources were available to perform the requested action.

ETSI

Radio Network Layer cause	Meaning
Unspecified	Sent for radio network layer cause when none of the specified cause values applies
Handover triggered	The action is due to a handover that has been triggered.
TX2RELOCOverall Expiry	The timer guarding the handover that takes place over X2 has abnormally expired.
Release due to E-UTRAN generated reason	Release is initiated due to E-UTRAN generated reason.
Handover Cancelled	The reason for the action is cancellation of Handover
Partial Handover	Provides a reason for the handover cancellation. The HANDOVER COMMAND message from MME contained *SAE Bearers to Release List* IE and the source eNB estimated service continuity for the UE would be better by not proceeding with handover towards this particular target eNB.
Handover Failure In Target EPC/eNB Or Target System	The handover failed due to a failure in target EPC/eNB or target system.
Handover Target not allowed	Handover to the indicated target cell is not allowed for the UE in question.
TS1$_{RELOCoverall}$ Expiry	The reason for the action is expiry of timer TS1$_{RELOCoverall}$.
TS1$_{RELOCprep}$ Expiry	Handover Preparation procedure is cancelled when timer TS1$_{RELOCprep}$ expires.
Cell not available	The concerned cell is not available.
Unknown Target ID	Handover rejected because the target ID is not known to the EPC.
No radio resources available in target cell	Load on target cell is too high.
Unknown MME UE S1AP ID	The action failed because the MME UE S1AP ID is unknown.
Unknown eNB UE S1AP ID	The action failed because the eNB UE S1AP ID is unknown.
Unknown pair of UE S1AP ID	The action failed because the pair of UE S1AP IDs is unknown.

Transport Layer cause	Meaning
Transport Resource Unavailable	The required transport resources are not available
Unspecified	Sent when none of the above cause values applies but still the cause is Transport Network Layer related

NAS cause	Meaning
Normal Release	The release is normal
Authentication Failure	The action is due to authentication failure.
Detach	The action is due to detach.
Unspecified	Sent when none of the above cause values applies but still the cause is NAS related

Protocol cause	Meaning
Transfer Syntax Error	The received message included a transfer syntax error.
Abstract Syntax Error (Reject)	The received message included an abstract syntax error and the concerning criticality indicated "reject".
Abstract Syntax Error (Ignore And Notify)	The received message included an abstract syntax error and the concerning criticality indicated "ignore and notify".
Message Not Compatible With Receiver State	The received message was not compatible with the receiver state.
Semantic Error	The received message included a semantic error.
Abstract Syntax Error (Falsely Constructed Message)	The received message contained IEs or IE groups in wrong order or with too many occurrences.
Unspecified	Sent when none of the above cause values applies but still the cause is Protocol related

Miscellaneous cause	Meaning
Control Processing Overload	Control processing overload
Not Enough User Plane Processing Resources Available	No enough resources are available related to user plane processing.
Hardware Failure	Action related to hardware failure
O&M Intervention	The action is due to O&M intervention.
Unspecified Failure	Sent when none of the above cause values applies and the cause is not related to any of the categories Radio Network

	Layer, Transport Network Layer, NAS or Protocol.
Unknown PLMN	The MME doesn"t identify at least one of the PLMN provided by the eNB

9.2.1.4 Trace activation

Defines parameters related to a trace activation.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Trace Reference	M		OCTET STRING (8)			
Interfaces To Trace		1 to <maxInterfaces>				
>Interface	M		ENUMERAT ED (s1, x2 Uu, ...)			
>Trace depth	M		ENUMERAT ED(minimum, medium, maximum, vendorMinim um, vendorMediu m, vendorMaxi mum,...)	Defined in [10]		

9.2.1.5 Source ID

The *Source ID* IE identifies the source for a handover.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Source ID					-	
>Source eNB-ID	–			FFS	-	

9.2.1.6 Target ID

The *Target ID* IE identifies the target for the handover. The target ID may be e.g. the target eNB-ID (for intra SAE/LTE), the RNC-ID (for SAE/LTE-UMTS handover) or the Cell Global ID of the handover target (in case of

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Choice **Target ID**					-	
>**Target eNB-ID**				FFS		
>**Target RNC-ID**					-	
>>LAI	M		9.2.3.1		-	
>>RAC	O		9.2.3.2		-	
>>RNC-ID	M		INTEGER (0..4095)	If the *Extended RNC-ID* IE is included in the *Target ID* IE, the *RNC-ID* IE shall be ignored.	-	
>>Extended RNC-ID	O		9.2.1.14	The *Extended RNC-ID* IE shall be used if the RNC identity has a value larger than 4095.	YES	reject
>**CGI**					-	
>> PLMN identity	M		OCTET STRING (SIZE (3))	- digits 0 to 9, encoded 0000 to 1001, - 1111 used as filler digit, two digits per octet, - bits 4 to 1 of octet n encoding digit 2n-1 - bits 8 to 5 of octet n encoding digit 2n -The PLMN identity consists of 3 digits from MCC followed by either -a filler digit plus 2 digits from MNC (in case of 2 digit MNC) or -3 digits from MNC (in case of a 3 digit MNC).	-	
>> LAC	M		OCTET STRING (2)	0000 and FFFE not allowed.	-	
>>CI	M		OCTET STRING (2)		-	
>>RAC	O		9.2.3.2		YES	ignore

SAE/LTE to GERAN A/Gb mode handover).

9.2.1.7 Source eNB to Target eNB Transparent Container

The *Source eNB to target eNB Transparent Container* IE is an information element that is produced by the source eNB and is transmitted to the target eNB. This IE is used for the intra SAE/LTE handover case.

This IE is transparent to the EPC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
RRC Container	M		OCTET STRING		-	-
SAE Bearers Information List	M				YES	ignore
> SAE Bearers Information Item		1 to <maxnoof SAEbearers >			EACH	ignore
>> SAE Bearer ID	M		BIT STRING (SIZE (8))		-	-
>> DL Forwarding	O		9.2.3.14		-	-

Range bound	Explanation
maxnoofSAEbearers	Maximum no. of SAE Bearers for one UE. Value is 256.

9.2.1.8 Target eNB to Source eNB Transparent Container

The *Target eNB to Source eNB Transparent Container* IE is an information element that is produced by the target eNB and is transmitted to the source eNB. This IE is used for the intra SAE/LTE handover case.

This IE is transparent to EPC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
RRC Container	M		OCTET STRING		-	-

9.2.1.9 Source RNC to Target RNC Transparent Container

This IE is used to transparently pass radio related information between the handover source and the handover target through the EPC. This container is used for inter 3GPP RAT handovers from SAE/LTE to UTRAN and vice versa.

This IE defined in TS 25.413. Content FFS.

9.2.1.10 Target RNC to Source RNC Transparent Container

This container is used to transparently pass radio related information between the handover target and the handover source through the EPC. This container is used inter 3GPP RAT handovers from SAE/LTE to UTRAN and vice versa.

This IE is defined in TS 25.413. Content FFS.

9.2.1.11 Source BSS to Target BSS Transparent Container

This container is used to transparently pass radio related information between the handover source and the handover target through the EPC. This container is used for inter 3GPP RAT handovers from SAE/LTE to GERAN A/Gb mode and vice versa.

This IE is defined in TS 48.018. Content FFS.

9.2.1.12 Target BSS to Source BSS Transparent Container

This container is used to transparently pass radio related information between the handover source and the handover target through the EPC. This container is used for inter 3GPP RAT handovers from SAE/LTE to GERAN A/Gb mode and vice versa.

This IE is defined in TS 48.018. Content FFS.

9.2.1.13   Handover Type

This IE indicates which kind of handover was triggered in the source side.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Handover Type	M		ENUMERATED (IntraLTE, LTEtoUTRAN, LTEtoGERAN, UTRANtoLTE, GERANtoTLE)	

9.2.1.14   Extended RNC-ID

The Extended RNC-ID is used to identify an RNC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Extended RNC-ID	M		INTEGER (4096..65535)	The *Extended RNC-ID* IE shall be used if the RNC identity has a value larger than 4095. Note: Application of the *Extended RNC-ID* IE to very large networks is FFS.

9.2.1.15   SAE Bearer Level QoS Parameters

This IE defines the QoS to be applied to a SAE bearer.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
SAE Bearer Level QoS Parameters				
>QCI	M		INTEGER (1..256)	Coded as specified in TS 23.xxx, which will be defined in SA2
>Allocation and Retention Priority	FFS		FFS	The ARP definition is left FFS in SA2.
>SAE Bearer Type	M		9.2.1.18	**Desc.:** Either GBR or non-GBR Bearer

9.2.1.16   Paging DRX

This IE indicates the Paging DRX as defined in [xx].

Editor"s Note: The definition is FFS and should be aligned to RRC 36.331 referenced as [xx].

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Paging DRX	M		FFS			

9.2.1.17 Paging Cause

This element indicates the cause for paging a UE.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Paging Cause	M		ENUMERATED(Terminating Conversational Call, Terminating Streaming Call, Terminating Interactive Call, Terminating Background Call, Terminating Low Priority Signalling, ..., Terminating High Priority Signalling)			

9.2.1.18 SAE Bearer Type

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Choice **SAE Bearer Type**				
> GBR bearer				
>> SAE Bearer Maximum Bit Rate Downlink	M		SAE Bearer Bit Rate SAE Bearer Bit Rate 9.2.1.19	**Desc**.: to be added
>> SAE Bearer Maximum Bit Rate Uplink	M		SAE Bearer Bit Rate 9.2.1.19	**Desc**.: to be added
>> SAE Bearer Guaranteed Bit Rate Downlink	M		SAE Bearer Bit Rate 9.2.1.19	**Desc**.: to be added
>> SAE Bearer Guaranteed Bit Rate Uplink	M		SAE Bearer Bit Rate 9.2.1.19	**Desc**.: to be added
> Non-GBR bearer				
>> Non GBR bearer			ENUMERATED (Non GBR bearer,…)	

9.2.1.19 SAE Bearer Bit Rate

IE/Group Name	Presence	Range	IE type and reference	Semantics description
SAE Bearer Bit Rate			INTEGER (0..10,000,0 00,000)	**Desc.:** This IE indicates the maximum number of bits delivered by E-UTRAN and to E-UTRAN within a period of time, divided by the duration of the period. The unit is: bit/s

9.2.1.20 Aggregate Maximum Bit Rate

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Aggregate Maximum Bit Rate				**Desc**.: Applicable for non-GBR SAE Bearers,provided at initial context setup
>Aggregate Maximum Bit Rate Downlink	M		SAE Bearer Bit Rate 9.2.1.19	**Desc**.: to be added
>Aggregate Maximum Bit Rate Uplink	M		SAE Bearer Bit Rate 9.2.1.19	**Desc**.: to be added

9.2.1.21 Criticality Diagnostics

The *Criticality Diagnostics* IE is sent by the eNB or the MME when parts of a received message have not been comprehended or were missing, or if the message contained logical errors. When applicable, it contains information about which IEs were not comprehended or were missing.

For further details on how to use the *Criticality Diagnostics* IE, (see Annex A.2 – FFS).

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Criticality Diagnostics				
>Procedure Code	O		INTEGER (0..255)	Procedure Code is to be used if Criticality Diagnostics is part of Error Indication procedure, and not within the response message of the same procedure that caused the error
>Triggering Message	O		ENUMERATED(initiating message, successful outcome, unsuccessful outcome, outcome)	The Triggering Message is used only if the Criticality Diagnostics is part of Error Indication procedure.
>Procedure Criticality	O		ENUMERATED(reject, ignore, notify)	This Procedure Criticality is used for reporting the Criticality of the Triggering message (Procedure).
Information Element Criticality Diagnostics		0 to <maxnoof errors>		
>IE Criticality	M		ENUMERATED(reject, ignore, notify)	The IE Criticality is used for reporting the criticality of the triggering IE. The value 'ignore' shall not be used.
>IE ID	M		INTEGER (0..65535)	The IE ID of the not understood or missing IE
>Type of Error	M		ENUMERATED(not understood, missing, …)	

Range bound	Explanation
maxnooferrors	Maximum no. of IE errors allowed to be reported with a single message. The value for maxnooferrors is 256.

9.2.1.22 Handover Restriction List

This IE defines area roaming or access restrictions for handover. If the eNB receives the Handover Restriction List, it shall overwrite previously received restriction information.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Serving PLMN	M		9.2.3.8	
Equivalent PLMNs		0..<maxnoofEPLMNs>		Allowed PLMNs in addition to Serving PLMN. This list corresponds to the list of 'equivalent PLMNs' as defined in [TS 24.008].
>PLMN Identity	M		9.2.3.8	
Forbidden TAs		0..<maxnoofEPLMNsPlusOne>		intra LTE roaming restrictions
>PLMN Identity	M		9.2.3.8	The PLMN of forbidden TACs
>Forbidden TACs		1..<maxnoofForbTACs>		
>>TAC	M		9.2.3.7	The TAC of the forbidden TAI
Forbidden LAs		0..<maxnoofEPLMNsPlusOne>		inter-3GPP RAT roaming restrictions
>PLMN Identity	M		9.2.3.8	
>Forbidden LACs		1..<maxnoofForbLACs>		
>>LAC	M		OCTET STRING(2)	
Forbidden inter RATs	O		ENUMERATED(ALL, GERAN, UTRAN, …)	inter-3GPP RAT access restrictions

Range bound	Explanation
maxnoofEPLMNs	Maximum no. of equivalent PLMN Ids. Value is 15.
maxnooffEPLMNsPlusOne	Maximum no. of equivalent PLMN Ids plus one. Value is 16.
maxnoofforbiddenTACs	Maximum no. of forbidden Tracking Area Codes. Value is 256.
maxnoofforbiddenLACs	Maximum no. of forbidden Location Area Codes. Value is 256.

9.2.1.23 CDMA2000-PDU

This information element contains a CDMA2000 message between the UE and CDMA2000 RAT that is transferred without interpretation in the eNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CDMA2000-PDU	M		OCTET STRING	

9.2.1.24   CDMA2000 RAT Type

In the uplink, this information element , along with the *CDMA2000 Sector ID* IE is used for routing the tunnelled CDMA2000 message to the proper destination node in the CDMA2000 RAT and is set by the eNB to the CDMA2000 RAT type received from the UE.

Note: In the downlink, this information element is forwarded to the UE to help it route the tunnelled downlink CDMA2000 message to the appropriate CDMA upper layer.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CDMA2000 RAT Type	M		ENUMERATED (HRPD, 1xRTT,…)	This IE is used to identify which CDMA2000 RAT the tunnelled CDMA2000 signalling is associated with. The source of this information in the uplink is the UE and in the downlink it is the CDMA2000 system.

9.2.1.25   CDMA2000 Sector ID

This information element , along with the *RAT Type* IE is used for routing the tunnelled CDMA2000 message to the proper destination node in the CDMA2000 RAT.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CDMA2000 Sector ID	M		OCTET STRING	This IE is set to CDMA2000 Reference Cell ID corresponding to the HRPD/1xRTT sector under the HRPD AN/1xBS to which the eNB has initiated the UE to handover to. The CDMA2000 Reference Cell ID is statically configured in the eNB.

9.2.1.26   Security Information

The purpose of the *Security Information* IE is to indicate the AS security key.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
AS security key	M		BIT STRING (128)	

9.2.1.27   UE Radio Capability

This IE contains UE Radio Capability information.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
UE Radio Capability	M		OCTET STRING	FFS: reference to TS 36.331

9.2.1.28   CDMA2000 HO Status

This IE is used to indicate to the eNB which initiated an inter-RAT HO towards CDMA2000 about the outcome of the handover preparation to CDMA2000.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CDMA2000 HO Status	M		ENUMERATED (HO Success, HO Failure,…)	This IE indicates the status of the handover resource allocation in the CDMA2000 RAT.

9.2.1.29 CDMA2000 HO Required Indication

This information element is set by the eNB to provide an indication about whether the UE has initiated the handover preparation with the CDMA2000 RAT.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CDMA2000 HO Required Indication	M		ENUMERATED (true,…)	This IE indicates to MME that handover preparation to CDMA2000 has been started. It helps MME to decide when to send certain handover preparation information [8] to the CDMA2000 RAT.

9.2.1.30 1xRTT MEID

This information element is the Mobile Equipment Identifier or Hardware ID that is tunnelled from the UE to the 1xCS IWS [8] and is transparent to eNB and MME.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
1xRTT MEID	M		OCTET STRING	This IE is used to derive a MEID-based PLCM that is used for channelization in CDMA2000 1xRTT network.

9.2.1.31 eNB Status Transfer Transparent Container

The *eNB Status Transfer Transparent Container* IE is an information element that is produced by the source eNB and is transmitted to the target eNB. This IE is used for the intra SAE/LTE S1 handover case.

This IE is transparent to the EPC.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
SAE Bearers Subject to Status Transfer List	M				–	–
>SAE Bearers Subject to Status Transfer Item		1 to <maxnoof SAEbearers>			EACH	ignore
>> SAE bearer Identity	M		BIT STRING (SIZE (8))		–	–
>> UL COUNT value	M		9.2.1.32	PDCP-SN and HFN of first missing UL PDCP SDU	–	–
>> DL COUNT value	M		9.2.1.32	PDCP-SN and HFN that the target eNB should assign for the next DL SDU not having an SN yet	–	–

9.2.1.32   COUNT value

This IE contains a PDCP sequence number and a hyper frame number.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
PDCP-SN	M		INTEGER (0..4095)		–	–
HFN	M		INTEGER (0..1048575)		–	–

9.2.1.33   CDMA2000 1xRTT RAND

This information element is a random number generated by the eNB and tunnelled to the 1xCS IWS [8] and is transparent to MME.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CDMA2000 1xRTT RAND	M		OCTET STRING	This IE is a Random Challenge that is used for authentication of UE during handover from E-UTRAN to CDMA2000 1xRTT RAT.

9.2.1.34   Request Type

The purpose of the *Request Type* IE is to indicate the type of location request to be handled by the eNB.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
Request Type				
>Event	M		ENUMERATED(Direct, Change of service cell, Stop Change of service cell)	
>Report Area	M		E-UTRAN CGI (FFS for its definition)	

9.2.2 Transport Network Layer Related IEs

9.2.2.1 Transport Layer Address

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Transport Layer Address	M		BIT STRING (1..160, …)	The Radio Network Layer is not supposed to interpret the address information. It should pass it to the transport layer for interpretation. For details on the Transport Layer Address, see ref. [12].

This information element is an IP address to be used for the user plane transport.

9.2.2.2 GTP-TEID

This information element is the GTP Tunnel Endpoint Identifier to be used for the user plane transport between eNB and the serving gateway.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
GTP TEID	M		OCTET STRING (4)	

9.2.3 NAS Related IEs

9.2.3.1 LAI

This element is used to uniquely identify a Location Area.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
LAI				
>PLMN identity	M		OCTET STRING (SIZE (3))	- digits 0 to 9, encoded 0000 to 1001, - 1111 used as filler digit, two digits per octet, - bits 4 to 1 of octet n encoding digit 2n-1 - bits 8 to 5 of octet n encoding digit 2n -The PLMN identity consists of 3 digits from MCC followed by either -a filler digit plus 2 digits from MNC (in case of 2 digit MNC) or -3 digits from MNC (in case of a 3 digit MNC).
>LAC	M		OCTET STRING (2)	0000 and FFFE not allowed.

9.2.3.2 RAC

This element is used to identify a Routing Area within a Location Area. It is used for PS services.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RAC	M		OCTET STRING (1)	

9.2.3.3 MME UE S1AP ID

The MME UE S1AP ID uniquely identify the UE association over the S1 interface within the MME.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
MME UE S1AP ID	M		INTEGER (0 .. 2^{32} -1)	

9.2.3.4 eNB UE S1AP ID

The eNB UE S1AP ID uniquely identify the UE association over the S1 interface within the eNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
eNB UE S1AP ID	M		INTEGER (0 .. 2^{24} -1)	

9.2.3.5 NAS-PDU

This information element contains an EPC – UE or UE – EPC message that is transferred without interpretation in the eNB. Typically it contains call control, session management, supplementary services, short message service and mobility management messages.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
NAS-PDU	M		OCTET STRING	

9.2.3.6 S-TMSI

Temporary Mobile Subscriber Identity, used for security reasons to hide the identity of a subscriber.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
MMEC	M		9.2.3.12			
M-TMSI	M		OCTET STRING (SIZE (4))	M-TMSI is unique within MME that allocated it.		

9.2.3.7 TAC

This element is used to uniquely identify a Tracking Area Code.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
TAC	M		OCTET STRING	

9.2.3.8 PLMN Identity

This information element indicates the PLMN Identity.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
PLMN identity	M		OCTET STRING (SIZE (3))	- digits 0 to 9, encoded 0000 to 1001, - 1111 used as filler digit, two digits per octet, - bits 4 to 1 of octet n encoding digit 2n-1 - bits 8 to 5 of octet n encoding digit 2n -The Selected PLMN identity consists of 3 digits from MCC followed by either -a filler digit plus 2 digits from MNC (in case of 2 digit MNC) or -3 digits from MNC (in case of a 3 digit MNC).

9.2.3.9 GUMMEI

This information element indicates the global unique MME identity.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
GUMMEI				
>PLMN identity	M		OCTET STRING (SIZE (3))	- digits 0 to 9, encoded 0000 to 1001, - 1111 used as filler digit, two digits per octet, - bits 4 to 1 of octet n encoding digit 2n-1 - bits 8 to 5 of octet n encoding digit 2n -The Selected PLMN identity consists of 3 digits from MCC followed by either -a filler digit plus 2 digits from MNC (in case of 2 digit MNC) or -3 digits from MNC (in case of a 3 digit MNC).
>MME Group ID	M		OCTET STRING (2)	FFS
>MME code	M		9.2.3.12	

9.2.3.10 UE Identity Index value

IE/Group Name	Presence	Range	IE type and reference	Semantics description
UE identity Index Value	M		OCTET STRING	IMSI mod L as defined in FFS.

9.2.3.11 IMSI

IE/Group Name	Presence	Range	IE type and reference	Semantics description
IMSI	M		OCTET STRING (SIZE (3..8))	- digits 0 to 9, encoded 0000 to 1001, - 1111 used as filler digit, two digits per octet, - bit 4 to 1 of octet n encoding digit 2n-1 - bit 8 to 5 of octet n encoding digit 2n -Number of decimal digits shall be from 6 to 15 starting with the digits from the PLMN identity. When the IMSI is made of an odd number of digits, the filler digit shall be added at the end to make an even number of digits of length 2N. The filler digit shall then be consequently encoded as bit 8 to 5 of octet N.

9.2.3.12 MMEC

This element represents the MME Code to uniquely identify a MME within an MME pool area.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
MMEC	M		OCTET STRING (SIZE (1))	

9.2.3.13 UE Paging Identity

This IE represents the Identity with which the UE is paged.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Choice **UE Paging Identity**				
>IMSI	M		9.2.3.11	
>S-TMSI	M		9.2.3.6	

9.2.3.14 DL Forwarding

This element indicates that the SAE bearer is proposed for forwarding of downlink packets.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
DL Forwarding				
>DL Forwarding	M		ENUMERATED (DL forwarding proposed, …)	

9.2.3.15 Direct Forwarding Path Availability

The availability of a direct forwarding path shall be determined by the source eNB. EPC behaviour on receipt of this IE is specified in [x2].

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Direct Forwarding Path Availability	M		ENUMERATED (Direct Path Available, …)	

9.2.3.16 TAI

This element is used to uniquely identify a Tracking Area.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
TAI				
>PLMN identity	M		9.2.3.8	
>TAC	M		9.2.3.7	

9.2.3.17 Relative MME Capacity

This IE indicates the relative processing capacity of an MME with respect to the other MMEs in the pool in order to load-balance MMEs within a pool [defined 11].

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Relative MME Capacity	M		INTEGER (0..255)	

9.2.3.18 UE S1 AP ID pair

This IE contains the a pair of UE S1 AP identities.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
MME UE S1AP ID	M		9.2.3.3		-	-
eNB UE S1AP ID	M		9.2.3.4		-	-

9.3 Message and Information Element Abstract Syntax (with ASN.1)

9.3.0 General

S1AP ASN.1 definition conforms with [4] and [5].

The ASN.1 definition specifies the structure and content of S1AP messages. S1AP messages can contain any IEs specified in the object set definitions for that message without the order or number of occurrence being restricted by ASN.1. However, for this version of the standard, a sending entity shall construct a S1AP message according to the PDU definitions module and with the following additional rules (Note that in the following IE means an IE in the object set with an explicit id. If one IE needed to appear more than once in one object set, then the different occurrences have different IE ids):

- IEs shall be ordered (in an IE container) in the order they appear in object set definitions..

- Object set definitions specify how many times IEs may appear. An IE shall appear exactly once if the presence field in an object has value "mandatory". An IE may appear at most once if the presence field in an object has value "optional" or "conditional". If in a tabular format there is multiplicity specified for an IE (i.e. an IE list) then in the corresponding ASN.1 definition the list definition is separated into two parts. The first part defines an IE container list where the list elements reside. The second part defines list elements. The IE container list appears as an IE of its own. For this version of the standard an IE container list may contain only one kind of list elements.

If a S1AP message that is not constructed as defined above is received, this shall be considered as Abstract Syntax Error, and the message shall be handled as defined for Abstract Syntax Error in subclause 10.3.6.

Subclause 9.3 presents the Abstract Syntax of S1AP protocol with ASN.1. In case there is contradiction between the ASN.1 definition in this subclause and the tabular format in subclause 9.1 and 9.2, the ASN.1 shall take precedence, except for the definition of conditions for the presence of conditional elements, where the tabular format shall take precedence.

9.3.1 Usage of private message mechanism for non-standard use

The private message mechanism for non-standard use may be used:

- for special operator- (and/or vendor) specific features considered not to be part of the basic functionality, i.e. the functionality required for a complete and high-quality specification in order to guarantee multivendor interoperability;

- by vendors for research purposes, e.g. to implement and evaluate new algorithms/features before such features are proposed for standardisation.

The private message mechanism shall not be used for basic functionality. Such functionality shall be standardised.

9.3.2 Elementary Procedure Definitions

```
-- ***************************************************************
--
-- Elementary Procedure definitions
--
-- ***************************************************************

S1AP-PDU-Descriptions  {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (20) modules (3) s1ap (1) version1 (1) s1ap-PDU-Descriptions (0)}

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

-- ***************************************************************
--
-- IE parameter types from other modules.
--
-- ***************************************************************

IMPORTS
    Criticality,
    ProcedureCode
FROM S1AP-CommonDataTypes

    DeactivateTrace,
    DownlinkNASTransport,
    DownlinkS1cdma2000tunneling,
    ENBStatusTransfer,
    ENBConfigurationUpdate,
    ENBConfigurationUpdateAcknowledge,
    ENBConfigurationUpdateFailure,
    ErrorIndication,
    HandoverCancel,
    HandoverCancelAcknowledge,
    HandoverCommand,
    HandoverFailure,
    HandoverNotify,
    HandoverPreparationFailure,
    HandoverRequest,
    HandoverRequestAcknowledge,
    HandoverRequired,
    InitialContextSetupFailure,
    InitialContextSetupRequest,
    InitialContextSetupResponse,
    InitialUEMessage,
    LocationReportingControl,
    LocationReportingFailureIndication,
    LocationReport,

    MMEConfigurationUpdate,
```

```
    MMEConfigurationUpdateAcknowledge,
    MMEConfigurationUpdateFailure,
    MMEStatusTransfer,
    NASNonDeliveryIndication,
    Paging,
    PathSwitchRequest,
    PathSwitchRequestAcknowledge,
    PathSwitchRequestFailure,
    Reset,
    ResetAcknowledge,
    S1SetupFailure,
    S1SetupRequest,
    S1SetupResponse,
    SAEBearerModifyRequest,
    SAEBearerModifyResponse,
    SAEBearerReleaseCommand,
    SAEBearerReleaseResponse,
    SAEBearerReleaseRequest,
    SAEBearerSetupRequest,
    SAEBearerSetupResponse,
    TraceFailureIndication,
    TraceStart,
    UECapabilityInfoIndication,
    UEContextModificationFailure,
    UEContextModificationRequest,
    UEContextModificationResponse,
    UEContextReleaseCommand,
    UEContextReleaseComplete,
    UEContextReleaseRequest,
    UplinkNASTransport,
    UplinkS1cdma2000tunneling

FROM S1AP-PDU-Contents

    id-DeactivateTrace,
    id-downlinkNASTransport,
    id-DownlinkS1cdma2000tunneling,
    id-eNBStatusTransfer,
    id-ErrorIndication,
    id-HandoverCancel,
    id-HandoverNotification,
    id-HandoverPreparation,
    id-HandoverResourceAllocation,
    id-InitialContextSetup,
    id-initialUEMessage,
    id-ENBConfigurationUpdate,
    id-LocationReportingControl,
    id-LocationReportingFailureIndication,
    id-LocationReport,
    id-MMEConfigurationUpdate,
    id-MMEStatusTransfer,
    id-NASNonDeliveryIndication,
    id-Paging,
    id-PathSwitchRequest,
```

```
        id-Reset,
        id-S1Setup,
        id-SAEBearerModify,
        id-SAEBearerRelease,
        id-SAEBearerReleaseRequest,
        id-SAEBearerSetup,
        id-TraceFailureIndication,
        id-TraceStart,
        id-UECapabilityInfoIndication,
        id-UEContextModification,
        id-UEContextRelease,
        id-UEContextReleaseRequest,
        id-uplinkNASTransport,
        id-UplinkS1cdma2000tunneling
FROM S1AP-Constants;


-- *************************************************************
--
-- Interface Elementary Procedure Class
--
-- *************************************************************

S1AP-ELEMENTARY-PROCEDURE ::= CLASS {
    &InitiatingMessage          ,
    &SuccessfulOutcome          OPTIONAL,
    &UnsuccessfulOutcome            OPTIONAL,
    &procedureCode      ProcedureCode   UNIQUE,
    &criticality        Criticality     DEFAULT ignore
}
WITH SYNTAX {
    INITIATING MESSAGE      &InitiatingMessage
    [SUCCESSFUL OUTCOME     &SuccessfulOutcome]
    [UNSUCCESSFUL OUTCOME       &UnsuccessfulOutcome]
    PROCEDURE CODE              &procedureCode
    [CRITICALITY            &criticality]
}

-- *************************************************************
--
-- Interface PDU Definition
--
-- *************************************************************

S1AP-PDU ::= CHOICE {
    initiatingMessage   InitiatingMessage,
    successfulOutcome   SuccessfulOutcome,
    unsuccessfulOutcome UnsuccessfulOutcome,
    ...
}

InitiatingMessage ::= SEQUENCE {
    procedureCode   S1AP-ELEMENTARY-PROCEDURE.&procedureCode    ({S1AP-ELEMENTARY-PROCEDURES}),
    criticality S1AP-ELEMENTARY-PROCEDURE.&criticality      ({S1AP-ELEMENTARY-PROCEDURES}{@procedureCode}),
```

```
    value       S1AP-ELEMENTARY-PROCEDURE.&InitiatingMessage     ({S1AP-ELEMENTARY-PROCEDURES}{@procedureCode})
}

SuccessfulOutcome ::= SEQUENCE {
    procedureCode   S1AP-ELEMENTARY-PROCEDURE.&procedureCode     ({S1AP-ELEMENTARY-PROCEDURES}),
    criticality S1AP-ELEMENTARY-PROCEDURE.&criticality       ({S1AP-ELEMENTARY-PROCEDURES}{@procedureCode}),
    value       S1AP-ELEMENTARY-PROCEDURE.&SuccessfulOutcome     ({S1AP-ELEMENTARY-PROCEDURES}{@procedureCode})
}

UnsuccessfulOutcome ::= SEQUENCE {
    procedureCode   S1AP-ELEMENTARY-PROCEDURE.&procedureCode     ({S1AP-ELEMENTARY-PROCEDURES}),
    criticality S1AP-ELEMENTARY-PROCEDURE.&criticality       ({S1AP-ELEMENTARY-PROCEDURES}{@procedureCode}),
    value       S1AP-ELEMENTARY-PROCEDURE.&UnsuccessfulOutcome   ({S1AP-ELEMENTARY-PROCEDURES}{@procedureCode})
}

-- *************************************************************
--
-- Interface Elementary Procedure List
--
-- *************************************************************

S1AP-ELEMENTARY-PROCEDURES S1AP-ELEMENTARY-PROCEDURE ::= {
    S1AP-ELEMENTARY-PROCEDURES-CLASS-1      |
    S1AP-ELEMENTARY-PROCEDURES-CLASS-2,
    ...
}


S1AP-ELEMENTARY-PROCEDURES-CLASS-1 S1AP-ELEMENTARY-PROCEDURE ::= {
    handoverPreparation         |
    handoverResourceAllocation      |
    pathSwitchRequest           |
    sAEbearerSetup              |
    sAEbearerModify             |
    sAEbearerRelease            |
    initialContextSetup         |
    handoverCancel              |
    reset                       |
    s1Setup                     |
    uEContextModification       |
    uEContextRelease            |
    eNBConfigurationUpdate      |
    mMEConfigurationUpdate          ,
    ...
}

S1AP-ELEMENTARY-PROCEDURES-CLASS-2 S1AP-ELEMENTARY-PROCEDURE ::= {
    handoverNotification        |
    sAEbearerReleaseRequest     |
    paging                      |
    downlinkNASTransport                    |
    initialUEMessage                        |
    uplinkNASTransport          |
    errorIndication             |
```

```
    nASNonDeliveryIndication         |
    uEContextReleaseRequest          |
    downlinkS1cdma2000tunneling      |
    uplinkS1cdma2000tunneling        |
    uECapabilityInfoIndication       |
    eNBStatusTransfer                |
    mMEStatusTransfer                |
    deactivateTrace                  |
    traceStart                       |
    traceFailureIndication           |
    locationReportingControl         |
    locationReportingFailureIndication      |
    locationReport                   ,
    ...
}

-- ****************************************************************
--
-- Interface Elementary Procedures
--
-- ****************************************************************

handoverPreparation S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE  HandoverRequired
    SUCCESSFUL OUTCOME  HandoverCommand
    UNSUCCESSFUL OUTCOME    HandoverPreparationFailure
    PROCEDURE CODE          id-HandoverPreparation
    CRITICALITY     reject
}

handoverResourceAllocation S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE  HandoverRequest
    SUCCESSFUL OUTCOME  HandoverRequestAcknowledge
    UNSUCCESSFUL OUTCOME    HandoverFailure
    PROCEDURE CODE          id-HandoverResourceAllocation
    CRITICALITY     reject
}

handoverNotification S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE  HandoverNotify
    PROCEDURE CODE          id-HandoverNotification
    CRITICALITY     ignore
}

pathSwitchRequest S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE  PathSwitchRequest
    SUCCESSFUL OUTCOME  PathSwitchRequestAcknowledge
    UNSUCCESSFUL OUTCOME    PathSwitchRequestFailure
    PROCEDURE CODE          id-PathSwitchRequest
    CRITICALITY     reject
}

sAEbearerSetup S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE  SAEBearerSetupRequest
```

ETSI

```
        SUCCESSFUL OUTCOME   SAEBearerSetupResponse
        PROCEDURE CODE       id-SAEBearerSetup
        CRITICALITY     reject
}

sAEbearerModify S1AP-ELEMENTARY-PROCEDURE ::= {
        INITIATING MESSAGE   SAEBearerModifyRequest
        SUCCESSFUL OUTCOME   SAEBearerModifyResponse
        PROCEDURE CODE       id-SAEBearerModify
        CRITICALITY     reject
}

sAEbearerRelease S1AP-ELEMENTARY-PROCEDURE ::= {
        INITIATING MESSAGE   SAEBearerReleaseCommand
        SUCCESSFUL OUTCOME   SAEBearerReleaseResponse
        PROCEDURE CODE       id-SAEBearerRelease
        CRITICALITY     reject
}

sAEbearerReleaseRequest S1AP-ELEMENTARY-PROCEDURE ::= {
        INITIATING MESSAGE   SAEBearerReleaseRequest
        PROCEDURE CODE       id-SAEBearerReleaseRequest
        CRITICALITY     ignore
}

initialContextSetup S1AP-ELEMENTARY-PROCEDURE ::= {
        INITIATING MESSAGE  InitialContextSetupRequest
        SUCCESSFUL OUTCOME  InitialContextSetupResponse
        UNSUCCESSFUL OUTCOME InitialContextSetupFailure
        PROCEDURE CODE       id-InitialContextSetup
        CRITICALITY     reject
}

uEContextReleaseRequest S1AP-ELEMENTARY-PROCEDURE ::= {
        INITIATING MESSAGE       UEContextReleaseRequest
        PROCEDURE CODE           id-UEContextReleaseRequest
        CRITICALITY              ignore
}

paging S1AP-ELEMENTARY-PROCEDURE ::= {
        INITIATING MESSAGE  Paging
        PROCEDURE CODE      id-Paging
        CRITICALITY         ignore
}

downlinkNASTransport S1AP-ELEMENTARY-PROCEDURE ::= {
        INITIATING MESSAGE       DownlinkNASTransport
        PROCEDURE CODE           id-downlinkNASTransport
        CRITICALITY              ignore
}

initialUEMessage S1AP-ELEMENTARY-PROCEDURE ::= {
        INITIATING MESSAGE       InitialUEMessage
        PROCEDURE CODE           id-initialUEMessage
```

```
    CRITICALITY            ignore
}

uplinkNASTransport S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      UplinkNASTransport
    PROCEDURE CODE          id-uplinkNASTransport
    CRITICALITY             ignore
}
nASNonDeliveryIndication S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      NASNonDeliveryIndication
    PROCEDURE CODE          id-NASNonDeliveryIndication
    CRITICALITY             ignore
}

handoverCancel S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE   HandoverCancel
    SUCCESSFUL OUTCOME   HandoverCancelAcknowledge
    PROCEDURE CODE          id-HandoverCancel
    CRITICALITY     reject
}

reset S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE   Reset
    SUCCESSFUL OUTCOME   ResetAcknowledge
    PROCEDURE CODE      id-Reset
    CRITICALITY             reject
}

errorIndication S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE   ErrorIndication
    PROCEDURE CODE       id-ErrorIndication
    CRITICALITY     ignore
}

s1Setup S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      S1SetupRequest
    SUCCESSFUL OUTCOME      S1SetupResponse
    UNSUCCESSFUL OUTCOME    S1SetupFailure
    PROCEDURE CODE          id-S1Setup
    CRITICALITY             reject
}

eNBConfigurationUpdate S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      ENBConfigurationUpdate
    SUCCESSFUL OUTCOME      ENBConfigurationUpdateAcknowledge
    UNSUCCESSFUL OUTCOME    ENBConfigurationUpdateFailure
    PROCEDURE CODE          id-ENBConfigurationUpdate
    CRITICALITY             reject
}

mMEConfigurationUpdate S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      MMEConfigurationUpdate
    SUCCESSFUL OUTCOME      MMEConfigurationUpdateAcknowledge
    UNSUCCESSFUL OUTCOME    MMEConfigurationUpdateFailure
```

```
    PROCEDURE CODE          id-MMEConfigurationUpdate
    CRITICALITY             reject
}

downlinkS1cdma2000tunneling S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      DownlinkS1cdma2000tunneling
    PROCEDURE CODE          id-DownlinkS1cdma2000tunneling
    CRITICALITY             ignore
}

uplinkS1cdma2000tunneling S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      UplinkS1cdma2000tunneling
    PROCEDURE CODE          id-UplinkS1cdma2000tunneling
    CRITICALITY             ignore
}

uEContextModification S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      UEContextModificationRequest
    SUCCESSFUL OUTCOME      UEContextModificationResponse
    UNSUCCESSFUL OUTCOME    UEContextModificationFailure

    PROCEDURE CODE      id-UEContextModification
    CRITICALITY     reject
}

uECapabilityInfoIndication S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      UECapabilityInfoIndication
    PROCEDURE CODE          id-UECapabilityInfoIndication
    CRITICALITY             ignore
}

uEContextRelease S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      UEContextReleaseCommand
    SUCCESSFUL OUTCOME      UEContextReleaseComplete
    PROCEDURE CODE          id-UEContextRelease
    CRITICALITY             reject
}

eNBStatusTransfer S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      ENBStatusTransfer
    PROCEDURE CODE          id-eNBStatusTransfer
    CRITICALITY             ignore
}

mMEStatusTransfer S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      MMEStatusTransfer
    PROCEDURE CODE          id-MMEStatusTransfer
    CRITICALITY             ignore
}

deactivateTrace S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      DeactivateTrace
    PROCEDURE CODE          id-DeactivateTrace
    CRITICALITY             ignore
```

```
}

traceStart S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE  TraceStart
    PROCEDURE CODE      id-TraceStart
    CRITICALITY         ignore
}

traceFailureIndication S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE  TraceFailureIndication
    PROCEDURE CODE      id-TraceFailureIndication
    CRITICALITY         ignore
}

locationReportingControl S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      LocationReportingControl
    PROCEDURE CODE          id-LocationReportingControl
    CRITICALITY             ignore
}

locationReportingFailureIndication S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      LocationReportingFailureIndication
    PROCEDURE CODE          id-LocationReportingFailureIndication
    CRITICALITY             ignore
}

locationReport S1AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      LocationReport
    PROCEDURE CODE          id-LocationReport
    CRITICALITY             ignore
}
END
```

9.3.3 PDU Definitions

```
-- **************************************************************
--
-- PDU definitions for S1AP.
--
-- **************************************************************

S1AP-PDU-Contents {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (20) modules (3) s1ap (1) version1 (1) s1ap-PDU-Contents (1) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

-- **************************************************************
--
-- IE parameter types from other modules.
--
-- **************************************************************

IMPORTS

    AggregateMaximumBitrate,
    Cause,
    Cdma2000HORequiredIndication,
    Cdma2000HOStatus,
    Cdma2000OneXMEID,
    Cdma2000OneXRAND,
    Cdma2000PDU,
    Cdma2000RATType,
    Cdma2000SectorID,
    CriticalityDiagnostics,
    Direct-Forwarding-Path-Availability,
    ENB-Global-ID,
    EUTRAN-CGI-ID,   ENBname,
    ENB-StatusTransfer-TransparentContainer,
    ENB-UE-S1AP-ID,
    GTP-TEID,
    GUMMEI,
    HandoverRestrictionList,
    HandoverType,
    MMEname,
    MME-UE-S1AP-ID,
    NAS-PDU,    PagingCause,
    PagingDRX,
    PLMNidentity,
    RelativeMMECapacity,    RequestType,
    SAE-Bearer-ID,
    SAE-BearerLevelQoSParameters,
    SAEBearerList,
    SecurityInfo,
```

ETSI

```
    SecurityInformation,
    ServedPLMNs,
    SourceBSS-ToTargetBSS-TransparentContainer,
    SourceeNodeB-ToTargeteNodeB-TransparentContainer,
    SourceID,
    SourceRNC-ToTargetRNC-TransparentContainer,
    SupportedTAs,
    TAI,
    TargetBSS-ToSourceBSS-TransparentContainer,
    TargeteNodeB-ToSourceeNodeB-TransparentContainer,
    TargetID,
    TargetRNC-ToSourceRNC-TransparentContainer,
    TimeToWait,
    TraceActivation,
    TraceReference,
    TransportLayerAddress,
    UEIdentityIndexValue,
    UEPagingID,
    UERadioCapability,
    UE-S1AP-IDs,
    UE-associatedLogicalS1-ConnectionItem,
    S-TMSI

FROM S1AP-IEs

    PrivateIE-Container{},
    ProtocolExtensionContainer{},
    ProtocolIE-Container{},
    ProtocolIE-ContainerList{},
    ProtocolIE-ContainerPair{},
    ProtocolIE-ContainerPairList{},
    ProtocolIE-SingleContainer{},
    S1AP-PRIVATE-IES,
    S1AP-PROTOCOL-EXTENSION,
    S1AP-PROTOCOL-IES,
    S1AP-PROTOCOL-IES-PAIR
FROM S1AP-Containers


    id-aggregateMaximumBitrate,

    id-Cause,
    id-cdma2000HORequiredIndication,
    id-cdma2000HOStatus,
    id-cdma20000OneXMEID,
    id-cdma20000OneXRAND,
    id-cdma2000PDU,
    id-cdma2000RATType,
    id-cdma2000SectorID,
    id-CriticalityDiagnostics,
    id-Direct-Forwarding-Path-Availability,
    id-ENB-Global-ID,
    id-EUTRAN-CGI-ID,
    id-eNBname,
```

```
        id-eNB-StatusTransfer-TransparentContainer, id-eNB-UE-S1AP-ID,
        id-GERANtoLTEHOInformationReq,
        id-GERANtoLTEHOInformationRes,
        id-GUMMEI-ID,
        id-HandoverRestrictionList,
        id-HandoverType,
        id-InitialContextSetup,
        id-Intra-LTEHOInformationReq,
        id-Intra-LTEHOInformationRes,
        id-LTEtoGERANHOInformationReq,
        id-LTEtoGERANHOInformationRes,
        id-LTEtoUTRANHOInformationReq,
        id-LTEtoUTRANHOInformationRes,
        id-MMEname,
        id-MME-UE-S1AP-ID,
        id-NAS-PDU,
        id-pagingCause,
        id-pagingDRX,
        id-RelativeMMECapacity,
        id-RequestType,
        id-SAEBearerAdmittedItem,
        id-SAEBearerAdmittedList,
        id-SAEBearerDataForwardingItem,
        id-SAEBearerFailedToModifyList,
        id-SAEBearerFailedToReleaseList,
        id-SAEBearerFailedtoSetupItemHOReqAck,
        id-SAEBearerFailedToSetupListBearerSURes,
        id-SAEBearerFailedToSetupListCtxtSURes,
        id-SAEBearerFailedToSetupListHOReqAck,
        id-SAEBearerModify,
        id-SAEBearerModifyItemBearerModRes,
        id-SAEBearerModifyListBearerModRes,
        id-SAEBearerRelease,
        id-SAEBearerReleaseItemBearerRelComp,
        id-SAEBearerReleaseItemHOCmd,
        id-SAEBearerReleaseListBearerRelComp,
        id-SAEBearerReleaseRequest,
        id-SAEBearerSetup,
        id-SAEBearerSetupItemBearerSURes,
        id-SAEBearerSetupItemCtxtSURes,
        id-SAEBearerSetupListBearerSURes,
        id-SAEBearerSetupListCtxtSURes,
        id-SAEBearerSubjecttoDataForwardingList,
        id-SAEBearerToBeModifiedItemBearerModReq,
        id-SAEBearerToBeModifiedListBearerModReq,
        id-SAEBearerToBeReleasedList,
        id-SAEBearerToBeSetupItemBearerSUReq,
        id-SAEBearerToBeSetupItemCtxtSUReq,
        id-SAEBearerToBeSetupItemHOReq,
        id-SAEBearerToBeSetupListBearerSUReq,
        id-SAEBearerToBeSetupListCtxtSUReq,
        id-SAEBearerToBeSetupListHOReq,
        id-SAEBearerToBeSwitchedDLItem,
        id-SAEBearerToBeSwitchedDLList,
```

```
        id-SAEBearerToBeSwitchedULList,
        id-SAEBearerToBeSwitchedULItem,
        id-SAEBearertoReleaseListHOCmd,
        id-SecurityInfo,
        id-Security-Information,
        id-ServedPLMNs,
        id-SourceID,
        id-SourceMME-UE-S1AP-ID,
        id-SupportedTAs,
        id-S-TMSI,
        id-TAI,
        id-TAIItem,
        id-TAIList,
        id-TargetID,
        id-TimeToWait,
        id-TraceActivation,
        id-TraceReference,
        id-UEIdentityIndexValue,
        id-UEPagingID,
        id-UERadioCapability,
        id-UTRANtoLTEHOInformationReq,
        id-UTRANtoLTEHOInformationRes,
        id-UE-associatedLogicalS1-ConnectionListResAck,
        id-UE-associatedLogicalS1-ConnectionItem,
        id-UE-S1AP-IDs,
        id-ResetType,
        maxnoofTAI,
        maxNrOfErrors,
        maxNrOfSAEBs,
        maxNrOfIndividualS1ConnectionsToReset


FROM S1AP-Constants;

-- **************************************************************
--
-- Common Container Lists
--
-- **************************************************************

SAEB-IE-ContainerList                { S1AP-PROTOCOL-IES      : IEsSetParam } ::= ProtocolIE-ContainerList     { 1, maxNrOfSAEBs,   {IEsSetParam}
}
SAEB-IE-ContainerPairList            { S1AP-PROTOCOL-IES-PAIR : IEsSetParam } ::= ProtocolIE-ContainerPairList { 1, maxNrOfSAEBs,   {IEsSetParam}
}
ProtocolError-IE-ContainerList       { S1AP-PROTOCOL-IES      : IEsSetParam } ::= ProtocolIE-ContainerList     { 1, maxNrOfSAEBs,   {IEsSetParam}
}

-- **************************************************************
--
-- HANDOVER PREPARATION ELEMTARY PROCEDURE
--
-- **************************************************************

-- **************************************************************
```

```
--
-- Handover Required
--
-- *************************************************************

HandoverRequired ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container       { { HandoverRequiredIEs} },
    ...
}

HandoverRequiredIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID                      CRITICALITY reject  TYPE MME-UE-S1AP-ID                 PRESENCE mandatory   } |
    { ID id-HandoverType                        CRITICALITY reject  TYPE HandoverType                  PRESENCE mandatory   } |
    { ID id-Cause                    CRITICALITY ignore  TYPE Cause                    PRESENCE mandatory   } |
    { ID id-SourceID                 CRITICALITY ignore  TYPE SourceID                      PRESENCE mandatory } |
    { ID id-TargetID                 CRITICALITY reject  TYPE TargetID                      PRESENCE mandatory } |
    { ID id-Direct-Forwarding-Path-Availability CRITICALITY ignore  TYPE Direct-Forwarding-Path-Availability PRESENCE optional } |
    { ID id-Intra-LTEHOInformationReq           CRITICALITY reject  TYPE Intra-LTEHOInformationReq     PRESENCE conditional
    -- This IE shall be present if Handover Type IE is set to value 'IntraLTE' --          } |
    { ID id-LTEtoUTRANHOInformationReq          CRITICALITY reject  TYPE LTEtoUTRANHOInformationReq        PRESENCE conditional
    -- This IE shall be present if the Handover Type IE is set to value 'LTEtoUTRAN' --        } |
    { ID id-LTEtoGERANHOInformationReq
                        CRITICALITY reject  TYPE LTEtoGERANHOInformationReq PRESENCE conditional
    -- This IE shall be present if the Handover Type IE is set to value 'LTEtoGERAN' --                             },
    ...
}

Intra-LTEHOInformationReq ::= SEQUENCE {
    sourceeNodeB-ToTargeteNodeB-TransparentContainer                SourceeNodeB-ToTargeteNodeB-TransparentContainer,
    iE-Extensions                   ProtocolExtensionContainer { {Intra-LTEHOInformationReq-ExtIEs} }        OPTIONAL,
    ...
}

Intra-LTEHOInformationReq-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

LTEtoUTRANHOInformationReq ::= SEQUENCE {
    sourceRNC-ToTargetRNC-TransparentContainer                SourceRNC-ToTargetRNC-TransparentContainer,
    iE-Extensions                   ProtocolExtensionContainer { {LTEtoUTRANHOInformationReq-ExtIEs} }        OPTIONAL,
    ...
}

LTEtoUTRANHOInformationReq-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

LTEtoGERANHOInformationReq ::= SEQUENCE {
    sourceBSS-ToTargetBSS-TransparentContainer                SourceBSS-ToTargetBSS-TransparentContainer,
    iE-Extensions                   ProtocolExtensionContainer { {LTEtoGERANHOInformationReq-ExtIEs} }        OPTIONAL,
    ...
}

LTEtoGERANHOInformationReq-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
```

```
    ...
}

-- ****************************************************************
--
-- Handover Command
--
-- ****************************************************************

HandoverCommand ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container { { HandoverCommandIEs} },
    ...
}

HandoverCommandIEs S1AP-PROTOCOL-IES ::= {
    { ID id-eNB-UE-S1AP-ID                          CRITICALITY reject  TYPE ENB-UE-S1AP-ID                  PRESENCE mandatory   } |
    { ID id-SAEBearerSubjecttoDataForwardingList                        CRITICALITY ignore  TYPE SAEBearerSubjecttoDataForwardingList
    PRESENCE mandatory  } |
    { ID id-SAEBearertoReleaseListHOCmd             CRITICALITY ignore  TYPE SAEBearertoReleaseListHOCmd              PRESENCE mandatory   } |
    { ID id-Intra-LTEHOInformationRes               CRITICALITY reject  TYPE Intra-LTEHOInformationRes     PRESENCE conditional
    -- This IE shall be present if Handover Type IE is set to value 'IntraLTE' --          } |
    { ID id-LTEtoUTRANHOInformationRes              CRITICALITY reject  TYPE LTEtoUTRANHOInformationRes       PRESENCE conditional
    -- This IE shall be present if the Handover Type IE is set to value 'LTEtoUTRAN' --      } |
    { ID id-LTEtoGERANHOInformationRes
                        CRITICALITY reject  TYPE LTEtoGERANHOInformationRes PRESENCE conditional
    -- This IE shall be present if the Handover Type IE is set to value 'LTEtoGERAN' --                                          }|
    { ID id-CriticalityDiagnostics     CRITICALITY ignore  TYPE CriticalityDiagnostics         PRESENCE optional   },
    ...
}

SAEBearerSubjecttoDataForwardingList ::= SAEB-IE-ContainerList { {SAEBearerDataForwardingItemIEs} }

SAEBearerDataForwardingItemIEs S1AP-PROTOCOL-IES ::= {
    { ID id-SAEBearerDataForwardingItem        CRITICALITY ignore  TYPE SAEBearerDataForwardingItem       PRESENCE mandatory   },
    ...
}

SAEBearerDataForwardingItem ::= SEQUENCE {
    sAE-Bearer-ID                    SAE-Bearer-ID,
    dL-transportLayerAddress              TransportLayerAddress,
    dL-gTP-TEID               GTP-TEID,
    iE-Extensions                 ProtocolExtensionContainer { { SAEBearerDataForwardingItem-ExtIEs} }        OPTIONAL,
    ...
}

SAEBearerDataForwardingItem-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

SAEBearertoReleaseListHOCmd                ::= SAEB-IE-ContainerList { {SAEBearerReleaseItemHOCmdIEs} }

SAEBearerReleaseItemHOCmdIEs S1AP-PROTOCOL-IES ::= {
    { ID id-SAEBearerReleaseItemHOCmd          CRITICALITY ignore  TYPE SAEBearerReleaseItemHOCmd       PRESENCE mandatory   },
    ...
```

```
}

SAEBearerReleaseItemHOCmd ::= SEQUENCE {
    sAE-Bearer-ID                     SAE-Bearer-ID,
    iE-Extensions                     ProtocolExtensionContainer { { SAEBearerReleaseItemHOCmd-ExtIEs} }        OPTIONAL,
    ...
}

SAEBearerReleaseItemHOCmd-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

Intra-LTEHOInformationRes ::= SEQUENCE {
    targeteNodeB-ToSourceeNodeB-TransparentContainer              TargeteNodeB-ToSourceeNodeB-TransparentContainer,
    iE-Extensions                     ProtocolExtensionContainer { {Intra-LTEHOInformationRes-ExtIEs} }        OPTIONAL,
    ...
}

Intra-LTEHOInformationRes-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

LTEtoUTRANHOInformationRes ::= SEQUENCE {
    targetRNC-ToSourceRNC-TransparentContainer              TargetRNC-ToSourceRNC-TransparentContainer,
    iE-Extensions                     ProtocolExtensionContainer { {LTEtoUTRANHOInformationRes-ExtIEs} }        OPTIONAL,
    ...
}

LTEtoUTRANHOInformationRes-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

LTEtoGERANHOInformationRes ::= SEQUENCE {
    targetBSS-ToSourceBSS-TransparentContainer              TargetBSS-ToSourceBSS-TransparentContainer,
    iE-Extensions                     ProtocolExtensionContainer { {LTEtoGERANHOInformationRes-ExtIEs} }        OPTIONAL,
    ...
}

LTEtoGERANHOInformationRes-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

-- **************************************************************
--
-- Handover Preparation Failure
--
-- **************************************************************

HandoverPreparationFailure ::= SEQUENCE {
    protocolIEs        ProtocolIE-Container      { { HandoverPreparationFailureIEs} },
    ...
}

HandoverPreparationFailureIEs S1AP-PROTOCOL-IES ::= {
```

```
   { ID id-eNB-UE-S1AP-ID                      CRITICALITY reject  TYPE ENB-UE-S1AP-ID               PRESENCE mandatory   } |
   { ID id-Cause                     CRITICALITY ignore  TYPE Cause                        PRESENCE mandatory  }|
   { ID id-CriticalityDiagnostics     CRITICALITY ignore  TYPE CriticalityDiagnostics          PRESENCE optional   },
   ...
}


-- ****************************************************************
--
-- HANDOVER RESOURCE ALLOCATION ELEMTARY PROCEDURE
--
-- ****************************************************************


-- ****************************************************************
--
-- Handover Request
--
-- ****************************************************************

HandoverRequest ::= SEQUENCE {
    protocolIEs        ProtocolIE-Container       { {HandoverRequestIEs} },
    ...
}

HandoverRequestIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID                      CRITICALITY reject  TYPE MME-UE-S1AP-ID               PRESENCE mandatory   } |
    { ID id-HandoverType                        CRITICALITY reject  TYPE HandoverType                 PRESENCE mandatory   } |
    { ID id-Cause                      CRITICALITY ignore  TYPE Cause                  PRESENCE mandatory } |
    { ID id-aggregateMaximumBitrate    CRITICALITY reject  TYPE AggregateMaximumBitrate     PRESENCE mandatory }|
    { ID id-SAEBearerToBeSetupListHOReq             CRITICALITY reject  TYPE SAEBearerToBeSetupListHOReq         PRESENCE mandatory   } |
    { ID id-Intra-LTEHOInformationReq          CRITICALITY reject  TYPE Intra-LTEHOInformationReq     PRESENCE conditional
    -- This IE shall be present if Handover Type IE is set to value 'IntraLTE' --        } |
    { ID id-UTRANtoLTEHOInformationReq          CRITICALITY reject  TYPE UTRANtoLTEHOInformationReq        PRESENCE conditional
    -- This IE shall be present if the Handover Type IE is set to value 'UTRANtoLTE' --     } |
    { ID id-GERANtoLTEHOInformationReq
                          CRITICALITY reject  TYPE GERANtoLTEHOInformationReq PRESENCE conditional
    -- This IE shall be present if the Handover Type IE is set to value 'GERANtoLTE' --                     } |
    { ID id-HandoverRestrictionList    CRITICALITY ignore  TYPE HandoverRestrictionList    PRESENCE optional }|
    { ID id-TraceActivation            CRITICALITY ignore  TYPE TraceActivation            PRESENCE optional },
    ...
}

SAEBearerToBeSetupListHOReq                        ::= SAEB-IE-ContainerList { {SAEBearerToBeSetupItemHOReqIEs} }

SAEBearerToBeSetupItemHOReqIEs S1AP-PROTOCOL-IES ::= {
    { ID id-SAEBearerToBeSetupItemHOReq         CRITICALITY ignore  TYPE SAEBearerToBeSetupItemHOReq      PRESENCE mandatory   },
    ...
}

SAEBearerToBeSetupItemHOReq ::= SEQUENCE {
    sAE-Bearer-ID                   SAE-Bearer-ID,
    transportLayerAddress           TransportLayerAddress,
    gTP-TEID                GTP-TEID,
    sAE-BearerlevelQosParameters            SAE-BearerLevelQoSParameters,
    iE-Extensions               ProtocolExtensionContainer { {SAEBearerToBeSetupItemHOReq-ExtIEs} }      OPTIONAL,
```

ETSI

```
    ...
}

SAEBearerToBeSetupItemHOReq-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}
UTRANtoLTEHOInformationReq ::= SEQUENCE {
    sourceRNC-ToTargetRNC-TransparentContainer                SourceRNC-ToTargetRNC-TransparentContainer,
    iE-Extensions                    ProtocolExtensionContainer { {UTRANtoLTEHOInformationReq-ExtIEs} }        OPTIONAL,
    ...
}

UTRANtoLTEHOInformationReq-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

GERANtoLTEHOInformationReq ::= SEQUENCE {
    sourceBSS-ToTargetBSS-TransparentContainer                SourceBSS-ToTargetBSS-TransparentContainer,
    iE-Extensions                    ProtocolExtensionContainer { {GERANtoLTEHOInformationReq-ExtIEs} }        OPTIONAL,
    ...
}

GERANtoLTEHOInformationReq-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}


-- ***************************************************************
--
-- Handover Request Acknowledge
--
-- ***************************************************************

HandoverRequestAcknowledge ::= SEQUENCE {
    protocolIEs        ProtocolIE-Container        { {HandoverRequestAcknowledgeIEs} },
    ...
}

HandoverRequestAcknowledgeIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID                    CRITICALITY reject  TYPE MME-UE-S1AP-ID                PRESENCE mandatory    } |
    { ID id-eNB-UE-S1AP-ID                    CRITICALITY reject  TYPE ENB-UE-S1AP-ID                PRESENCE mandatory    } |
    { ID id-HandoverType                      CRITICALITY reject  TYPE HandoverType                  PRESENCE mandatory    } |
    { ID id-SAEBearerAdmittedList             CRITICALITY reject  TYPE SAEBearerAdmittedList              PRESENCE mandatory    } |
    { ID id-SAEBearerFailedToSetupListHOReqAck            CRITICALITY ignore  TYPE SAEBearerFailedtoSetupListHOReqAck       PRESENCE
mandatory    } |
    { ID id-Intra-LTEHOInformationRes          CRITICALITY reject  TYPE Intra-LTEHOInformationRes     PRESENCE conditional
    -- This IE shall be present if Handover Type IE is set to value 'IntraLTE' --        } |
    { ID id-UTRANtoLTEHOInformationRes         CRITICALITY reject  TYPE UTRANtoLTEHOInformationRes      PRESENCE conditional
    -- This IE shall be present if the Handover Type IE is set to value 'UTRANtoLTE' --     } |
    { ID id-GERANtoLTEHOInformationRes
                        CRITICALITY reject  TYPE GERANtoLTEHOInformationRes PRESENCE conditional
    -- This IE shall be present if the Handover Type IE is set to value 'GERANtoLTE' --                        }|
    { ID id-CriticalityDiagnostics     CRITICALITY ignore  TYPE CriticalityDiagnostics        PRESENCE optional  },
    ...
```

```
}

SAEBearerAdmittedList                         ::= SAEB-IE-ContainerList { {SAEBearerAdmittedItemIEs} }

SAEBearerAdmittedItemIEs S1AP-PROTOCOL-IES ::= {
    { ID id-SAEBearerAdmittedItem          CRITICALITY ignore  TYPE SAEBearerAdmittedItem       PRESENCE mandatory   },
    ...
}

SAEBearerAdmittedItem ::= SEQUENCE {
    sAE-Bearer-ID                     SAE-Bearer-ID,
    transportLayerAddress             TransportLayerAddress,
    gTP-TEID               GTP-TEID,
    dL-transportLayerAddress          TransportLayerAddress   OPTIONAL,
    dL-gTP-TEID                       GTP-TEID   OPTIONAL,
    iE-Extensions                ProtocolExtensionContainer { {SAEBearerAdmittedItem-ExtIEs} }      OPTIONAL,
    ...
}

SAEBearerAdmittedItem-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

SAEBearerFailedtoSetupListHOReqAck                  ::= SAEB-IE-ContainerList { {SAEBearerFailedtoSetupItemHOReqAckIEs} }

SAEBearerFailedtoSetupItemHOReqAckIEs S1AP-PROTOCOL-IES ::= {
    { ID id-SAEBearerFailedtoSetupItemHOReqAck          CRITICALITY ignore  TYPE SAEBearerFailedToSetupItemHOReqAck       PRESENCE mandatory   },
    ...
}

SAEBearerFailedToSetupItemHOReqAck ::= SEQUENCE {
    sAE-Bearer-ID                     SAE-Bearer-ID,
    cause               Cause,
    iE-Extensions                ProtocolExtensionContainer { { SAEBearerFailedToSetupItemHOReqAckExtIEs} }        OPTIONAL,
    ...
}

SAEBearerFailedToSetupItemHOReqAckExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

UTRANtoLTEHOInformationRes ::= SEQUENCE {
    targetRNC-ToSourceRNC-TransparentContainer            TargetRNC-ToSourceRNC-TransparentContainer,
    iE-Extensions                ProtocolExtensionContainer { {UTRANtoLTEHOInformationRes-ExtIEs} }       OPTIONAL,
    ...
}

UTRANtoLTEHOInformationRes-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

GERANtoLTEHOInformationRes ::= SEQUENCE {
    targetBSS-ToSourceBSS-TransparentContainer            TargetBSS-ToSourceBSS-TransparentContainer,
    iE-Extensions                ProtocolExtensionContainer { {GERANtoLTEHOInformationRes-ExtIEs} }        OPTIONAL,
```

```
    ...
}


GERANtoLTEHOInformationRes-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}



-- *************************************************************
--
-- Handover Failure
--
-- *************************************************************

HandoverFailure ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container        { { HandoverFailureIEs} },
    ...
}

HandoverFailureIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID              CRITICALITY reject  TYPE MME-UE-S1AP-ID           PRESENCE mandatory  } |
    { ID id-Cause                       CRITICALITY ignore  TYPE Cause                    PRESENCE mandatory }|
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics   PRESENCE optional  },
    ...
}

-- *************************************************************
--
-- HANDOVER NOTIFICATION ELEMTARY PROCEDURE
--
-- *************************************************************


-- *************************************************************
--
-- Handover Notify
--
-- *************************************************************

HandoverNotify ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container        { { HandoverNotifyIEs} },
    ...
}

HandoverNotifyIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID              CRITICALITY reject  TYPE MME-UE-S1AP-ID           PRESENCE mandatory  } |
    { ID id-eNB-UE-S1AP-ID              CRITICALITY reject  TYPE ENB-UE-S1AP-ID           PRESENCE mandatory  } |
    { ID id-Cause                       CRITICALITY ignore  TYPE Cause                    PRESENCE mandatory },
    ...
}

-- *************************************************************
--
-- PATH SWITCH REQUEST ELEMTARY PROCEDURE
--
```

```
-- ***************************************************************

-- ***************************************************************
--
-- Path Switch Request
--
-- ***************************************************************

PathSwitchRequest ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container        { { PathSwitchRequestIEs} },
    ...
}

PathSwitchRequestIEs S1AP-PROTOCOL-IES ::= {
    { ID id-eNB-UE-S1AP-ID                    CRITICALITY reject  TYPE ENB-UE-S1AP-ID             PRESENCE mandatory }|
    { ID id-SAEBearerToBeSwitchedDLList                 CRITICALITY reject  TYPE SAEBearerToBeSwitchedDLList        PRESENCE mandatory  }|
    { ID id-SourceMME-UE-S1AP-ID                      CRITICALITY reject  TYPE MME-UE-S1AP-ID          PRESENCE mandatory  },
    ...
}

SAEBearerToBeSwitchedDLList                       ::= SAEB-IE-ContainerList { {SAEBearerToBeSwitchedDLItemIEs} }

SAEBearerToBeSwitchedDLItemIEs S1AP-PROTOCOL-IES ::= {
    { ID id-SAEBearerToBeSwitchedDLItem        CRITICALITY ignore  TYPE SAEBearerToBeSwitchedDLItem      PRESENCE mandatory  },
    ...
}

SAEBearerToBeSwitchedDLItem ::= SEQUENCE {
    sAE-Bearer-ID                   SAE-Bearer-ID,
    transportLayerAddress               TransportLayerAddress,
    gTP-TEID                GTP-TEID,
    iE-Extensions                  ProtocolExtensionContainer { { SAEBearerToBeSwitchedDLItem-ExtIEs} }        OPTIONAL,
    ...
}

SAEBearerToBeSwitchedDLItem-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

-- ***************************************************************
--
-- Path Switch Request Acknowledge
--
-- ***************************************************************

PathSwitchRequestAcknowledge ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container        { { PathSwitchRequestAcknowledgeIEs} },
    ...
}

PathSwitchRequestAcknowledgeIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID                    CRITICALITY reject  TYPE MME-UE-S1AP-ID                PRESENCE mandatory  } |
    { ID id-eNB-UE-S1AP-ID                    CRITICALITY reject  TYPE ENB-UE-S1AP-ID                PRESENCE mandatory }| { ID id-
SAEBearerToBeSwitchedULList     CRITICALITY ignore  TYPE SAEBearerToBeSwitchedULList     PRESENCE optional }|
```

```
    { ID id-HandoverRestrictionList       CRITICALITY ignore  TYPE HandoverRestrictionList    PRESENCE optional  } |  { ID id-
CriticalityDiagnostics     CRITICALITY ignore  TYPE CriticalityDiagnostics       PRESENCE optional  },
    ...
}

SAEBearerToBeSwitchedULList ::= SAEB-IE-ContainerList { {SAEBearerToBeSwitchedULItemIEs} }

SAEBearerToBeSwitchedULItemIEs S1AP-PROTOCOL-IES ::= {
    { ID id-SAEBearerToBeSwitchedULItem    CRITICALITY ignore  TYPE SAEBearerToBeSwitchedULItem  PRESENCE mandatory  },
    ...
}

SAEBearerToBeSwitchedULItem ::= SEQUENCE {
    sAE-Bearer-ID                     SAE-Bearer-ID,
    transportLayerAddress             TransportLayerAddress,
    gTP-TEID                          GTP-TEID,
    iE-Extensions                     ProtocolExtensionContainer { { SAEBearerToBeSwitchedULItem-ExtIEs} }       OPTIONAL,
    ...
}

SAEBearerToBeSwitchedULItem-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}


-- *************************************************************
--
-- Path Switch Request Failure
--
-- *************************************************************

PathSwitchRequestFailure ::= SEQUENCE {
    protocolIEs        ProtocolIE-Container      { { PathSwitchRequestFailureIEs} },
    ...
}

PathSwitchRequestFailureIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID                    CRITICALITY reject  TYPE MME-UE-S1AP-ID                 PRESENCE mandatory   } |
    { ID id-eNB-UE-S1AP-ID                    CRITICALITY reject  TYPE ENB-UE-S1AP-ID                 PRESENCE mandatory } |
    { ID id-Cause                    CRITICALITY reject  TYPE Cause                    PRESENCE mandatory }|
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics       PRESENCE optional  },
    ...
}

-- *************************************************************
--
-- HANDOVER CANCEL ELEMTARY PROCEDURE
--
-- *************************************************************

-- *************************************************************
--
-- Handover Cancel
--
```

```
-- *****************************************************************


HandoverCancel ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container       { { HandoverCancelIEs} },
    ...
}

HandoverCancelIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID                      CRITICALITY reject  TYPE MME-UE-S1AP-ID               PRESENCE mandatory  } |
    { ID id-eNB-UE-S1AP-ID                      CRITICALITY reject  TYPE ENB-UE-S1AP-ID               PRESENCE mandatory  } |
    { ID id-Cause                       CRITICALITY ignore  TYPE Cause                       PRESENCE mandatory  },
    ...
}


-- *****************************************************************
--
-- Handover Cancel Request Acknowledge
--
-- *****************************************************************

HandoverCancelAcknowledge ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container       { { HandoverCancelAcknowledgeIEs} },
    ...
}

HandoverCancelAcknowledgeIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID                      CRITICALITY reject  TYPE MME-UE-S1AP-ID               PRESENCE mandatory  } |
    { ID id-eNB-UE-S1AP-ID                      CRITICALITY reject  TYPE ENB-UE-S1AP-ID               PRESENCE mandatory  }|
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics       PRESENCE optional  },
    ...
}


-- *****************************************************************
--
-- SAE BEARER SETUP ELEMENTARY PROCEDURE
--
-- *****************************************************************


-- *****************************************************************
--
-- SAE Bearer Setup Request
--
-- *****************************************************************

SAEBearerSetupRequest ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container       { {SAEBearerSetupRequestIEs} },
    ...
}

SAEBearerSetupRequestIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID              CRITICALITY reject  TYPE MME-UE-S1AP-ID                       PRESENCE mandatory }|
    { ID id-eNB-UE-S1AP-ID              CRITICALITY reject  TYPE ENB-UE-S1AP-ID                       PRESENCE mandatory }|
    { ID id-SAEBearerToBeSetupListBearerSUReq           CRITICALITY reject  TYPE SAEBearerToBeSetupListBearerSUReq    PRESENCE mandatory  }|
        { ID id-NAS-PDU             CRITICALITY ignore  TYPE NAS-PDU                PRESENCE mandatory},
```

```
    ...
}

SAEBearerToBeSetupListBearerSUReq ::= SEQUENCE (SIZE(1.. maxNrOfSAEBs)) OF ProtocolIE-SingleContainer { {SAEBearerToBeSetupItemBearerSUReqIEs} }

SAEBearerToBeSetupItemBearerSUReqIEs    S1AP-PROTOCOL-IES ::= {
    { ID id-SAEBearerToBeSetupItemBearerSUReq    CRITICALITY reject    TYPE SAEBearerToBeSetupItemBearerSUReq   PRESENCE mandatory },
    ...
}

SAEBearerToBeSetupItemBearerSUReq ::= SEQUENCE {
    sAE-Bearer-ID                SAE-Bearer-ID,
    sAE-BearerlevelQoSParameters            SAE-BearerLevelQoSParameters,
    transportLayerAddress            TransportLayerAddress,
    gTP-TEID                GTP-TEID,
    iE-Extensions                ProtocolExtensionContainer { {SAEBearerToBeSetupItemBearerSUReqExtIEs} } OPTIONAL,
    ...
}


SAEBearerToBeSetupItemBearerSUReqExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}


-- **************************************************************
--
-- SAE Bearer Setup Response
--
-- **************************************************************

SAEBearerSetupResponse ::= SEQUENCE {
    protocolIEs        ProtocolIE-Container        { {SAEBearerSetupResponseIEs} },
    ...
}

SAEBearerSetupResponseIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID            CRITICALITY reject  TYPE MME-UE-S1AP-ID                PRESENCE mandatory }|
    { ID id-eNB-UE-S1AP-ID            CRITICALITY reject  TYPE ENB-UE-S1AP-ID                PRESENCE mandatory }|
    { ID id-SAEBearerSetupListBearerSURes            CRITICALITY reject  TYPE SAEBearerSetupListBearerSURes       PRESENCE optional }|
    { ID id-SAEBearerFailedToSetupListBearerSURes        CRITICALITY ignore  TYPE SAEBearerList            PRESENCE optional }|
    { ID id-NAS-PDU            CRITICALITY ignore  TYPE NAS-PDU            PRESENCE mandatory}|
    { ID id-CriticalityDiagnostics        CRITICALITY ignore  TYPE CriticalityDiagnostics        PRESENCE optional  },
    ...
}


SAEBearerSetupListBearerSURes ::= SEQUENCE (SIZE(0.. maxNrOfSAEBs)) OF ProtocolIE-SingleContainer { {SAEBearerSetupItemBearerSUResIEs} }

SAEBearerSetupItemBearerSUResIEs    S1AP-PROTOCOL-IES ::= {
    { ID id-SAEBearerSetupItemBearerSURes    CRITICALITY reject    TYPE SAEBearerSetupItemBearerSURes  PRESENCE mandatory },
    ...
}
```

```
SAEBearerSetupItemBearerSURes ::= SEQUENCE {
    sAE-Bearer-ID                     SAE-Bearer-ID,
    transportLayerAddress             TransportLayerAddress,
    gTP-TEID                     GTP-TEID,
    iE-Extensions                     ProtocolExtensionContainer { {SAEBearerSetupItemBearerSUResExtIEs} } OPTIONAL,
    ...
}


SAEBearerSetupItemBearerSUResExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}




-- ****************************************************************
--
-- SAE BEARER MODIFY ELEMENTARY PROCEDURE
--
-- ****************************************************************

-- ****************************************************************
--
-- SAE Bearer Modify Request
--
-- ****************************************************************

SAEBearerModifyRequest ::= SEQUENCE {
    protocolIEs        ProtocolIE-Container        { {SAEBearerModifyRequestIEs} },
    ...
}

SAEBearerModifyRequestIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID               CRITICALITY reject  TYPE MME-UE-S1AP-ID                   PRESENCE mandatory }|
    { ID id-eNB-UE-S1AP-ID               CRITICALITY reject  TYPE ENB-UE-S1AP-ID                   PRESENCE mandatory }|
    { ID id-SAEBearerToBeModifiedListBearerModReq     CRITICALITY reject  TYPE SAEBearerToBeModifiedListBearerModReq   PRESENCE mandatory   }|
    { ID id-NAS-PDU               CRITICALITY ignore  TYPE NAS-PDU               PRESENCE mandatory},
    ...
}

SAEBearerToBeModifiedListBearerModReq ::= SEQUENCE (SIZE(1.. maxNrOfSAEBs)) OF ProtocolIE-SingleContainer {
{SAEBearerToBeModifiedItemBearerModReqIEs} }

SAEBearerToBeModifiedItemBearerModReqIEs    S1AP-PROTOCOL-IES ::= {
    { ID id-SAEBearerToBeModifiedItemBearerModReq    CRITICALITY reject    TYPE SAEBearerToBeModifiedItemBearerModReq   PRESENCE mandatory },
    ...
}

SAEBearerToBeModifiedItemBearerModReq ::= SEQUENCE {
    sAE-Bearer-ID               SAE-Bearer-ID,
    sAE-BearerLevelQoSParameters                SAE-BearerLevelQoSParameters,
    iE-Extensions                 ProtocolExtensionContainer { {SAEBearerToBeModifyItemBearerModReqExtIEs} } OPTIONAL,
    ...
}
```

```
SAEBearerToBeModifyItemBearerModReqExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}



-- *************************************************************
--
-- SAE Bearer Modify Response
--
-- *************************************************************

SAEBearerModifyResponse ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container       { {SAEBearerModifyResponseIEs} },
    ...
}

SAEBearerModifyResponseIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID                CRITICALITY reject  TYPE MME-UE-S1AP-ID                    PRESENCE mandatory }|
    { ID id-eNB-UE-S1AP-ID                CRITICALITY reject  TYPE ENB-UE-S1AP-ID                    PRESENCE mandatory }|
    { ID id-SAEBearerModifyListBearerModRes          CRITICALITY ignore  TYPE SAEBearerModifyListBearerModRes    PRESENCE optional }|
    { ID id-SAEBearerFailedToModifyList    CRITICALITY ignore  TYPE SAEBearerList              PRESENCE optional  }|
    { ID id-NAS-PDU            CRITICALITY ignore  TYPE NAS-PDU             PRESENCE mandatory}|
    { ID id-CriticalityDiagnostics     CRITICALITY ignore  TYPE CriticalityDiagnostics         PRESENCE optional  },
    ...
}


SAEBearerModifyListBearerModRes ::= SEQUENCE (SIZE(0.. maxNrOfSAEBs)) OF ProtocolIE-SingleContainer { {SAEBearerModifyItemBearerModResIEs} }

SAEBearerModifyItemBearerModResIEs  S1AP-PROTOCOL-IES ::= {
    { ID id-SAEBearerModifyItemBearerModRes  CRITICALITY reject     TYPE SAEBearerModifyItemBearerModRes   PRESENCE mandatory },
    ...
}

SAEBearerModifyItemBearerModRes ::= SEQUENCE {
    sAE-Bearer-ID                 SAE-Bearer-ID,
    iE-Extensions                 ProtocolExtensionContainer { {SAEBearerModifyItemBearerModResExtIEs} } OPTIONAL,
    ...
}


SAEBearerModifyItemBearerModResExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}
```

```
-- ******************************************************************
--
-- SAE BEARER RELEASE ELEMENTARY PROCEDURE
--
-- ******************************************************************


-- ******************************************************************
--
-- SAE Bearer Release Command
--
-- ******************************************************************

SAEBearerReleaseCommand ::= SEQUENCE {
    protocolIEs        ProtocolIE-Container      { {SAEBearerReleaseCommandIEs} },
    ...
}

SAEBearerReleaseCommandIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID              CRITICALITY reject  TYPE MME-UE-S1AP-ID              PRESENCE mandatory }|
    { ID id-eNB-UE-S1AP-ID              CRITICALITY reject  TYPE ENB-UE-S1AP-ID              PRESENCE mandatory }|
    { ID id-SAEBearerToBeReleasedList      CRITICALITY ignore  TYPE SAEBearerList              PRESENCE optional },
    ...
}


-- ******************************************************************
--
-- SAE Bearer Release Response
--
-- ******************************************************************

SAEBearerReleaseResponse ::= SEQUENCE {
    protocolIEs        ProtocolIE-Container      { { SAEBearerReleaseResponseIEs } },
    ...
}

SAEBearerReleaseResponseIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID              CRITICALITY reject  TYPE MME-UE-S1AP-ID              PRESENCE mandatory }|
    { ID id-eNB-UE-S1AP-ID              CRITICALITY reject  TYPE ENB-UE-S1AP-ID              PRESENCE mandatory }|
    { ID id-SAEBearerReleaseListBearerRelComp          CRITICALITY ignore  TYPE SAEBearerReleaseListBearerRelComp   PRESENCE optional }|
    { ID id-SAEBearerFailedToReleaseList      CRITICALITY ignore  TYPE SAEBearerList              PRESENCE optional }|
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics          PRESENCE optional  },
    ...
}


SAEBearerReleaseListBearerRelComp ::= SEQUENCE (SIZE(0.. maxNrOfSAEBs)) OF ProtocolIE-SingleContainer { {SAEBearerReleaseItemBearerRelCompIEs} }

SAEBearerReleaseItemBearerRelCompIEs     S1AP-PROTOCOL-IES ::= {
    { ID id-SAEBearerReleaseItemBearerRelComp   CRITICALITY reject    TYPE SAEBearerReleaseItemBearerRelComp  PRESENCE mandatory },
    ...
}

SAEBearerReleaseItemBearerRelComp ::= SEQUENCE {
```

ETSI

```
    sAE-Bearer-ID                     SAE-Bearer-ID,
    iE-Extensions                     ProtocolExtensionContainer { {SAEBearerReleaseItemBearerRelCompExtIEs} } OPTIONAL,
    ...
}


SAEBearerReleaseItemBearerRelCompExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}



-- **************************************************************
--
-- SAE BEARER RELEASE REQUEST ELEMENTARY PROCEDURE
--
-- **************************************************************


-- **************************************************************
--
-- SAE Bearer Release Request
--
-- **************************************************************

SAEBearerReleaseRequest ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container      { {SAEBearerReleaseRequestIEs} },
    ...
}

SAEBearerReleaseRequestIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID                CRITICALITY ignore  TYPE MME-UE-S1AP-ID                  PRESENCE mandatory }|
    { ID id-eNB-UE-S1AP-ID                CRITICALITY ignore  TYPE ENB-UE-S1AP-ID                  PRESENCE mandatory }|
    { ID id-SAEBearerToBeReleasedList        CRITICALITY ignore  TYPE SAEBearerList                   PRESENCE optional },
    ...
}
-- **************************************************************
--
-- INITIAL CONTEXT SETUP ELEMENTARY PROCEDURE
--
-- **************************************************************


-- **************************************************************
--
-- Initial Context Setup Request
--
-- **************************************************************

InitialContextSetupRequest ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container      { {InitialContextSetupRequestIEs} },
    ...
}

InitialContextSetupRequestIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID                CRITICALITY reject  TYPE MME-UE-S1AP-ID                  PRESENCE mandatory }|
```

```
    { ID id-eNB-UE-S1AP-ID                 CRITICALITY reject  TYPE ENB-UE-S1AP-ID                     PRESENCE mandatory }|
    { ID id-aggregateMaximumBitrate        CRITICALITY reject  TYPE AggregateMaximumBitrate           PRESENCE mandatory }|
    { ID id-SAEBearerToBeSetupListCtxtSUReq          CRITICALITY reject  TYPE SAEBearerToBeSetupListCtxtSUReq    PRESENCE mandatory   }|
    { ID id-Security-Information            CRITICALITY ignore  TYPE SecurityInformation               PRESENCE mandatory  }|
    { ID id-TraceActivation                CRITICALITY ignore  TYPE TraceActivation                   PRESENCE optional }|
    { ID id-HandoverRestrictionList        CRITICALITY ignore  TYPE HandoverRestrictionList           PRESENCE optional }|
    { ID id-NAS-PDU             CRITICALITY ignore  TYPE NAS-PDU                   PRESENCE optional}|
    { ID id-UERadioCapability               CRITICALITY ignore  TYPE UERadioCapability                 PRESENCE optional  },
    ...
}
-- ****************************************************************
--
-- UE CONTEXT RELEASE REQUEST
--
-- ****************************************************************

UEContextReleaseRequest ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container        {{UEContextReleaseRequest-IEs}},
    ...
}

UEContextReleaseRequest-IEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID           CRITICALITY reject  TYPE MME-UE-S1AP-ID             PRESENCE mandatory} |
    { ID id-eNB-UE-S1AP-ID           CRITICALITY reject  TYPE ENB-UE-S1AP-ID             PRESENCE mandatory} |
    { ID id-Cause                    CRITICALITY ignore  TYPE Cause              PRESENCE mandatory} ,
    ...
}




SAEBearerToBeSetupListCtxtSUReq ::= SEQUENCE (SIZE(1.. maxNrOfSAEBs)) OF ProtocolIE-SingleContainer { {SAEBearerToBeSetupItemCtxtSUReqIEs} }

SAEBearerToBeSetupItemCtxtSUReqIEs  S1AP-PROTOCOL-IES ::= {
    { ID id-SAEBearerToBeSetupItemCtxtSUReq  CRITICALITY reject     TYPE SAEBearerToBeSetupItemCtxtSUReq  PRESENCE mandatory },
    ...
}

SAEBearerToBeSetupItemCtxtSUReq ::= SEQUENCE {
    sAE-Bearer-ID               SAE-Bearer-ID,
    sAE-BearerlevelQoSParameters                SAE-BearerLevelQoSParameters,
    transportLayerAddress       TransportLayerAddress,
    gTP-TEID            GTP-TEID,
    iE-Extensions               ProtocolExtensionContainer { {SAEBearerToBeSetupItemCtxtSUReqExtIEs} } OPTIONAL,
    ...
}


SAEBearerToBeSetupItemCtxtSUReqExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}


-- ****************************************************************
```

```
--
-- Initial Context Setup Response
--
-- ************************************************************

InitialContextSetupResponse ::= SEQUENCE {
    protocolIEs          ProtocolIE-Container       { {InitialContextSetupResponseIEs} },
    ...
}

InitialContextSetupResponseIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID                  CRITICALITY reject  TYPE MME-UE-S1AP-ID                    PRESENCE mandatory }|
    { ID id-eNB-UE-S1AP-ID                  CRITICALITY reject  TYPE ENB-UE-S1AP-ID                    PRESENCE mandatory }|
    { ID id-SAEBearerSetupListCtxtSURes         CRITICALITY reject  TYPE SAEBearerSetupListCtxtSURes        PRESENCE optional }|
    { ID id-SAEBearerFailedToSetupListCtxtSURes    CRITICALITY ignore  TYPE SAEBearerList              PRESENCE optional }|
    { ID id-CriticalityDiagnostics          CRITICALITY ignore  TYPE CriticalityDiagnostics          PRESENCE optional  },
    ...
}


SAEBearerSetupListCtxtSURes ::= SEQUENCE (SIZE(1.. maxNrOfSAEBs)) OF ProtocolIE-SingleContainer { {SAEBearerSetupItemCtxtSUResIEs} }

SAEBearerSetupItemCtxtSUResIEs  S1AP-PROTOCOL-IES ::= {
    { ID id-SAEBearerSetupItemCtxtSURes  CRITICALITY reject     TYPE SAEBearerSetupItemCtxtSURes  PRESENCE mandatory },
    ...
}

SAEBearerSetupItemCtxtSURes ::= SEQUENCE {
    sAE-Bearer-ID                SAE-Bearer-ID,
    transportLayerAddress            TransportLayerAddress,
    gTP-TEID            GTP-TEID,
    iE-Extensions                ProtocolExtensionContainer { {SAEBearerSetupItemCtxtSUResExtIEs} } OPTIONAL,
    ...
}


SAEBearerSetupItemCtxtSUResExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}



-- ************************************************************
--
-- Initial Context Setup Failure
--
-- ************************************************************

InitialContextSetupFailure ::= SEQUENCE {
    protocolIEs          ProtocolIE-Container       { {InitialContextSetupFailureIEs} },
    ...
}

InitialContextSetupFailureIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID                  CRITICALITY reject  TYPE MME-UE-S1AP-ID                    PRESENCE mandatory }|
```

```
    { ID id-eNB-UE-S1AP-ID             CRITICALITY reject  TYPE ENB-UE-S1AP-ID                    PRESENCE mandatory }|
    { ID id-Cause                      CRITICALITY ignore  TYPE Cause                         PRESENCE mandatory  }|
    { ID id-CriticalityDiagnostics     CRITICALITY ignore  TYPE CriticalityDiagnostics        PRESENCE optional  },
    ...
}


-- *************************************************************
--
-- Paging
--
-- *************************************************************

Paging ::= SEQUENCE {
    protocolIEs        ProtocolIE-Container       {{PagingIEs}},
    ...
}

PagingIEs S1AP-PROTOCOL-IES ::= {
    { ID id-UEIdentityIndexValue         CRITICALITY ignore  TYPE UEIdentityIndexValue    PRESENCE mandatory } |
    { ID id-UEPagingID                         CRITICALITY ignore  TYPE UEPagingID                PRESENCE mandatory  } |
    { ID id-pagingDRX                    CRITICALITY ignore  TYPE PagingDRX             PRESENCE mandatory } |
    { ID id-pagingCause                  CRITICALITY ignore  TYPE PagingCause           PRESENCE mandatory } |
    { ID id-TAIList                CRITICALITY ignore  TYPE TAIList             PRESENCE mandatory  },
    ...
}

TAIList::= SEQUENCE (SIZE(1.. maxnoofTAI)) OF ProtocolIE-SingleContainer {{TAIItemIEs}}

TAIItemIEs  S1AP-PROTOCOL-IES ::= {
    { ID id-TAIItem  CRITICALITY ignore     TYPE TAIItem    PRESENCE mandatory },
    ...
}

TAIItem ::= SEQUENCE {
    tAI                       TAI,
    iE-Extensions             ProtocolExtensionContainer { {TAIItemExtIEs} } OPTIONAL,
    ...
}


TAIItemExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

-- *************************************************************
--
-- UE CONTEXT RELEASE ELEMENTARY PROCEDURE
--
-- *************************************************************


-- *************************************************************
--
-- UE Context Release Command
```

```
--
-- ****************************************************************

UEContextReleaseCommand ::= SEQUENCE {
    protocolIEs                    ProtocolIE-Container        {{UEContextReleaseCommand-IEs}},
    ...
}

UEContextReleaseCommand-IEs S1AP-PROTOCOL-IES ::= {
    { ID id-UE-S1AP-IDs              CRITICALITY reject  TYPE UE-S1AP-IDs                      PRESENCE mandatory} |

    { ID id-Cause                    CRITICALITY ignore  TYPE Cause                           PRESENCE mandatory} ,
    ...
}

-- ****************************************************************
--
-- UE Context Release Complete
--
-- ****************************************************************

UEContextReleaseComplete ::= SEQUENCE {
    protocolIEs                    ProtocolIE-Container        {{UEContextReleaseComplete-IEs}},
    ...
}

UEContextReleaseComplete-IEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID           CRITICALITY reject  TYPE MME-UE-S1AP-ID          PRESENCE mandatory} |
    { ID id-eNB-UE-S1AP-ID           CRITICALITY reject  TYPE ENB-UE-S1AP-ID          PRESENCE mandatory} |
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics        PRESENCE optional  },
    ...
}


-- ****************************************************************
--
-- UE Context Modification
--
-- ****************************************************************

-- ****************************************************************
--
-- UE Context Modification Request
--
-- ****************************************************************

UEContextModificationRequest ::= SEQUENCE {
    protocolIEs        ProtocolIE-Container        { { UEContextModificationRequestIEs} },
    ...
}

UEContextModificationRequestIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID                    CRITICALITY reject  TYPE MME-UE-S1AP-ID                      PRESENCE mandatory  } |
    { ID id-eNB-UE-S1AP-ID                    CRITICALITY reject  TYPE ENB-UE-S1AP-ID              PRESENCE mandatory  } |
```

```
    { ID id-SecurityInfo                        CRITICALITY reject  TYPE SecurityInfo                   PRESENCE optional }, ...
}
-- ****************************************************************
--
-- UE Context Modification Response
--
-- ****************************************************************

UEContextModificationResponse ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container       { { UEContextModificationResponseIEs} },
    ...
}

UEContextModificationResponseIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID                      CRITICALITY reject  TYPE MME-UE-S1AP-ID                  PRESENCE mandatory  } |
    { ID id-eNB-UE-S1AP-ID              CRITICALITY reject  TYPE ENB-UE-S1AP-ID             PRESENCE mandatory  }|
    { ID id-CriticalityDiagnostics     CRITICALITY ignore  TYPE CriticalityDiagnostics         PRESENCE optional  },
    ...
}-- ****************************************************************
--
-- UE Context Modification Failure
--
-- ****************************************************************

UEContextModificationFailure ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container       { { UEContextModificationFailureIEs} },
    ...
}

UEContextModificationFailureIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID                      CRITICALITY reject  TYPE MME-UE-S1AP-ID                  PRESENCE mandatory  } |
    { ID id-eNB-UE-S1AP-ID              CRITICALITY reject  TYPE ENB-UE-S1AP-ID             PRESENCE mandatory  } |
    { ID id-Cause             CRITICALITY ignore  TYPE Cause                PRESENCE mandatory  }|
    { ID id-CriticalityDiagnostics     CRITICALITY ignore  TYPE CriticalityDiagnostics         PRESENCE optional  },
    ...
}

-- ****************************************************************
--
-- DOWNLINK NAS TRANSPORT
--
-- ****************************************************************

DownlinkNASTransport ::= SEQUENCE {
    protocolIEs                  ProtocolIE-Container      {{DownlinkNASTransport-IEs}},
    ...
}

DownlinkNASTransport-IEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID            CRITICALITY reject  TYPE MME-UE-S1AP-ID              PRESENCE mandatory} |
    { ID id-eNB-UE-S1AP-ID            CRITICALITY reject  TYPE ENB-UE-S1AP-ID              PRESENCE mandatory} |
    { ID id-NAS-PDU                   CRITICALITY reject  TYPE NAS-PDU                PRESENCE mandatory} |
    { ID id-HandoverRestrictionList    CRITICALITY ignore  TYPE HandoverRestrictionList    PRESENCE optional },
    ...
```

```
}


-- *****************************************************************
--
-- INITIAL UE MESSAGE
--
-- *****************************************************************

InitialUEMessage ::= SEQUENCE {
    protocolIEs                 ProtocolIE-Container       {{InitialUEMessage-IEs}},
    ...
}

InitialUEMessage-IEs S1AP-PROTOCOL-IES ::= {
    { ID id-eNB-UE-S1AP-ID           CRITICALITY reject  TYPE ENB-UE-S1AP-ID            PRESENCE mandatory} |
    { ID id-NAS-PDU                  CRITICALITY reject  TYPE NAS-PDU                   PRESENCE mandatory} |
    { ID id-TAI                      CRITICALITY reject  TYPE TAI                       PRESENCE mandatory}|
    { ID id-S-TMSI                   CRITICALITY reject  TYPE S-TMSI           PRESENCE optional},
    ...
}


-- *****************************************************************
--
-- UPLINK NAS TRANSPORT
--
-- *****************************************************************

UplinkNASTransport ::= SEQUENCE {
    protocolIEs                 ProtocolIE-Container       {{UplinkNASTransport-IEs}},
    ...
}

UplinkNASTransport-IEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID           CRITICALITY reject  TYPE MME-UE-S1AP-ID            PRESENCE mandatory} |
    { ID id-eNB-UE-S1AP-ID           CRITICALITY reject  TYPE ENB-UE-S1AP-ID            PRESENCE mandatory} |
    { ID id-NAS-PDU                  CRITICALITY reject  TYPE NAS-PDU          PRESENCE mandatory} ,
    ...
}
-- *****************************************************************
--
-- NAS NON DELIVERY INDICATION
--
-- *****************************************************************

NASNonDeliveryIndication ::= SEQUENCE {
    protocolIEs                 ProtocolIE-Container       {{NASNonDeliveryIndication-IEs}},
    ...
}

NASNonDeliveryIndication-IEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID           CRITICALITY reject  TYPE MME-UE-S1AP-ID            PRESENCE mandatory} |
    { ID id-eNB-UE-S1AP-ID           CRITICALITY reject  TYPE ENB-UE-S1AP-ID            PRESENCE mandatory} |
```

```
    { ID id-NAS-PDU                    CRITICALITY ignore  TYPE NAS-PDU               PRESENCE mandatory} |
    { ID id-Cause                      CRITICALITY ignore  TYPE Cause              PRESENCE mandatory} ,
    ...
}


-- **************************************************************
--
-- RESET ELEMENTARY PROCEDURE
--
-- **************************************************************


-- **************************************************************
--
-- Reset
--
-- **************************************************************

Reset ::= SEQUENCE {
    protocolIEs        ProtocolIE-Container       { {ResetIEs} },
    ...
}

ResetIEs S1AP-PROTOCOL-IES ::= {
    { ID id-Cause                      CRITICALITY ignore  TYPE Cause                           PRESENCE mandatory  }|
    { ID id-ResetType              CRITICALITY reject  TYPE ResetType          PRESENCE mandatory   },
    ...
}

ResetType ::= CHOICE {
    s1-Interface        ResetAll,
    partOfS1-Interface      UE-associatedLogicalS1-ConnectionListRes,
    ...
}



ResetAll ::= ENUMERATED {
    reset-all,
    ...
}

UE-associatedLogicalS1-ConnectionListRes ::= SEQUENCE (SIZE(1.. maxNrOfIndividualS1ConnectionsToReset)) OF ProtocolIE-SingleContainer { { UE-
associatedLogicalS1-ConnectionItemRes } }

UE-associatedLogicalS1-ConnectionItemRes    S1AP-PROTOCOL-IES ::= {
    { ID id-UE-associatedLogicalS1-ConnectionItem   CRITICALITY reject   TYPE UE-associatedLogicalS1-ConnectionItem   PRESENCE mandatory },
    ...
}


-- **************************************************************
--
-- Reset Acknowledge
--
```

```
-- *************************************************************

ResetAcknowledge ::= SEQUENCE {
    protocolIEs          ProtocolIE-Container       { {ResetAcknowledgeIEs} },
    ...
}

ResetAcknowledgeIEs S1AP-PROTOCOL-IES ::= {
    { ID id-UE-associatedLogicalS1-ConnectionListResAck    CRITICALITY ignore  TYPE UE-associatedLogicalS1-ConnectionListResAck       PRESENCE
optional    }|
    { ID id-CriticalityDiagnostics     CRITICALITY ignore  TYPE CriticalityDiagnostics        PRESENCE optional  },
    ...
}

UE-associatedLogicalS1-ConnectionListResAck ::= SEQUENCE (SIZE(1.. maxNrOfIndividualS1ConnectionsToReset)) OF ProtocolIE-SingleContainer { { UE-
associatedLogicalS1-ConnectionItemResAck } }

UE-associatedLogicalS1-ConnectionItemResAck    S1AP-PROTOCOL-IES ::= {
    { ID id-UE-associatedLogicalS1-ConnectionItem    CRITICALITY ignore    TYPE UE-associatedLogicalS1-ConnectionItem   PRESENCE mandatory },
    ...
}

-- *************************************************************
--
-- ERROR INDICATION ELEMENTARY PROCEDURE
--
-- *************************************************************

-- *************************************************************
--
-- Error Indication
--
-- *************************************************************

ErrorIndication ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container       {{ErrorIndicationIEs}},
    ...
}

ErrorIndicationIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID            CRITICALITY ignore  TYPE MME-UE-S1AP-ID           PRESENCE optional } |
    { ID id-eNB-UE-S1AP-ID            CRITICALITY ignore  TYPE ENB-UE-S1AP-ID           PRESENCE optional } |
    { ID id-Cause                     CRITICALITY ignore  TYPE Cause                    PRESENCE optional } |
    { ID id-CriticalityDiagnostics    CRITICALITY ignore  TYPE CriticalityDiagnostics   PRESENCE optional } ,
    ...
}

-- *************************************************************
--
-- S1 SETUP ELEMENTARY PROCEDURE
--
-- *************************************************************

-- *************************************************************
```

ETSI

```
--
-- S1 Setup Request
--
-- ****************************************************************

S1SetupRequest ::= SEQUENCE {
    protocolIEs          ProtocolIE-Container        { {S1SetupRequestIEs} },
    ...
}

S1SetupRequestIEs S1AP-PROTOCOL-IES ::= {
    { ID id-ENB-Global-ID              CRITICALITY reject  TYPE ENB-Global-ID           PRESENCE mandatory  }|
    { ID id-eNBname             CRITICALITY ignore  TYPE ENBname          PRESENCE mandatory  }|
    { ID id-SupportedTAs        CRITICALITY reject  TYPE SupportedTAs     PRESENCE mandatory  },
    ...
}

-- ****************************************************************
--
-- S1 Setup Response
--
-- ****************************************************************

S1SetupResponse ::= SEQUENCE {
    protocolIEs          ProtocolIE-Container        { {S1SetupResponseIEs} },
    ...
}


S1SetupResponseIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MMEname             CRITICALITY ignore  TYPE MMEname          PRESENCE mandatory  }|
    { ID id-ServedPLMNs         CRITICALITY reject  TYPE ServedPLMNs      PRESENCE mandatory  }|
    { ID id-GUMMEI-ID              CRITICALITY reject  TYPE GUMMEI             PRESENCE mandatory  }|
    { ID id-RelativeMMECapacity                CRITICALITY reject  TYPE RelativeMMECapacity          PRESENCE mandatory  }|
    { ID id-CriticalityDiagnostics     CRITICALITY ignore  TYPE CriticalityDiagnostics      PRESENCE optional  },
    ...
}

-- ****************************************************************
--
-- S1 Setup Failure
--
-- ****************************************************************

S1SetupFailure ::= SEQUENCE {
    protocolIEs          ProtocolIE-Container        { {S1SetupFailureIEs} },
    ...
}

S1SetupFailureIEs S1AP-PROTOCOL-IES ::= {
    { ID id-Cause                      CRITICALITY ignore  TYPE Cause                        PRESENCE mandatory  }|
    { ID id-TimeToWait                 CRITICALITY ignore  TYPE TimeToWait              PRESENCE optional }|
    { ID id-CriticalityDiagnostics     CRITICALITY ignore  TYPE CriticalityDiagnostics      PRESENCE optional  },
    ...
```

```
}

-- **************************************************************
--
-- ENB CONFIGURATION UPDATE ELEMENTARY PROCEDURE
--
-- **************************************************************

-- **************************************************************
--
-- eNB Configuration Update
--
-- **************************************************************

ENBConfigurationUpdate ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container        { {ENBConfigurationUpdateIEs} },
    ...
}

ENBConfigurationUpdateIEs S1AP-PROTOCOL-IES ::= {
    { ID id-eNBname              CRITICALITY ignore  TYPE ENBname         PRESENCE optional   }|
    { ID id-SupportedTAs         CRITICALITY reject  TYPE SupportedTAs    PRESENCE optional   },
    ...
}

-- **************************************************************
--
-- eNB Configuration Update Acknowledge
--
-- **************************************************************

ENBConfigurationUpdateAcknowledge ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container        { {ENBConfigurationUpdateAcknowledgeIEs} },
    ...
}


ENBConfigurationUpdateAcknowledgeIEs S1AP-PROTOCOL-IES ::= {
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics       PRESENCE optional  },
    ...
}

-- **************************************************************
--
-- eNB Configuration Update Failure
--
-- **************************************************************

ENBConfigurationUpdateFailure ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container        { {ENBConfigurationUpdateFailureIEs} },
    ...
}

ENBConfigurationUpdateFailureIEs S1AP-PROTOCOL-IES ::= {
```

```
    { ID id-Cause                     CRITICALITY ignore  TYPE Cause                      PRESENCE mandatory  }|
    { ID id-TimeToWait                CRITICALITY ignore  TYPE TimeToWait                 PRESENCE optional }|
    { ID id-CriticalityDiagnostics    CRITICALITY ignore  TYPE CriticalityDiagnostics      PRESENCE optional },
...
}


-- ****************************************************************
--
-- MME Configuration UPDATE ELEMENTARY PROCEDURE
--
-- ****************************************************************

-- ****************************************************************
--
-- MME Configuration Update
--
-- ****************************************************************

MMEConfigurationUpdate ::= SEQUENCE {
    protocolIEs        ProtocolIE-Container       { {MMEConfigurationUpdateIEs} },
    ...
}

MMEConfigurationUpdateIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MMEname             CRITICALITY ignore  TYPE MMEname             PRESENCE optional   }|
    { ID id-ServedPLMNs         CRITICALITY reject  TYPE ServedPLMNs         PRESENCE optional   }|
    { ID id-GUMMEI-ID           CRITICALITY reject  TYPE GUMMEI             PRESENCE optional   }|
    { ID id-RelativeMMECapacity CRITICALITY reject  TYPE RelativeMMECapacity   PRESENCE optional},
    ...
}

-- ****************************************************************
--
-- MME Configuration Update Acknowledge
--
-- ****************************************************************

MMEConfigurationUpdateAcknowledge ::= SEQUENCE {
    protocolIEs        ProtocolIE-Container       { {MMEConfigurationUpdateAcknowledgeIEs} },
    ...
}


MMEConfigurationUpdateAcknowledgeIEs S1AP-PROTOCOL-IES ::= {
    { ID id-CriticalityDiagnostics     CRITICALITY ignore  TYPE CriticalityDiagnostics       PRESENCE optional  },
    ...
}

-- ****************************************************************
--
-- MME Configuration Update Failure
--
-- ****************************************************************
```

```
MMEConfigurationUpdateFailure ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container       { {MMEConfigurationUpdateFailureIEs} },
    ...
}

MMEConfigurationUpdateFailureIEs S1AP-PROTOCOL-IES ::= {
    { ID id-Cause                       CRITICALITY ignore  TYPE Cause                         PRESENCE mandatory   }|
    { ID id-TimeToWait                  CRITICALITY ignore  TYPE TimeToWait                    PRESENCE optional }|
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics        PRESENCE optional   },
    ...
}

-- **************************************************************
--
-- DOWNLINK S1 CDMA2000 TUNNELING ELEMTARY PROCEDURE
--
-- **************************************************************

-- **************************************************************
--
-- Downlink S1 CDMA2000 Tunneling
--
-- **************************************************************

DownlinkS1cdma2000tunneling ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container       { {DownlinkS1cdma2000tunnelingIEs} },
    ...
}

DownlinkS1cdma2000tunnelingIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID              CRITICALITY reject  TYPE MME-UE-S1AP-ID                PRESENCE mandatory   } |
    { ID id-eNB-UE-S1AP-ID              CRITICALITY reject  TYPE ENB-UE-S1AP-ID                PRESENCE mandatory   } |
    { ID id-SAEBearerSubjecttoDataForwardingList                       CRITICALITY ignore  TYPE SAEBearerSubjecttoDataForwardingList
    PRESENCE optional    } |
    { ID id-cdma2000HOStatus                      CRITICALITY ignore  TYPE Cdma2000HOStatus             PRESENCE optional   } |
    { ID id-cdma2000RATType             CRITICALITY reject  TYPE Cdma2000RATType               PRESENCE mandatory   } |
    { ID id-cdma2000PDU                 CRITICALITY reject  TYPE Cdma2000PDU                   PRESENCE mandatory   },
    ...
}

-- **************************************************************
--
-- UPLINK S1 CDMA2000 TUNNELING ELEMTARY PROCEDURE
--
-- **************************************************************

-- **************************************************************
--
-- Uplink S1 CDMA2000 Tunneling
--
-- **************************************************************

UplinkS1cdma2000tunneling ::= SEQUENCE {
```

```
    protocolIEs          ProtocolIE-Container      { {UplinkS1cdma2000tunnelingIEs} },
    ...
}

UplinkS1cdma2000tunnelingIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID                CRITICALITY reject  TYPE MME-UE-S1AP-ID              PRESENCE mandatory  } |
    { ID id-eNB-UE-S1AP-ID                CRITICALITY reject  TYPE ENB-UE-S1AP-ID              PRESENCE mandatory  } |
    { ID id-cdma2000RATType               CRITICALITY reject  TYPE Cdma2000RATType             PRESENCE mandatory  } |
    { ID id-cdma2000SectorID              CRITICALITY reject  TYPE Cdma2000SectorID            PRESENCE mandatory  } |
    { ID id-cdma2000HORequiredIndication        CRITICALITY ignore  TYPE Cdma2000HORequiredIndication      PRESENCE optional } |
    { ID id-cdma2000OneXMEID              CRITICALITY ignore  TYPE Cdma2000OneXMEID            PRESENCE optional } |
    { ID id-cdma2000OneXRAND              CRITICALITY ignore  TYPE Cdma2000OneXRAND            PRESENCE optional } |
    { ID id-cdma2000PDU                   CRITICALITY reject  TYPE Cdma2000PDU                 PRESENCE mandatory  },
    ...
}

-- *****************************************************************
--
-- UE CAPABILITY INFO INDICATION PROCEDURE
--
-- *****************************************************************


-- *****************************************************************
--
-- UE Capability Info Indication
--
-- *****************************************************************

UECapabilityInfoIndication ::= SEQUENCE {
    protocolIEs          ProtocolIE-Container      { { UECapabilityInfoIndicationIEs} },
    ...
}

UECapabilityInfoIndicationIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID                CRITICALITY reject  TYPE MME-UE-S1AP-ID              PRESENCE mandatory } |
    { ID id-eNB-UE-S1AP-ID                CRITICALITY reject  TYPE ENB-UE-S1AP-ID              PRESENCE mandatory } |
    { ID id-UERadioCapability             CRITICALITY ignore  TYPE UERadioCapability           PRESENCE mandatory } ,
    ...
}

-- *****************************************************************
--
-- eNB STATUS TRANSFER
--
-- *****************************************************************


-- *****************************************************************
--
-- eNB Status Transfer
--
-- *****************************************************************

ENBStatusTransfer ::= SEQUENCE {
    protocolIEs          ProtocolIE-Container      { {ENBStatusTransferIEs} },
```

```
    ...
}

ENBStatusTransferIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID          CRITICALITY reject  TYPE MME-UE-S1AP-ID                PRESENCE mandatory} |
    { ID id-eNB-UE-S1AP-ID          CRITICALITY reject  TYPE ENB-UE-S1AP-ID                PRESENCE mandatory} |
    { ID id-eNB-StatusTransfer-TransparentContainer CRITICALITY reject  TYPE ENB-StatusTransfer-TransparentContainer    PRESENCE mandatory} ,
    ...
}


-- *************************************************************
--
-- MME STATUS TRANSFER
--
-- *************************************************************


-- *************************************************************
--
-- MME Status Transfer
--
-- *************************************************************

MMEStatusTransfer ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container        { {MMEStatusTransferIEs} },
    ...
}

MMEStatusTransferIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID          CRITICALITY reject  TYPE MME-UE-S1AP-ID                PRESENCE mandatory} |
    { ID id-eNB-UE-S1AP-ID          CRITICALITY reject  TYPE ENB-UE-S1AP-ID                PRESENCE mandatory} |
    { ID id-eNB-StatusTransfer-TransparentContainer CRITICALITY reject  TYPE ENB-StatusTransfer-TransparentContainer    PRESENCE mandatory} ,
    ...
}


-- *************************************************************
--
-- Trace Procedures
--
-- *************************************************************
-- *************************************************************
--
-- Trace Start
--
-- *************************************************************

TraceStart ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container        { {TraceStartIEs} },
    ...
}

TraceStartIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID              CRITICALITY reject  TYPE MME-UE-S1AP-ID                PRESENCE mandatory} |
```

```
    { ID id-eNB-UE-S1AP-ID             CRITICALITY reject  TYPE ENB-UE-S1AP-ID           PRESENCE mandatory} |
    { ID id-TraceActivation            CRITICALITY ignore  TYPE TraceActivation          PRESENCE optional },
    ...
}


-- **************************************************************
--
-- Trace Failure Indication
--
-- **************************************************************

TraceFailureIndication ::= SEQUENCE {
    protocolIEs        ProtocolIE-Container      { {TraceFailureIndicationIEs} },
    ...
}

TraceFailureIndicationIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID             CRITICALITY reject  TYPE MME-UE-S1AP-ID           PRESENCE mandatory} |
    { ID id-eNB-UE-S1AP-ID             CRITICALITY reject  TYPE ENB-UE-S1AP-ID           PRESENCE mandatory} |
    { ID id-TraceReference             CRITICALITY ignore  TYPE TraceReference           PRESENCE mandatory} |
    { ID id-Cause                      CRITICALITY ignore  TYPE Cause                    PRESENCE mandatory} ,
    ...
}

-- **************************************************************
--
-- DEACTIVATE TRACE ELEMENTARY PROCEDURE
--
-- **************************************************************


-- **************************************************************
--
-- DEACTIVATE TRACE
--
-- **************************************************************

DeactivateTrace ::= SEQUENCE {
    protocolIEs        ProtocolIE-Container      { { DeactivateTraceIEs} },
    ...
}

DeactivateTraceIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID      CRITICALITY reject  TYPE MME-UE-S1AP-ID    PRESENCE mandatory} |
    { ID id-eNB-UE-S1AP-ID      CRITICALITY reject  TYPE ENB-UE-S1AP-ID    PRESENCE mandatory} |
    { ID id-TraceReference      CRITICALITY ignore  TYPE TraceReference    PRESENCE mandatory  },
    ...
}

-- **************************************************************
--
-- Location Reporting Control
--
-- **************************************************************
```

```
LocationReportingControl ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container        { { LocationReportingControlIEs} },
    ...
}

LocationReportingControlIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID          CRITICALITY reject  TYPE MME-UE-S1AP-ID          PRESENCE mandatory} |
    { ID id-eNB-UE-S1AP-ID          CRITICALITY reject  TYPE ENB-UE-S1AP-ID          PRESENCE mandatory} |
    { ID id-RequestType             CRITICALITY ignore  TYPE RequestType             PRESENCE mandatory } ,
    ...
}

-- ****************************************************************
--
-- Location Report Failure Indication
--
-- ****************************************************************

LocationReportingFailureIndication ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container        { { LocationReportingFailureIndicationIEs} },
    ...
}

LocationReportingFailureIndicationIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID          CRITICALITY reject  TYPE MME-UE-S1AP-ID          PRESENCE mandatory} |
    { ID id-eNB-UE-S1AP-ID          CRITICALITY reject  TYPE ENB-UE-S1AP-ID          PRESENCE mandatory} |
    { ID id-Cause                   CRITICALITY ignore  TYPE Cause                   PRESENCE optional } ,
    ...
}

-- ****************************************************************
--
-- Location Report
--
-- ****************************************************************

LocationReport ::= SEQUENCE {
    protocolIEs         ProtocolIE-Container        { { LocationReportIEs} },
    ...
}

LocationReportIEs S1AP-PROTOCOL-IES ::= {
    { ID id-MME-UE-S1AP-ID          CRITICALITY reject  TYPE MME-UE-S1AP-ID          PRESENCE mandatory} |
    { ID id-eNB-UE-S1AP-ID          CRITICALITY reject  TYPE ENB-UE-S1AP-ID          PRESENCE mandatory} |
    { ID id-EUTRAN-CGI-ID           CRITICALITY ignore  TYPE EUTRAN-CGI-ID           PRESENCE mandatory} |
    { ID id-RequestType             CRITICALITY ignore  TYPE RequestType             PRESENCE mandatory} ,
    ...
}


END
```

9.3.4 Information Element Definitions

```
-- **************************************************************
--
-- Information Element Definitions
--
-- **************************************************************

S1AP-IEs {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (20) modules (3) s1ap (1) version1 (1) s1ap-IEs (2) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS
    id-SAEBearerInformationListItem,
    id-SAEBearerItem,
    id-Bearers-SubjectToStatusTransfer-Item,
    maxNrOfSAEBs,
    maxNrOfInterfaces,

    maxNrOfErrors,
    maxnoofBPLMNs,
    maxnoofPLMNsPerMME,
    maxnoofTACs,
    maxnoofEPLMNs,
    maxnoofEPLMNsPlusOne,
    maxnoofForbLACs,
    maxnoofForbTACs,
    maxnoofTACs

FROM S1AP-Constants

    Criticality,
    ProcedureCode,
    ProtocolIE-ID,
    TriggeringMessage
FROM S1AP-CommonDataTypes

    ProtocolExtensionContainer{},
    S1AP-PROTOCOL-EXTENSION,
    ProtocolIE-SingleContainer{},
    S1AP-PROTOCOL-IES

FROM S1AP-Containers;

-- A

AllocationRetentionPriority ::= SEQUENCE {
    priorityLevel          PriorityLevel,
    iE-Extensions          ProtocolExtensionContainer { {AllocationRetentionPriority-ExtIEs} } OPTIONAL,
```

ETSI

```
    ...
}

AllocationRetentionPriority-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

AggregateMaximumBitrate ::= SEQUENCE {
    aggregateMaximumBitRateDL               SAE-Bearer-BitRate,
    aggregateMaximumBitRateUL               SAE-Bearer-BitRate,
    iE-Extensions                           ProtocolExtensionContainer { {Aggregate-MaximumBitrates-ExtIEs} } OPTIONAL,
    ...
}

Aggregate-MaximumBitrates-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

-- B

Bearers-SubjectToStatusTransferList ::= SEQUENCE (SIZE(0.. maxNrOfSAEBs)) OF ProtocolIE-SingleContainer { { Bearers-SubjectToStatusTransfer-ItemIEs
} }

Bearers-SubjectToStatusTransfer-ItemIEs S1AP-PROTOCOL-IES ::= {
    { ID id-Bearers-SubjectToStatusTransfer-Item   CRITICALITY ignore  TYPE Bearers-SubjectToStatusTransfer-Item   PRESENCE mandatory   },
    ...
}

Bearers-SubjectToStatusTransfer-Item ::= SEQUENCE {
    sAE-Bearer-ID                           SAE-Bearer-ID,
    uL-COUNTvalue                           COUNTvalue,
    dL-COUNTvalue                           COUNTvalue,
    iE-Extensions                           ProtocolExtensionContainer { {Bearers-SubjectToStatusTransfer-ItemExtIEs} } OPTIONAL,
    ...
}

Bearers-SubjectToStatusTransfer-ItemExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

BPLMNs ::= SEQUENCE (SIZE(1.. maxnoofBPLMNs)) OF PLMNidentity


-- C

Cause ::= CHOICE {
    radioNetwork        CauseRadioNetwork,
    transport           CauseTransport,
    nas                 CauseNas,
    protocol            CauseProtocol,
    misc                CauseMisc,
    ...
}
```

ETSI

```
CauseMisc ::= ENUMERATED {
    control-processing-overload,
    not-enough-user-plane-processing-resources,
    hardware-failure,
    om-intervention,
    unspecified,
    unknown-PLMN,
...
}

CauseProtocol ::= ENUMERATED {
    transfer-syntax-error,
    abstract-syntax-error-reject,
    abstract-syntax-error-ignore-and-notify,
    message-not-compatible-with-receiver-state,
    semantic-error,
    abstract-syntax-error-falsely-constructed-message,
    unspecified,
    ...
}

CauseRadioNetwork ::= ENUMERATED {
    unspecified,
    handover-triggered,
    tx2relocoverall-expiry,
    successful-handover,
    release-due-to-eutran-generated-reason,
    handover-cancelled,
    partial-handover,
    ho-failure-in-target-EPC-eNB-or-target-system,
    ho-target-not-allowed,
    tS1relocoverall-expiry,
    tS1relocprep-expiry,
    cell-not-available,
    unknown-targetID,
    no-radio-resources-available-in-target-cell,
    unknown-mme-ue-s1ap-id,
    unknown-enb-ue-s1ap-id,
    unknown-pair-ue-s1ap-id,
    ...

}

CauseTransport ::= ENUMERATED {
    transport-resource-unavailable,
    unspecified,
    ...
}

CauseNas ::= ENUMERATED {
    normal-release,
    authentication-failure,
    detach,
    unspecified,
```

```
    ...
}


Cdma2000PDU ::= OCTET STRING

Cdma2000RATType ::= ENUMERATED {
    hRPD,
    onexRTT,
    ...
}

Cdma2000SectorID ::= OCTET STRING

Cdma2000HOStatus ::= ENUMERATED {
    hOSuccess,
    hOFailure,
    ...
}

Cdma2000HORequiredIndication ::= ENUMERATED {
    true,
    ...
}

Cdma2000OneXMEID ::= OCTET STRING

Cdma2000OneXRAND ::= OCTET STRING

CGI ::= SEQUENCE {
    pLMNidentity              PLMNidentity,
    lAC            LAC,
    cI            CI
    }


CI                 ::= OCTET STRING (SIZE (2))

COUNTvalue ::= SEQUENCE {
    pDCP-SN        PDCP-SN,
    hFN            HFN,
    ...
}

CriticalityDiagnostics ::= SEQUENCE {
    procedureCode                  ProcedureCode                   OPTIONAL,
    triggeringMessage              TriggeringMessage          OPTIONAL,
    procedureCriticality           Criticality                OPTIONAL,
    iEsCriticalityDiagnostics      CriticalityDiagnostics-IE-List  OPTIONAL,
    iE-Extensions                  ProtocolExtensionContainer {{CriticalityDiagnostics-ExtIEs}} OPTIONAL,
    ...
}

CriticalityDiagnostics-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
```

```
    ...
}

CriticalityDiagnostics-IE-List ::= SEQUENCE (SIZE (1..maxNrOfErrors)) OF CriticalityDiagnostics-IE-Item

CriticalityDiagnostics-IE-Item ::=  SEQUENCE {
    iECriticality          Criticality,
    iE-ID                  ProtocolIE-ID,
    typeOfError            TypeOfError              OPTIONAL,
    iE-Extensions          ProtocolExtensionContainer {{CriticalityDiagnostics-IE-Item-ExtIEs}} OPTIONAL,
    ...
}

CriticalityDiagnostics-IE-Item-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}


-- D

DL-Forwarding ::= ENUMERATED {
    dL-Forwarding-proposed,
    ...
}

Direct-Forwarding-Path-Availability ::= ENUMERATED {
    directPathAvailable,
    ...
}

-- E

ENB-StatusTransfer-TransparentContainer     ::= SEQUENCE {
    bearers-SubjectToStatusTransferList    Bearers-SubjectToStatusTransferList    OPTIONAL,
    iE-Extensions           ProtocolExtensionContainer { {ENB-StatusTransfer-TransparentContainer-ExtIEs} } OPTIONAL,
    ...
}

ENB-StatusTransfer-TransparentContainer-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

ENB-UE-S1AP-ID             ::= INTEGER (0..16777215)
ENB-Global-ID                             ::= INTEGER (0..65535)

ENBname ::= OCTET STRING

EPLMNs ::= SEQUENCE (SIZE(1..maxnoofEPLMNs)) OF PLMNidentity
EventType   ::= ENUMERATED {
    direct,
    change-of-serve-cell,
    stop-change-of-serve-cell,
    ...
}
```

```
EUTRAN-CGI-ID ::= OCTET STRING
ExtendedRNC-ID                    ::= INTEGER (4096..65535)


-- F

ForbiddenInterRATs ::= ENUMERATED {
    all,
    geran,
    utran,
    ...
}

ForbiddenTAs ::= SEQUENCE (SIZE(1.. maxnoofEPLMNsPlusOne)) OF ForbiddenTAs-Item

ForbiddenTAs-Item ::= SEQUENCE {
    pLMN-Identity      PLMNidentity,
    forbiddenTACs      ForbiddenTACs
}

ForbiddenTACs ::= SEQUENCE (SIZE(1..maxnoofForbTACs)) OF TAC

ForbiddenLAs ::= SEQUENCE (SIZE(1..maxnoofEPLMNsPlusOne)) OF ForbiddenLAs-Item

ForbiddenLAs-Item ::= SEQUENCE {
    pLMN-Identity      PLMNidentity,
    forbiddenLACs      ForbiddenLACs
}

ForbiddenLACs ::= SEQUENCE (SIZE(1..maxnoofForbLACs)) OF LAC

-- G

GTP-TEID                   ::= OCTET STRING (SIZE (4))

GUMMEI          ::= SEQUENCE {
    pLMN-Identity      PLMNidentity,
    mME-Group-ID       MME-Group-ID,
    mME-Code           MME-Code,
    iE-Extensions                     ProtocolExtensionContainer { {GUMMEI-ExtIEs} } OPTIONAL,
    ...
}

GUMMEI-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

-- H

HandoverRestrictionList ::= SEQUENCE {
    servingPLMN               PLMNidentity,
    equivalentPLMNs           EPLMNs                   OPTIONAL,
    forbiddenTAs              ForbiddenTAs             OPTIONAL,
    forbiddenLAs              ForbiddenLAs             OPTIONAL,
```

ETSI

```
    forbiddenInterRATs              ForbiddenInterRATs          OPTIONAL,
    iE-Extensions                   ProtocolExtensionContainer { {HandoverRestrictionList-ExtIEs} } OPTIONAL,
    ...
}

HandoverRestrictionList-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

HandoverType ::= ENUMERATED {
    intralte,
    ltetoutran,
    ltetogeran,
    utrantolte,
    gerantolte,
    ...
}

HFN ::= INTEGER (0..1048575)

-- I

IMSI    ::= OCTET STRING (SIZE (3..8))

InterfacesToTraceList ::= SEQUENCE (SIZE (1..maxNrOfInterfaces)) OF InterfacesToTraceItem

InterfacesToTraceItem ::= SEQUENCE {
    interfaceType           InterfaceType,
    traceDepth              TraceDepth,
    iE-Extensions           ProtocolExtensionContainer { {InterfacesToTraceItem-ExtIEs} }   OPTIONAL,
    ...
}

InterfacesToTraceItem-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

InterfaceType ::= ENUMERATED {
    s1,
    x2,
    uu,
...
}

-- J
-- K
-- L


LAC ::= OCTET STRING (SIZE (2))

LAI ::= SEQUENCE {
    pLMNidentity            PLMNidentity,
    lAC             LAC,
```

```
    iE-Extensions          ProtocolExtensionContainer { {LAI-ExtIEs} } OPTIONAL
}

LAI-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

-- M

MMEname ::= OCTET STRING

MME-Group-ID    ::= OCTET STRING (SIZE (2))

MME-Code        ::= OCTET STRING (SIZE (1))

MME-UE-S1AP-ID              ::= INTEGER (0..4294967295)
M-TMSI          ::= OCTET STRING (SIZE (4))


-- N

NAS-PDU ::=  OCTET STRING


-- O
-- P

PagingDRX ::= INTEGER (0..4095)

PagingCause ::= ENUMERATED {
    terminating-conversational-call,
    terminating-streaming-call,
    terminating-interactive-call,
    terminating-background-call,
    terminating-low-priority-signalling,
    ...,
    terminating-high-priority-signalling
}
PDCP-SN ::= INTEGER (0..4095)

PLMNidentity              ::= TBCD-STRING

PriorityLevel             ::= INTEGER (0..15)


-- Q

QCI                       ::= INTEGER (1..256)

-- R

RelativeMMECapacity          ::= INTEGER (0..255)

RAC              ::= OCTET STRING (SIZE (1))
```

```
RequestType ::= SEQUENCE {
    eventType               EventType,
    reportArea              ReportArea,
    iE-Extensions           ProtocolExtensionContainer { { RequestType-ExtIEs} }    OPTIONAL,
    ...
}


RequestType-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

ReportArea   ::= OCTET STRING


RNC-ID                  ::= INTEGER (0..4095)

RRC-Container    ::= OCTET STRING

-- S

SAE-Bearer-ID       ::= OCTET STRING

SAEBearerInformationList     ::= SEQUENCE (SIZE (1.. maxNrOfSAEBs)) OF ProtocolIE-SingleContainer { { SAEBearerInformationListIEs } }

SAEBearerInformationListIEs S1AP-PROTOCOL-IES ::= {
    { ID id-SAEBearerInformationListItem           CRITICALITY ignore  TYPE SAEBearerInformationListItem      PRESENCE mandatory   },
    ...
}

SAEBearerInformationListItem ::= SEQUENCE {
    sAE-Bearer-ID               SAE-Bearer-ID,
    dL-Forwarding               DL-Forwarding,
    iE-Extensions               ProtocolExtensionContainer { {SAEBearerInformationListItem-ExtIEs} }       OPTIONAL,
    ...
}

SAEBearerInformationListItem-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

SAEBearerList ::= SEQUENCE (SIZE(0.. maxNrOfSAEBs)) OF ProtocolIE-SingleContainer { {SAEBearerItemIEs} }

SAEBearerItemIEs    S1AP-PROTOCOL-IES ::= {
    { ID id-SAEBearerItem   CRITICALITY reject    TYPE SAEBearerItem  PRESENCE mandatory },
    ...
}

SAEBearerItem ::= SEQUENCE {
    sAE-Bearer-ID           SAE-Bearer-ID,
    cause                   Cause,
    iE-Extensions           ProtocolExtensionContainer { {SAEBearerItem-ExtIEs} } OPTIONAL,
```

ETSI

```
    ...
}

SAEBearerItem-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}


SAE-Bearer-BitRate  ::= INTEGER (0..10000000)


SAE-BearerLevelQoSParameters ::= SEQUENCE {
    qCI          QCI,
    allocationRetentionPriority        AllocationRetentionPriority OPTIONAL,
    sAE-BearerType                     SAE-Bearer-Type,
    iE-Extensions                      ProtocolExtensionContainer { {SAE-Bearer-QoSParameters-ExtIEs} } OPTIONAL,
    ...
}

SAE-Bearer-QoSParameters-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

SAE-Bearer-Type ::= CHOICE {
    sAE-GBR-Bearer        SAE-GBR-Bearer,
    sAE-non-GBR-Bearer    SAE-non-GBR-Bearer,
    ...
}

SAE-GBR-Bearer ::= SEQUENCE {
    sAE-Bearer-MaximumBitrateDL        SAE-Bearer-BitRate,
    sAE-Bearer-MaximumBitrateUL        SAE-Bearer-BitRate,
    sAE-Bearer-GuaranteedBitrateDL     SAE-Bearer-BitRate,
    sAE-Bearer-GuaranteedBitrateUL     SAE-Bearer-BitRate,
    iE-Extensions                      ProtocolExtensionContainer { {SAE-GBR-Bearer-Parameters-ExtIEs} } OPTIONAL,
    ...
}

SAE-GBR-Bearer-Parameters-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}


SAE-non-GBR-Bearer ::= SEQUENCE {
    sAE-non-GBR-Bearer-Type        SAE-non-GBR-Bearer-Type,
    iE-Extensions                      ProtocolExtensionContainer { {SAE-non-GBR-Bearer-Parameters-ExtIEs} } OPTIONAL,
    ...
}


SAE-non-GBR-Bearer-Type ::= ENUMERATED {
    non-GBR-Bearer,
    ...
}
```

ETSI

```
SAE-non-GBR-Bearer-Parameters-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

SecurityInfo ::= SEQUENCE {
    securityKey      SecurityKey,
    iE-Extensions             ProtocolExtensionContainer { { SecurityInfo-ExtIEs} } OPTIONAL,
    ...
}

SecurityKey ::= BIT STRING (SIZE(128))


SecurityInfo-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

SecurityInformation ::= SEQUENCE {
    securityPlaceHolder    SecurityPlaceHolder,
    iE-Extensions             ProtocolExtensionContainer { { SecurityInformation-ExtIEs} } OPTIONAL,
    ...
}

SecurityPlaceHolder ::= ENUMERATED {
    whatever,
    ...
}

SecurityInformation-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

SourceBSS-ToTargetBSS-TransparentContainer     ::= OCTET STRING

SourceID ::= SEQUENCE {
    sourceeNB-ID          SourceeNB-ID,
    ...
}

SourceeNB-ID ::= SEQUENCE {
    pLMNidentity              PLMNidentity,
    eNB-Global-ID             ENB-Global-ID -- FFS
}

SourceeNodeB-ToTargeteNodeB-TransparentContainer      ::= SEQUENCE {
    rRC-Container                RRC-Container,
    sAEBearerInformationList     SAEBearerInformationList       OPTIONAL,
    iE-Extensions             ProtocolExtensionContainer { {SourceeNodeB-ToTargeteNodeB-TransparentContainer-ExtIEs} } OPTIONAL,
    ...
}

SourceeNodeB-ToTargeteNodeB-TransparentContainer-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
```

```
}


SourceRNC-ToTargetRNC-TransparentContainer      ::= OCTET STRING


ServedPLMNs ::= SEQUENCE (SIZE(1.. maxnoofPLMNsPerMME)) OF PLMNidentity

SupportedTAs ::= SEQUENCE (SIZE(1.. maxnoofTACs)) OF SupportedTAs-Item

SupportedTAs-Item ::=   SEQUENCE  {
    tAC                 TAC,
    broadcastPLMNs      BPLMNs,
    ...
}

S-TMSI ::= SEQUENCE {
    mMEC    MME-Code,
    m-TMSI  M-TMSI,
    ...
}


-- T

TAC ::= OCTET STRING

TAI ::= SEQUENCE {
    pLMNidentity            PLMNidentity,
    tAC                     TAC,
    iE-Extensions           ProtocolExtensionContainer { {TAI-ExtIEs} } OPTIONAL
}

TAI-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

TBCD-STRING ::= OCTET STRING (SIZE (3))

TargetID ::= CHOICE {
    targeteNB-ID            TargeteNB-ID,
    targetRNC-ID            TargetRNC-ID,
    cGI             CGI,
    ...
}

TargeteNB-ID ::= SEQUENCE {
    pLMNidentity                PLMNidentity,
    eNB-Global-ID               ENB-Global-ID -- FFS
}

TargetRNC-ID ::= SEQUENCE {
    lAI            LAI,
    rAC            RAC         OPTIONAL,
```

```
    rNC-ID              RNC-ID
    }


TargeteNodeB-ToSourceeNodeB-TransparentContainer        ::= SEQUENCE {
    rRC-Container               RRC-Container,
    iE-Extensions           ProtocolExtensionContainer { {TargeteNodeB-ToSourceeNodeB-TransparentContainer-ExtIEs} } OPTIONAL,
    ...
}

TargeteNodeB-ToSourceeNodeB-TransparentContainer-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

TargetRNC-ToSourceRNC-TransparentContainer      ::= OCTET STRING
TargetBSS-ToSourceBSS-TransparentContainer      ::= OCTET STRING

TimeToWait ::= OCTET STRING

TransportLayerAddress        ::= OCTET STRING

TraceActivation ::= SEQUENCE {
    traceReference                  TraceReference,
    interfacesToTraceList           InterfacesToTraceList,
    iE-Extensions                   ProtocolExtensionContainer { { TraceActivation-ExtIEs} }     OPTIONAL
}

TraceActivation-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

TraceDepth ::= ENUMERATED {
    minimum,
    medium,
    maximum,
    vendorMinimum,
    vendorMedium,
    vendorMaximum,
    ...
}

TraceReference ::=  OCTET STRING (SIZE (8))

TypeOfError ::= ENUMERATED {
    not-understood,
    missing,
    ...
}

-- U


UE-S1AP-IDs ::= CHOICE{
    uE-S1AP-ID-pair     UE-S1AP-ID-pair,
```

```
    mME-UE-S1AP-ID       MME-UE-S1AP-ID,
    eNB-UE-S1AP-ID       ENB-UE-S1AP-ID,
    ...
}

UE-S1AP-ID-pair ::= SEQUENCE{
    mME-UE-S1AP-ID       MME-UE-S1AP-ID,
    eNB-UE-S1AP-ID       ENB-UE-S1AP-ID
}

UE-associatedLogicalS1-ConnectionItem ::= SEQUENCE {
    mME-UE-S1AP-ID                    MME-UE-S1AP-ID OPTIONAL,
    eNB-UE-S1AP-ID                    ENB-UE-S1AP-ID OPTIONAL,
    iE-Extensions                     ProtocolExtensionContainer { { UE-associatedLogicalS1-ConnectionItemExtIEs} } OPTIONAL,
    ...
}


UE-associatedLogicalS1-ConnectionItemExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

UEIdentityIndexValue    ::= OCTET STRING

UEPagingID ::= CHOICE {
    s-TMSI      S-TMSI,
    iMSI        IMSI,
    ...
    }

UERadioCapability ::= OCTET STRING


-- V
-- W
-- X
-- Y
-- Z

END
```

9.3.5   Common Definitions

```
-- **************************************************************
--
-- Common definitions
--
-- **************************************************************

S1AP-CommonDataTypes {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (20) modules (3) s1ap (1) version1 (1) s1ap-CommonDataTypes (3) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

Criticality     ::= ENUMERATED { reject, ignore, notify }

Presence        ::= ENUMERATED { optional, conditional, mandatory }

PrivateIE-ID    ::= CHOICE {
    local               INTEGER (0..65535),
    global              OBJECT IDENTIFIER
}

ProcedureCode       ::= INTEGER (0..255)

ProtocolExtensionID ::= INTEGER (0..65535)

ProtocolIE-ID       ::= INTEGER (0..65535)

TriggeringMessage   ::= ENUMERATED { initiating-message, successful-outcome, unsuccessfull-outcome }

END
```

9.3.6   Constant Definitions

```
-- **************************************************************
--
-- Constant definitions
--
-- **************************************************************

S1AP-Constants {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (20) modules (3) s1ap (1) version1 (1) s1ap-Constants (4) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN
```

```
-- ***************************************************************
--
-- IE parameter types from other modules.
--
-- ***************************************************************

IMPORTS
    ProcedureCode,
    ProtocolIE-ID

FROM S1AP-CommonDataTypes;


-- ***************************************************************
--
-- Elementary Procedures
--
-- ***************************************************************

id-HandoverPreparation              ProcedureCode ::= 0
id-HandoverResourceAllocation       ProcedureCode ::= 1
id-HandoverNotification             ProcedureCode ::= 2
id-PathSwitchRequest                ProcedureCode ::= 3
id-HandoverCancel                   ProcedureCode ::= 4
id-SAEBearerSetup                      ProcedureCode ::= 5
id-SAEBearerModify                  ProcedureCode ::= 6
id-SAEBearerRelease                 ProcedureCode ::= 7
id-SAEBearerReleaseRequest             ProcedureCode ::= 8
id-InitialContextSetup                 ProcedureCode ::= 9
id-Paging                           ProcedureCode ::= 10
id-downlinkNASTransport             ProcedureCode ::= 11
id-initialUEMessage                 ProcedureCode ::= 12
id-uplinkNASTransport               ProcedureCode ::= 13
id-Reset                            ProcedureCode::= 14
id-ErrorIndication                  ProcedureCode ::= 15
id-NASNonDeliveryIndication         ProcedureCode ::= 16
id-S1Setup                          ProcedureCode ::= 17
id-UEContextReleaseRequest          ProcedureCode ::= 18
id-DownlinkS1cdma2000tunneling      ProcedureCode ::= 19
id-UplinkS1cdma2000tunneling        ProcedureCode ::= 20
id-UEContextModification            ProcedureCode ::= 21
id-UECapabilityInfoIndication       ProcedureCode ::= 22
id-UEContextRelease                 ProcedureCode ::= 23
id-eNBStatusTransfer                ProcedureCode ::= 24
id-MMEStatusTransfer                ProcedureCode ::= 25
id-DeactivateTrace                  ProcedureCode ::= 26
id-TraceStart                       ProcedureCode ::= 27
id-TraceFailureIndication           ProcedureCode ::= 28
id-ENBConfigurationUpdate           ProcedureCode ::= 29
id-MMEConfigurationUpdate           ProcedureCode ::= 30
id-LocationReportingControl         ProcedureCode ::= 31
id-LocationReportingFailureIndication   ProcedureCode ::= 32
id-LocationReport                   ProcedureCode ::= 33
```

```
-- *****************************************************************
--
-- Extension constants
--
-- *****************************************************************

maxPrivateIEs                        INTEGER ::= 65535
maxProtocolExtensions                INTEGER ::= 65535
maxProtocolIEs                       INTEGER ::= 65535
-- *****************************************************************
--
-- Lists
--
-- *****************************************************************

maxNrOfSAEBs                         INTEGER ::= 256
maxNrOfInterfaces                    INTEGER ::= 3    --FFS
maxnoofTAI                           INTEGER ::= 256 --FFS
maxnoofTACs                          INTEGER ::= 256 --FFS
maxNrOfErrors                        INTEGER ::= 256
maxnoofBPLMNs                        INTEGER ::= 6
maxnoofPLMNsPerMME                   INTEGER ::= 32 -- FFS
maxnoofEPLMNs                        INTEGER ::= 15
maxnoofEPLMNsPlusOne                 INTEGER ::= 16
maxnoofForbLACs                      INTEGER ::= 256      -- FFS Value to be checked
maxnoofForbTACs                      INTEGER ::= 256      -- FFS Value to be checked
maxNrOfIndividualS1ConnectionsToReset  INTEGER ::= 256




-- *****************************************************************
--
-- IEs
--
-- *****************************************************************

id-MME-UE-S1AP-ID                            ProtocolIE-ID ::= 0
id-HandoverType                              ProtocolIE-ID ::= 1
id-Cause                                     ProtocolIE-ID ::= 2
id-SourceID                                  ProtocolIE-ID ::= 3
id-TargetID                                  ProtocolIE-ID ::= 4
id-Intra-LTEHOInformationReq                 ProtocolIE-ID ::= 5
id-LTEtoUTRANHOInformationReq                ProtocolIE-ID ::= 6
id-LTEtoGERANHOInformationReq                ProtocolIE-ID ::= 7
id-eNB-UE-S1AP-ID                            ProtocolIE-ID ::= 8
id-Intra-LTEHOInformationRes                 ProtocolIE-ID ::= 9
id-LTEtoUTRANHOInformationRes                ProtocolIE-ID ::= 10
id-LTEtoGERANHOInformationRes                ProtocolIE-ID ::= 11
id-SAEBearerSubjecttoDataForwardingList      ProtocolIE-ID ::= 12
id-SAEBearertoReleaseListHOCmd               ProtocolIE-ID ::= 13
id-SAEBearerDataForwardingItem               ProtocolIE-ID ::= 14
id-SAEBearerReleaseItemBearerRelComp         ProtocolIE-ID ::= 15
id-SAEBearerToBeSetupListBearerSUReq         ProtocolIE-ID ::= 16
```

```
id-SAEBearerToBeSetupItemBearerSUReq          ProtocolIE-ID ::= 17
id-SAEBearerAdmittedList                      ProtocolIE-ID ::= 18
id-SAEBearerFailedToSetupListHOReqAck         ProtocolIE-ID ::= 19
id-SAEBearerAdmittedItem                      ProtocolIE-ID ::= 20
id-SAEBearerFailedtoSetupItemHOReqAck         ProtocolIE-ID ::= 21
id-SAEBearerToBeSwitchedDLList                ProtocolIE-ID ::= 22
id-SAEBearerToBeSwitchedDLItem                ProtocolIE-ID ::= 23
id-SAEBearerToBeSetupListCtxtSUReq            ProtocolIE-ID ::= 24
id-TraceActivation                            ProtocolIE-ID ::= 25
id-NAS-PDU                                    ProtocolIE-ID ::= 26
id-SAEBearerToBeSetupItemHOReq                ProtocolIE-ID ::= 27
id-SAEBearerSetupListBearerSURes              ProtocolIE-ID ::= 28
id-SAEBearerFailedToSetupListBearerSURes      ProtocolIE-ID ::= 29
id-SAEBearerToBeModifiedListBearerModReq      ProtocolIE-ID ::= 30
id-SAEBearerModifyListBearerModRes            ProtocolIE-ID ::= 31
id-SAEBearerFailedToModifyList                ProtocolIE-ID ::= 32
id-SAEBearerToBeReleasedList                  ProtocolIE-ID ::= 33
id-SAEBearerFailedToReleaseList               ProtocolIE-ID ::= 34
id-SAEBearerItem                              ProtocolIE-ID ::= 35
id-SAEBearerToBeModifiedItemBearerModReq      ProtocolIE-ID ::= 36
id-SAEBearerModifyItemBearerModRes            ProtocolIE-ID ::= 37
id-SAEBearerReleaseItem                       ProtocolIE-ID ::= 38
id-SAEBearerSetupItemBearerSURes              ProtocolIE-ID ::= 39
id-Security-Information                       ProtocolIE-ID ::= 40
id-HandoverRestrictionList                    ProtocolIE-ID ::= 41
id-UEPagingID                                 ProtocolIE-ID ::= 43
id-pagingDRX                                  ProtocolIE-ID ::= 44
id-pagingCause                                ProtocolIE-ID ::= 45
id-TAIList                                    ProtocolIE-ID ::= 46
id-TAIItem                                    ProtocolIE-ID ::= 47
id-SAEBearerFailedToSetupListCtxtSURes        ProtocolIE-ID ::= 48
id-SAEBearerReleaseItemHOCmd                  ProtocolIE-ID ::= 49
id-SAEBearerSetupItemCtxtSURes                ProtocolIE-ID ::= 50
id-SAEBearerSetupListCtxtSURes                ProtocolIE-ID ::= 51
id-SAEBearerToBeSetupItemCtxtSUReq            ProtocolIE-ID ::= 52
id-SAEBearerToBeSetupListHOReq                ProtocolIE-ID ::= 53
id-GERANtoLTEHOInformationReq                 ProtocolIE-ID ::= 54
id-GERANtoLTEHOInformationRes                 ProtocolIE-ID ::= 55
id-UTRANtoLTEHOInformationReq                 ProtocolIE-ID ::= 56
id-UTRANtoLTEHOInformationRes                 ProtocolIE-ID ::= 57
id-CriticalityDiagnostics                     ProtocolIE-ID ::= 58
id-ENB-Global-ID                              ProtocolIE-ID ::= 59
id-eNBname                                    ProtocolIE-ID ::= 60
id-MMEname                                    ProtocolIE-ID ::= 61
id-ServedPLMNs                                ProtocolIE-ID ::= 63
id-SupportedTAs                               ProtocolIE-ID ::= 64
id-TimeToWait                                 ProtocolIE-ID ::= 65
id-aggregateMaximumBitrate                    ProtocolIE-ID ::= 66
id-TAI                                        ProtocolIE-ID ::= 67
id-SAEBearerReleaseListBearerRelComp          ProtocolIE-ID ::= 69
id-cdma2000PDU                                ProtocolIE-ID ::= 70
id-cdma2000RATType                            ProtocolIE-ID ::= 71
id-cdma2000SectorID                           ProtocolIE-ID ::= 72
id-SecurityInfo                               ProtocolIE-ID ::= 73
```

```
id-UERadioCapability                              ProtocolIE-ID ::= 74
id-GUMMEI-ID                                      ProtocolIE-ID ::= 75
id-SAEBearerInformationListItem                   ProtocolIE-ID ::= 78
id-Direct-Forwarding-Path-Availability            ProtocolIE-ID ::= 79
id-UEIdentityIndexValue                           ProtocolIE-ID ::= 80
id-cdma2000HOStatus                               ProtocolIE-ID ::= 83
id-cdma2000HORequiredIndication                   ProtocolIE-ID ::= 84
id-cdma2000OneXMEID                               ProtocolIE-ID ::= 85
id-TraceReference                                 ProtocolIE-ID ::= 86
id-RelativeMMECapacity                            ProtocolIE-ID ::= 87
id-SourceMME-UE-S1AP-ID                           ProtocolIE-ID ::= 88
id-Bearers-SubjectToStatusTransfer-Item           ProtocolIE-ID ::= 89
id-eNB-StatusTransfer-TransparentContainer        ProtocolIE-ID ::= 90

id-UE-associatedLogicalS1-ConnectionItem          ProtocolIE-ID ::= 91
id-ResetType                                      ProtocolIE-ID ::= 92
id-UE-associatedLogicalS1-ConnectionListResAck    ProtocolIE-ID ::= 93
id-SAEBearerToBeSwitchedULItem                    ProtocolIE-ID ::= 94
id-SAEBearerToBeSwitchedULList                    ProtocolIE-ID ::= 95
id-S-TMSI                                         ProtocolIE-ID ::= 96
id-cdma2000OneXRAND                               ProtocolIE-ID ::= 97
id-RequestType                                    ProtocolIE-ID ::= 98
id-UE-S1AP-IDs                                    ProtocolIE-ID ::= 99
id-EUTRAN-CGI-ID                                  ProtocolIE-ID ::= 100

END
```

9.3.7   Container Definitions

```
-- **************************************************************
--
-- Container definitions
--
-- **************************************************************

S1AP-Containers {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (20) modules (3) s1ap (1) version1 (1) s1ap-Containers (5) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

-- **************************************************************
--
-- IE parameter types from other modules.
--
-- **************************************************************

IMPORTS
    Criticality,
    Presence,
    PrivateIE-ID,
```

```
    ProtocolExtensionID,
    ProtocolIE-ID
FROM S1AP-CommonDataTypes

    maxPrivateIEs,
    maxProtocolExtensions,
    maxProtocolIEs
FROM S1AP-Constants;

-- ***************************************************************
--
-- Class Definition for Protocol IEs
--
-- ***************************************************************

S1AP-PROTOCOL-IES ::= CLASS {
    &id             ProtocolIE-ID               UNIQUE,
    &criticality        Criticality,
    &Value,
    &presence          Presence
}
WITH SYNTAX {
    ID            &id
    CRITICALITY       &criticality
    TYPE              &Value
    PRESENCE          &presence
}

-- ***************************************************************
--
-- Class Definition for Protocol IEs
--
-- ***************************************************************

S1AP-PROTOCOL-IES-PAIR ::= CLASS {
    &id             ProtocolIE-ID               UNIQUE,
    &firstCriticality    Criticality,
    &FirstValue,
    &secondCriticality    Criticality,
    &SecondValue,
    &presence          Presence
}
WITH SYNTAX {
    ID            &id
    FIRST CRITICALITY      &firstCriticality
    FIRST TYPE         &FirstValue
    SECOND CRITICALITY      &secondCriticality
    SECOND TYPE        &SecondValue
    PRESENCE          &presence
}

-- ***************************************************************
--
-- Class Definition for Protocol Extensions
```

```
--
-- ****************************************************************

S1AP-PROTOCOL-EXTENSION ::= CLASS {
    &id             ProtocolExtensionID                 UNIQUE,
    &criticality         Criticality,
    &Extension,
    &presence        Presence
}
WITH SYNTAX {
    ID             &id
    CRITICALITY        &criticality
    EXTENSION          &Extension
    PRESENCE           &presence
}

-- ****************************************************************
--
-- Class Definition for Private IEs
--
-- ****************************************************************

S1AP-PRIVATE-IES ::= CLASS {
    &id             PrivateIE-ID,
    &criticality         Criticality,
    &Value,
    &presence        Presence
}
WITH SYNTAX {
    ID             &id
    CRITICALITY        &criticality
    TYPE           &Value
    PRESENCE           &presence
}

-- ****************************************************************
--
-- Container for Protocol IEs
--
-- ****************************************************************

ProtocolIE-Container {S1AP-PROTOCOL-IES : IEsSetParam} ::=
    SEQUENCE (SIZE (0..maxProtocolIEs)) OF
    ProtocolIE-Field {{IEsSetParam}}

ProtocolIE-SingleContainer {S1AP-PROTOCOL-IES : IEsSetParam} ::=
    ProtocolIE-Field {{IEsSetParam}}

ProtocolIE-Field {S1AP-PROTOCOL-IES : IEsSetParam} ::= SEQUENCE {
    id             S1AP-PROTOCOL-IES.&id               ({IEsSetParam}),
    criticality        S1AP-PROTOCOL-IES.&criticality         ({IEsSetParam}{@id}),
    value          S1AP-PROTOCOL-IES.&Value            ({IEsSetParam}{@id})
}
```

```
-- ***************************************************************
--
-- Container for Protocol IE Pairs
--
-- ***************************************************************

ProtocolIE-ContainerPair {S1AP-PROTOCOL-IES-PAIR : IEsSetParam} ::=
    SEQUENCE (SIZE (0..maxProtocolIEs)) OF
    ProtocolIE-FieldPair {{IEsSetParam}}

ProtocolIE-FieldPair {S1AP-PROTOCOL-IES-PAIR : IEsSetParam} ::= SEQUENCE {
    id                  S1AP-PROTOCOL-IES-PAIR.&id                ({IEsSetParam}),
    firstCriticality        S1AP-PROTOCOL-IES-PAIR.&firstCriticality    ({IEsSetParam}{@id}),
    firstValue          S1AP-PROTOCOL-IES-PAIR.&FirstValue          ({IEsSetParam}{@id}),
    secondCriticality       S1AP-PROTOCOL-IES-PAIR.&secondCriticality   ({IEsSetParam}{@id}),
    secondValue         S1AP-PROTOCOL-IES-PAIR.&SecondValue         ({IEsSetParam}{@id})
}

-- ***************************************************************
--
-- Container Lists for Protocol IE Containers
--
-- ***************************************************************

ProtocolIE-ContainerList {INTEGER : lowerBound, INTEGER : upperBound, S1AP-PROTOCOL-IES : IEsSetParam} ::=
    SEQUENCE (SIZE (lowerBound..upperBound)) OF
    ProtocolIE-SingleContainer {{IEsSetParam}}

ProtocolIE-ContainerPairList {INTEGER : lowerBound, INTEGER : upperBound, S1AP-PROTOCOL-IES-PAIR : IEsSetParam} ::=
    SEQUENCE (SIZE (lowerBound..upperBound)) OF
    ProtocolIE-ContainerPair {{IEsSetParam}}

-- ***************************************************************
--
-- Container for Protocol Extensions
--
-- ***************************************************************

ProtocolExtensionContainer {S1AP-PROTOCOL-EXTENSION : ExtensionSetParam} ::=
    SEQUENCE (SIZE (1..maxProtocolExtensions)) OF
    ProtocolExtensionField {{ExtensionSetParam}}

ProtocolExtensionField {S1AP-PROTOCOL-EXTENSION : ExtensionSetParam} ::= SEQUENCE {
    id                  S1AP-PROTOCOL-EXTENSION.&id             ({ExtensionSetParam}),
    criticality         S1AP-PROTOCOL-EXTENSION.&criticality        ({ExtensionSetParam}{@id}),
    extensionValue          S1AP-PROTOCOL-EXTENSION.&Extension      ({ExtensionSetParam}{@id})
}

-- ***************************************************************
--
-- Container for Private IEs
--
-- ***************************************************************
```

```
PrivateIE-Container {S1AP-PRIVATE-IES : IEsSetParam } ::=
    SEQUENCE (SIZE (1.. maxPrivateIEs)) OF
    PrivateIE-Field {{IEsSetParam}}

PrivateIE-Field {S1AP-PRIVATE-IES : IEsSetParam} ::= SEQUENCE {
    id              S1AP-PRIVATE-IES.&id             ({IEsSetParam}),
    criticality         S1AP-PRIVATE-IES.&criticality        ({IEsSetParam}{@id}),
    value           S1AP-PRIVATE-IES.&Value      ({IEsSetParam}{@id})
}

END
```

9.4 Message Transfer Syntax

S1AP shall use the ASN.1 Basic Packed Encoding Rules (BASIC-PER) Aligned Variant as transfer syntax as specified in ref. [3].

9.5 Timers

Void

10 Handling of Unknown, Unforeseen and Erroneous Protocol Data

10.1 General

Protocol Error cases can be divided into three classes:

- Transfer Syntax Error.

- Abstract Syntax Error.

- Logical Error.

Protocol errors can occur in the following functions within a receiving node:

Figure 10.1: Protocol Errors in S1AP.

The information stated in subclauses 10.2, 10.3 and 10.4, to be included in the message used when reporting an error, is what at minimum shall be included. Other optional information elements within the message may also be included, if available. This is also valid for the case when the reporting is done with a response message. The latter is an exception to what is stated in subclause 4.1.

10.2 Transfer Syntax Error

A Transfer Syntax Error occurs when the receiver is not able to decode the received physical message. Transfer syntax errors are always detected in the process of ASN.1 decoding. If a Transfer Syntax Error occurs, the receiver should initiate Error Indication procedure with appropriate cause value for the Transfer Syntax protocol error.

Examples for Transfer Syntax Errors are:

- Violation of value ranges in ASN.1 definition of messages. E.g.: If an IE has a defined value range of 0 to 10 (ASN.1: INTEGER (0..10)), and 12 will be received, then this will be treated as a transfer syntax error.

- Violation in list element constraints. E.g.: If a list is defined as containing 1 to 10 elements, and 12 elements will be received, than this case will be handled as a transfer syntax error.

- Missing mandatory elements in ASN.1 SEQUENCE definitions (as sent by the originator of the message).

- Wrong order of elements in ASN.1 SEQUENCE definitions (as sent by the originator of the message).

10.3   Abstract Syntax Error

10.3.1   General

An Abstract Syntax Error occurs when the receiving functional S1AP entity:

1. receives IEs or IE groups that cannot be understood (unknown IE ID);

2. receives IEs for which the logical range is violated (e.g.: ASN.1 definition: 0 to 15, the logical range is 0 to 10 (values 11 to 15 are undefined), and 12 will be received; this case will be handled as an abstract syntax error using criticality information sent by the originator of the message);

3. does not receive IEs or IE groups but according to the specified presence of the concerning object, the IEs or IE groups should have been present in the received message.

4. receives IEs or IE groups that are defined to be part of that message in wrong order or with too many occurrences of the same IE or IE group;

5. receives IEs or IE groups but according to the conditional presence of the concerning object and the specified condition, the IEs or IE groups should not have been present in the received message.

Cases 1 and 2 (not comprehended IE/IE group) are handled based on received Criticality information. Case 3 (missing IE/IE group) is handled based on Criticality information and Presence information for the missing IE/IE group specified in the version of the specification used by the receiver. Case 4 (IEs or IE groups in wrong order or with too many occurrences) and Case 5 (erroneously present conditional IEs or IE groups) result in rejecting the procedure.

If an Abstract Syntax Error occurs, the receiver shall read the remaining message and shall then for each detected Abstract Syntax Error that belong to cases 1-3 act according to the Criticality Information and Presence Information for the IE/IE group due to which Abstract Syntax Error occurred in accordance with subclauses 10.3.4 and 10.3.5. The handling of cases 4 and 5 is specified in subclause 10.3.6.

10.3.2   Criticality Information

In the S1AP messages there is criticality information set for individual IEs and/or IE groups. This criticality information instructs the receiver how to act when receiving an IE or an IE group that is not comprehended, i.e. the entire item (IE or IE group) which is not (fully or partially) comprehended shall be treated in accordance with its own criticality information as specified in subclause 10.3.4.

In addition, the criticality information is used in case of the missing IE/IE group abstract syntax error (see subclause 10.3.5).

The receiving node shall take different actions depending on the value of the Criticality Information. The three possible values of the Criticality Information for an IE/IE group are:

-   Reject IE.

-   Ignore IE and Notify Sender.

-   Ignore IE.

The following rules restrict when a receiving entity may consider an IE, an IE group, or an EP not comprehended (not implemented), and when action based on criticality information is applicable:

1. IE or IE group: When one new or modified IE or IE group is implemented for one EP from a standard version, then other new or modified IEs or IE groups specified for that EP in that standard version shall be considered comprehended by a receiving entity (some may still remain unsupported).

2. EP: The comprehension of different Eps within a standard version or between different standard versions is not mandated. Any EP that is not supported may be considered not comprehended, even if another EP from that standard version is comprehended, and action based on criticality shall be applied.

10.3.3   Presence Information

For many IEs/IE groups which are optional according to the ASN.1 transfer syntax, S1AP specifies separately if the presence of these IEs/IE groups is optional or mandatory with respect to RNS application by means of the presence field of the concerning object of class S1AP-PROTOCOL-IES, S1AP-PROTOCOL-IES-PAIR, S1AP-PROTOCOL-EXTENSION or S1AP-PRIVATE-IES.

The presence field of the indicated classes supports three values:

1. Optional;

2. Conditional;

3. Mandatory.

If an IE/IE group is not included in a received message and the presence of the IE/IE group is mandatory or the presence is conditional and the condition is true according to the version of the specification used by the receiver, an abstract syntax error occurs due to a missing IE/IE group.

If an IE/IE group is included in a received message and the presence of the IE/IE group is conditional and the condition is false according to the version of the specification used by the receiver, an abstract syntax error occurs due to this erroneously present conditional IE/IE group.

10.3.4   Not comprehended IE/IE group

10.3.4.1   Procedure Code

The receiving node shall treat the different types of received criticality information of the *Procedure Code* IE according to the following:

Reject IE:

-   If a message is received with a *Procedure Code* IE marked with "*Reject IE*" which the receiving node does not comprehend, the receiving node shall reject the procedure using the Error Indication procedure.

Ignore IE and Notify Sender:

-   If a message is received with a *Procedure Code* IE marked with "*Ignore IE and Notify Sender*" which the receiving node does not comprehend, the receiving node shall ignore the procedure and initiate the Error Indication procedure.

Ignore IE:

-   If a message is received with a *Procedure Code* IE marked with "*Ignore IE*" which the receiving node does not comprehend, the receiving node shall ignore the procedure.

When using the Error Indication procedure to reject a procedure or to report an ignored procedure it shall include the *Procedure Code* IE, the *Triggering Message* IE, and the *Procedure Criticality* IE in the *Criticality Diagnostics* IE.

10.3.4.1A   Type of Message

When the receiving node cannot decode the *Type of Message* IE, the Error Indication procedure shall be initiated with an appropriate cause value.

10.3.4.2   IEs other than the Procedure Code and Type of Message

The receiving node shall treat the different types of received criticality information of an IE/IE group other than the *Procedure Code* IE and *Type of Message* IE according to the following:

Reject IE:

-   If a message *initiating* a procedure is received containing one or more IEs/IE group marked with "*Reject IE*" which the receiving node does not comprehend; none of the functional requests of the message shall be executed.

The receiving node shall reject the procedure and report the rejection of one or more IEs/IE group using the message normally used to report unsuccessful outcome of the procedure. In case the information received in the initiating message was insufficient to determine a value for all IEs that are required to be present in the message used to report the unsuccessful outcome of the procedure, the receiving node shall instead terminate the procedure and initiate the Error Indication procedure.

- If a message *initiating* a procedure that does not have a message to report unsuccessful outcome is received containing one or more IEs/IE groups marked with "*Reject IE*" which the receiving node does not comprehend, the receiving node shall terminate the procedure and initiate the Error Indication procedure.

- If a *response* message is received containing one or more IEs marked with "*Reject IE*", that the receiving node does not comprehend, the receiving node shall consider the procedure as unsuccessfully terminated and initiate local error handling.

Ignore IE and Notify Sender:

- If a message *initiating* a procedure is received containing one or more IEs/IE groups marked with "*Ignore IE and Notify Sender*" which the receiving node does not comprehend, the receiving node shall ignore the content of the not comprehended IEs/IE groups, continue with the procedure as if the not comprehended IEs/IE groups were not received (except for the reporting) using the understood IEs/IE groups, and report in the response message of the procedure that one or more IEs/IE groups have been ignored. In case the information received in the initiating message was insufficient to determine a value for all IEs that are required to be present in the response message, the receiving node shall instead terminate the procedure and initiate the Error Indication procedure.

- if a message *initiating* a procedure that does not have a message to report the outcome of the procedure is received containing one or more IEs/IE groups marked with "*Ignore IE and Notify Sender*" which the receiving node does not comprehend, the receiving node shall ignore the content of the not comprehended IEs/IE groups, continue with the procedure as if the not comprehended IEs/IE groups were not received (except for the reporting) using the understood IEs/IE groups, and initiate the Error Indication procedure to report that one or more IEs/IE groups have been ignored.

- If a *response* message is received containing one or more IEs/IE groups marked with "*Ignore IE and Notify Sender*" which the receiving node does not comprehend, the receiving node shall ignore the content of the not comprehended IEs/IE groups, continue with the procedure as if the not comprehended IEs/IE groups were not received (except for the reporting) using the understood IEs/IE groups and initiate the Error Indication procedure.

Ignore IE:

- If a message *initiating* a procedure is received containing one or more IEs/IE groups marked with "*Ignore IE*" which the receiving node does not comprehend, the receiving node shall ignore the content of the not comprehended IEs/IE groups and continue with the procedure as if the not comprehended IEs/IE groups were not received using the understood IEs/IE groups.

- If a *response* message is received containing one or more IEs/IE groups marked with "*Ignore IE*" which the receiving node does not comprehend, the receiving node shall ignore the content of the not comprehended IEs/IE groups and continue with the procedure as if the not comprehended IEs/IE groups were not received using the understood IEs/IE groups.

When reporting not comprehended IEs/IE groups marked with "*Reject IE*" or "*Ignore IE and Notify Sender*" using a response message defined for the procedure, the *Information Element Criticality Diagnostics* IE shall be included in the *Criticality Diagnostics* IE for each reported IE/IE group.

When reporting not comprehended IEs/IE groups marked with "*Reject IE*" or "*Ignore IE and Notify Sender*" using the Error Indication procedure, the *Procedure Code* IE, the *Triggering Message* IE, *Procedure Criticality* IE, and the *Information Element Criticality Diagnostics* IE shall be included in the *Criticality Diagnostics* IE for each reported IE/IE group.

10.3.5   Missing IE or IE group

The receiving node shall treat the missing IE/IE group according to the criticality information for the missing IE/IE group in the received message specified in the version of this specification used by the receiver:

Reject IE:

- if a received message *initiating* a procedure is missing one or more IEs/IE groups with specified criticality "*Reject IE*"; none of the functional requests of the message shall be executed. The receiving node shall reject the procedure and report the missing IEs/IE groups using the message normally used to report unsuccessful outcome of the procedure. In case the information received in the initiating message was insufficient to determine a value for all IEs that are required to be present in the message used to report the unsuccessful outcome of the procedure, the receiving node shall instead terminate the procedure and initiate the Error Indication procedure.

- if a received message *initiating* a procedure that does not have a message to report unsuccessful outcome is missing one or more IEs/IE groups with specified criticality "*Reject IE*", the receiving node shall terminate the procedure and initiate the Error Indication procedure.

- if a received *response* message is missing one or more IEs/IE groups with specified criticality "*Reject IE*, the receiving node shall consider the procedure as unsuccessfully terminated and initiate local error handling.

Ignore IE and Notify Sender:

- if a received message *initiating* a procedure is missing one or more IEs/IE groups with specified criticality "*Ignore IE and Notify Sender*', the receiving node shall ignore that those IEs are missing and continue with the procedure based on the other IEs/IE groups present in the message and report in the response message of the procedure that one or more IEs/IE groups were missing. In case the information received in the initiating message was insufficient to determine a value for all IEs that are required to be present in the response message, the receiving node shall instead terminate the procedure and initiate the Error Indication procedure.

- if a received message *initiating* a procedure that does not have a message to report the outcome of the procedure is missing one or more IEs/IE groups with specified criticality "*Ignore IE and Notify Sender*', the receiving node shall ignore that those IEs are missing and continue with the procedure based on the other IEs/IE groups present in the message and initiate the Error Indication procedure to report that one or more IEs/IE groups were missing.

- if a received *response* message is missing one or more IEs/IE groups with specified criticality "*Ignore IE and Notify Sender*", the receiving node shall ignore that those IEs are missing and continue with the procedure based on the other IEs/IE groups present in the message and initiate the Error Indication procedure to report that one or more IEs/IE groups were missing.

Ignore IE:

- if a received message *initiating* a procedure is missing one or more IEs/IE groups with specified criticality '*Ignore IE*', the receiving node shall ignore that those IEs are missing and continue with the procedure based on the other IEs/IE groups present in the message.

- if a received *response* message is missing one or more IEs/IE groups with specified criticality '*Ignore IE*', the receiving node shall ignore that those IEs/IE groups are missing and continue with the procedure based on the other IEs/IE groups present in the message.

When reporting missing IEs/IE groups with specified criticality '*Reject IE*' or '*Ignore IE and Notify Sender*' using a response message defined for the procedure, the *Information Element Criticality Diagnostics* IE shall be included in the *Criticality Diagnostics* IE for each reported IE/IE group.

When reporting missing IEs/IE groups with specified criticality '*Reject IE*' or '*Ignore IE and Notify Sender*' using the Error Indication procedure, the *Procedure Code* IE, the *Triggering Message* IE, *Procedure Criticality* IE, and the *Information Element Criticality Diagnostics* IE shall be included in the *Criticality Diagnostics* IE for each reported IE/IE group.

10.3.6   IEs or IE groups received in wrong order or with too many occurrences or erroneously present

If a message with IEs or IE groups in wrong order or with too many occurrences is received or if IEs or IE groups with a conditional presence are present when the condition is not met (i.e. erroneously present), the receiving node shall behave according to the following:

- If a message *initiating* a procedure is received containing IEs or IE groups in wrong order or with too many occurrences or erroneously present, none of the functional requests of the message shall be executed. The receiving node shall reject the procedure and report the cause value "Abstract Syntax Error (Falsely Constructed

Message)" using the message normally used to report unsuccessful outcome of the procedure. In case the information received in the initiating message was insufficient to determine a value for all IEs that are required to be present in the message used to report the unsuccessful outcome of the procedure, the receiving node shall instead terminate the procedure and initiate the Error Indication procedure.

- If a message *initiating* a procedure that does not have a message to report unsuccessful outcome is received containing IEs or IE groups in wrong order or with too many occurrences or erroneously present, the receiving node shall terminate the procedure and initiate the Error Indication procedure, and use cause value "Abstract Syntax Error (Falsely Constructed Message)".

- If a *response* message is received containing IEs or IE groups in wrong order or with too many occurrences or erroneously present, the receiving node shall consider the procedure as unsuccessfully terminated and initiate local error handling.

When determining the correct order only the IEs specified in the specification version used by the receiver shall be considered.

10.4   Logical Error

Logical error situations occur when a message is comprehended correctly, but the information contained within the message is not valid (i.e. semantic error), or describes a procedure which is not compatible with the state of the receiver. In these conditions, the following behaviour shall be performed (unless otherwise specified) as defined by the class of the elementary procedure, irrespective of the criticality information of the IEs/IE groups containing the erroneous values.

<u>**Class 1:**</u>

Where the logical error occurs in a request message of a class 1 procedure, and the procedure has a message to report this unsuccessful outcome, this message shall be sent with an appropriate cause value. Typical cause values are:

- Semantic Error.

- Message not compatible with receiver state.

Where the logical error is contained in a request message of a class 1 procedure, and the procedure does not have a message to report this unsuccessful outcome, the procedure shall be terminated and the Error Indication procedure shall be initiated with an appropriate cause value. The *Procedure Code* IE and the *Triggering Message* IE within the *Criticality Diagnostics* IE shall then be included in order to identify the message containing the logical error.

Where the logical error exists in a response message of a class 1 procedure, the procedure shall be considered as unsuccessfully terminated and local error handling shall be initiated.

<u>**Class 2:**</u>

Where the logical error occurs in a message of a class 2 procedure, the procedure shall be terminated and the Error Indication procedure shall be initiated with an appropriate cause value. The *Procedure Code* IE and the *Triggering Message* IE within the *Criticality Diagnostics* IE shall then be included in order to identify the message containing the logical error.

10.5   Exceptions

The error handling for all the cases described hereafter shall take precedence over any other error handling described in the other subclauses of clause 10.

- If any type of error (Transfer Syntax Error, Abstract Syntax Error or Logical Error) is detected in the ERROR INDICATION message, it shall not trigger the Error Indication procedure in the receiving Node but local error handling.

- In case a response message or Error Indication message needs to be returned, but the information necessary to determine the receiver of that message is missing, the procedure shall be considered as unsuccessfully terminated and local error handling shall be initiated.

-    If an error that terminates a procedure occurs, the returned cause value shall reflect the error that caused the termination of the procedure even if one or more abstract syntax errors with criticality 'ignore and notify' have earlier occurred within the same procedure.

10.6   Handling of AP ID

Note: The 'first message' and the 'first returned message' as shown below correspond to the message for a UE-associated logical connection. The 'first message' has a new AP ID from the sending node and the 'first returned message' is the first response message, which have a new APID from the node sending the 'first returned message'. Thereafter the two APIDs are included in all messages over the UE-associated logical connection.

If a subsequent message followed by the first message is to be sent before receiving a first returned message from the peer node, the subsequent message shall include the previously sent AP ID. The node which receives such a subsequent message shall not initiate an Error Indication procedure. If such subsequent message is the last message for this UE-associated logical connection, the node which receives such a subsequent message initiates a local release of any established UE-associated logical connection having the received AP ID as remote node identifier.

If a node detects a first message that includes an AP ID which is erroneous e.g. an AP ID for the same peer node which have been stored previously for another UE-associated logical connection, the receiving node shall return an ERROR INDICATION message with inclusion of only the previously received AP ID from the peer node and an appropriate cause value. In this case, both nodes shall initiate a local release of any established UE-associated logical connection having the erroneous AP ID as local or remote identifier.

If a node receives a message other than the first message that include an AP ID which is unknown to the node, the node shall initiate an Error Indication procedure with inclusion of only the previously received AP ID from the peer node and an appropriate cause value. The peer node shall initiate a local release of any established UE-associated logical connection having the AP ID as identifier.

If a node receives an unrecognized message the node shall initiate an Error Indication procedure with inclusion of only the previously received AP ID from the peer node and an appropriate cause value.

Editor"s Note: How to retrieve the APID of the peer node from the unrecognized message is FFS

Annex A (informative): Change history

Change history								
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment		Old	New
2007-01					Scope, Skeleton			0.0.0
2007-05					inclusion of post-RAN3#55bis-email agreed text proposals		0.0.0	0.0.1
2007-06					inclusion of post-RAN3#56-email agreed text-proposals		0.0.1	0.1.0
2007-08					Updates according to discussions in RAN3#57		0.1.0	0.2.0
2007-09	37				Presentation to TSG-RAN for information -version 1.0.0		0.2.0	1.0.0
2007-10					Updates according to agreements in RAN3#57bis for ASN.1 framework and error handling, MME UE S1AP ID, eNB UE S1AP ID within all messages		1.0.0	1.1.0
2007-10					Updates according to agreements on the RAN3 email reflector following the 'complementing' exercise. The incorporated documents are R3-072031, R3-072032, R3-072033, R3-072034 and R3-072035. The content is related to tabular message representation with tabular representation of Information Elements and ASN.1 code. V120 then served as a base for RAN3#58		1.1.0	1.2.0
2007-11					Updates according to agreements in R3-072320 and R3-072355 achieved in RAN3#58 and according to post RAN3#58 email check: R3-072417, R3-072348, R3-072435, R3-072420, R3-072422, R3-072437, R3-072436, R3-072422, R3-072423.		1.2.0	1.3.0
2007-11	38	RP-070851			Presentation to TSG-RAN for approval		1.3.0	2.0.0
2007-12	38				specification approved at TSG-RAN and placed under change control		2.0.0	8.0.0
2008-03	39	RP-080080	58		RAN3 agreed changes for TS 36.413		8.0.0	8.1.0
2008-06	40	RP-080304	59	1	RAN3 agreed changes for TS 36.413		8.1.0	8.2.0

History

Document history		
V8.2.0	November 2008	Publication