LTE;
Evolved Universal Terrestrial Radio Access (E-UTRA);
S1 Application Protocol (S1AP)
(3GPP TS 36.413 version 8.6.1 Release 8)
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10 Handling of Unknown, Unforeseen and Erroneous Protocol Data

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Annex A (informative): S1AP Transparent containers content

Annex B (informative): Change history

History
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".
[7] 3GPP TS 32.421: "Trace concepts and requirements".
[10] 3GPP TS 32.422: "Trace control and configuration management".
[13] 3GPP TS 23.203: "Policy and charging control architecture".
[17] 3GPP TS 23.272: "Circuit Switched Fallback in Evolved Packet System; stage 2".
[18] 3GPP TS 48.018: "General Packet Radio Service (GPRS); BSS GPRS Protocol (BSSGP)".
[19] 3GPP TS 25.413: "UTRAN Iu interface RANAP signalling"


[22] 3GPP TS 36.423: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 Application Protocol (X2AP)".

[23] 3GPP TS 48.008: "Mobile Switching Centre-Base Station System (MSC-BSS) interface; Layer 3 specification".

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].

CSG Cell: an E-UTRAN cell broadcasting a CSG Identifier.

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. The usage of several S1AP EPs together or together with EPs from other interfaces is specified in stage 2 specifications (e.g. [11] and [14]).

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**: as defined in [2].

**MME UE S1AP ID**: as defined in [2].

**E-RAB**: as defined in [2].

**NOTE**: The E-RAB is either a default E-RAB or a dedicated E-RAB.

**E-RAB ID**: the E-RAB ID uniquely identifies an E-RAB for one UE.

**NOTE**: The E-RAB ID remains unique for the UE even if the UE-associated logical S1-connection is released during periods of user inactivity.

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

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].

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<td>CDMA</td>
<td>Code Division Multiple Access</td>
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<tr>
<td>CS</td>
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<td>CSG</td>
<td>Closed Subscriber Group</td>
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<td>CN</td>
<td>Core Network</td>
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<td>DL</td>
<td>Downlink</td>
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<td>ECGI</td>
<td>E-UTRAN Cell Global Identifier</td>
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<td>E-RAB</td>
<td>E-UTRAN Radio Access Bearer</td>
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<td>RRC</td>
<td>Radio Resource Control</td>
</tr>
<tr>
<td>RIM</td>
<td>RAN Information Management</td>
</tr>
<tr>
<td>SN</td>
<td>Sequence Number</td>
</tr>
<tr>
<td>S-TMSI</td>
<td>S-Temporary Mobile Subscriber Identity</td>
</tr>
<tr>
<td>TAI</td>
<td>Tracking Area Identity</td>
</tr>
<tr>
<td>TEID</td>
<td>Tunnel Endpoint Identifier</td>
</tr>
<tr>
<td>UE</td>
<td>User Equipment</td>
</tr>
<tr>
<td>UE-AMBR</td>
<td>UE-Aggregate Maximum Bitrate</td>
</tr>
<tr>
<td>UL</td>
<td>Uplink</td>
</tr>
</tbody>
</table>

4 General

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. E-RAB 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:

- **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.

- **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:

- **E-RAB management function:** This overall functionality is responsible for setting up, modifying and releasing E-RABs, which are triggered by the MME. The release of E-RABs 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 E-RAB(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
  - eNB and MME Configuration Update functions are to update application level configuration data needed for the eNB and MME to interoperate correctly on the S1 interface.

- **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.

- **UE Context Modification function:** This functionality allows to modify the established UE Context partly.

- **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.

- **Trace function:** This functionality is to control a trace recording for a UE in ECM_CONNECTED.

- **Location Reporting:** This functionality allows MME to be aware of the UE’s current location.

- **S1 CDMA2000 Tunneling function:** This functionality is to carry CDMA2000 signalling between UE and CDMA2000 RAT over the S1 Interface.

- **Warning message transmission function:** This functionality provides the means to start and overwrite the broadcasting of warning message.
- RAN Information Management (RIM) function: This functionality allows the request and transfer of RAN system information (e.g. GERAN system information) between two RAN nodes via the core network.

- Configuration Transfer function: This functionality allows the request and transfer of RAN configuration information (e.g. SON information) between two RAN nodes via the core network.
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

<table>
<thead>
<tr>
<th>Elementary Procedure</th>
<th>Initiating Message</th>
<th>Successful Outcome Response message</th>
<th>Unsuccessful Outcome Response message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handover Preparation</td>
<td>HANDOVER REQUIRED</td>
<td>HANDOVER COMMAND</td>
<td>HANDOVER PREPARATION FAILURE</td>
</tr>
<tr>
<td>Handover Resource Allocation</td>
<td>HANDOVER REQUEST</td>
<td>HANDOVER REQUEST ACKNOWLEDGE</td>
<td>HANDOVER FAILURE</td>
</tr>
<tr>
<td>Path Switch Request</td>
<td>PATH SWITCH REQUEST</td>
<td>PATH SWITCH REQUEST REQUEST ACKNOWLEDGE</td>
<td>PATH SWITCH REQUEST FAILURE</td>
</tr>
<tr>
<td>Handover Cancellation</td>
<td>HANONDOVER CANCEL</td>
<td>HANONDOVER CANCEL ACKNOWLEDGE</td>
<td></td>
</tr>
<tr>
<td>E-RAB Setup</td>
<td>E-RAB SETUP REQUEST</td>
<td>E-RAB SETUP RESPONSE</td>
<td></td>
</tr>
<tr>
<td>E-RAB Modify</td>
<td>E-RAB MODIFY REQUEST</td>
<td>E-RAB MODIFY RESPONSE</td>
<td></td>
</tr>
<tr>
<td>E-RAB Release</td>
<td>E-RAB RELEASE COMMAND</td>
<td>E-RAB RELEASE RESPONSE</td>
<td></td>
</tr>
<tr>
<td>Initial Context Setup</td>
<td>INITIAL CONTEXT SETUP REQUEST</td>
<td>INITIAL CONTEXT SETUP RESPONSE</td>
<td>INITIAL CONTEXT SETUP FAILURE</td>
</tr>
<tr>
<td>Reset</td>
<td>RESET</td>
<td>RESET ACKNOWLEDGE</td>
<td></td>
</tr>
<tr>
<td>S1 Setup</td>
<td>S1 SETUP REQUEST</td>
<td>S1 SETUP RESPONSE</td>
<td>S1 SETUP FAILURE</td>
</tr>
<tr>
<td>UE Context Release</td>
<td>UE CONTEXT RELEASE COMMAND</td>
<td>UE CONTEXT RELEASE COMPLETE</td>
<td></td>
</tr>
<tr>
<td>UE Context Modification</td>
<td>UE CONTEXT MODIFICATION REQUEST</td>
<td>UE CONTEXT MODIFICATION RESPONSE</td>
<td>UE CONTEXT MODIFICATION FAILURE</td>
</tr>
<tr>
<td>eNB Configuration Update</td>
<td>ENB CONFIGURATION UPDATE</td>
<td>ENB CONFIGURATION UPDATE ACKNOWLEDGE</td>
<td>ENB CONFIGURATION UPDATE FAILURE</td>
</tr>
<tr>
<td>MME Configuration Update</td>
<td>MME CONFIGURATION UPDATE</td>
<td>MME CONFIGURATION UPDATE ACKNOWLEDGE</td>
<td>MME CONFIGURATION UPDATE FAILURE</td>
</tr>
<tr>
<td>Write-Replace Warning</td>
<td>WRITE-REPLACE WARNING REQUEST</td>
<td>WRITE-REPLACE WARNING RESPONSE</td>
<td></td>
</tr>
</tbody>
</table>
Table 2: Class 2 procedures

<table>
<thead>
<tr>
<th>Elementary Procedure</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handover Notification</td>
<td>HANOVER NOTIFY</td>
</tr>
<tr>
<td>E-RAB Release Indication</td>
<td>E-RAB RELEASE INDICATION</td>
</tr>
<tr>
<td>Paging</td>
<td>PAGING</td>
</tr>
<tr>
<td>Initial UE Message</td>
<td>INITIAL UE MESSAGE</td>
</tr>
<tr>
<td>Downlink NAS Transport</td>
<td>DOWNLINK NAS TRANSPORT</td>
</tr>
<tr>
<td>Uplink NAS Transport</td>
<td>UPLINK NAS TRANSPORT</td>
</tr>
<tr>
<td>NAS non delivery indication</td>
<td>NAS NON DELIVERY INDICATION</td>
</tr>
<tr>
<td>Error Indication</td>
<td>ERROR INDICATION</td>
</tr>
<tr>
<td>UE Context Release Request</td>
<td>UE CONTEXT RELEASE REQUEST</td>
</tr>
<tr>
<td>DownlinkS1 CDMA2000 Tunneling</td>
<td>DOWNLINK S1 CDMA2000 TUNNELING</td>
</tr>
<tr>
<td>Uplink S1 CDMA2000 Tunneling</td>
<td>UPLINK S1 CDMA2000 TUNNELING</td>
</tr>
<tr>
<td>UE Capability Info Indication</td>
<td>UE CAPABILITY INFO INDICATION</td>
</tr>
<tr>
<td>eNB Status Transfer</td>
<td>eNB STATUS TRANSFER</td>
</tr>
<tr>
<td>MME Status Transfer</td>
<td>MME STATUS TRANSFER</td>
</tr>
<tr>
<td>Deactivate Trace</td>
<td>DEACTIVATE TRACE</td>
</tr>
<tr>
<td>Trace Start</td>
<td>TRACE START</td>
</tr>
<tr>
<td>Trace Failure Indication</td>
<td>TRACE FAILURE INDICATION</td>
</tr>
<tr>
<td>Location Reporting Control</td>
<td>LOCATION REPORTING CONTROL</td>
</tr>
<tr>
<td>Location Reporting Failure Indication</td>
<td>LOCATION REPORTING FAILURE INDICATION</td>
</tr>
<tr>
<td>Location Report</td>
<td>LOCATION REPORT</td>
</tr>
<tr>
<td>Overload Start</td>
<td>OVERLOAD START</td>
</tr>
<tr>
<td>Overload Stop</td>
<td>OVERLOAD STOP</td>
</tr>
<tr>
<td>eNB Direct Information Transfer</td>
<td>eNB DIRECT INFORMATION TRANSFER</td>
</tr>
<tr>
<td>MME Direct Information Transfer</td>
<td>MME DIRECT INFORMATION TRANSFER</td>
</tr>
<tr>
<td>eNB Configuration Transfer</td>
<td>eNB CONFIGURATION TRANSFER</td>
</tr>
<tr>
<td>MME Configuration Transfer</td>
<td>MME CONFIGURATION TRANSFER</td>
</tr>
<tr>
<td>Cell Traffic Trace</td>
<td>CELL TRAFFIC TRACE</td>
</tr>
</tbody>
</table>

The following applies concerning interference between Elementary Procedures:

- The Reset procedure takes precedence over all other EPs.
- The UE Context Release procedure takes precedence over all other EPs that are using the UE-associated signalling.

8.2 E-RAB Management procedures

8.2.1 E-RAB Setup

8.2.1.1 General

The purpose of the E-RAB Setup procedure is to assign resources on Uu and S1 for one or several E-RABs and to setup corresponding Data Radio Bearers for a given UE. The procedure uses UE-associated signalling.
8.2.1.2 Successful Operation

The MME initiates the procedure by sending an E-RAB SETUP REQUEST message to the eNB.

- The E-RAB SETUP REQUEST message shall contain the information required by the eNB to build the E-RAB configuration consisting of at least one E-RAB including for each E-RAB to setup in the E-RAB to be Setup List IE.

Upon reception of the E-RAB SETUP REQUEST message, and if resources are available for the requested configuration, the eNB shall execute the requested E-RAB configuration. For each E-RAB and based on the E-RAB level QoS parameters IE the eNB shall establish a Data Radio Bearer and allocate the required resources on Uu. The eNB shall pass the NAS-PDU IE and the value contained in the E-RAB ID IE received for the E-RAB for each established Data Radio Bearer to the UE. The eNB does not send the NAS PDUs associated to the failed Data radio bearers to the UE. The eNB shall allocate the required resources on S1 for the E-RABs requested to be established.

The E-RAB SETUP REQUEST message may contain

- the UE Aggregate Maximum Bit Rate IE

If the UE Aggregate Maximum Bit Rate IE is included in the E-RAB SETUP REQUEST the eNB shall

- replace the previously provided UE Aggregate Maximum Bit Rate by the received UE Aggregate Maximum Bit Rate in the UE context; the eNB shall use the received UE Aggregate Maximum Bit Rate for non-GBR Bearers for the concerned UE.

If the UE Aggregate Maximum Bit Rate IE is not contained in the E-RAB SETUP REQUEST message, the eNB shall use the previously provided UE Aggregate Maximum Bit Rate which is stored in the UE context.

The eNB shall establish or modify the resources according to the values of the Allocation and Retention Priority IE (priority level and pre-emption indicators) and the resource situation as follows:

- The eNB shall consider the priority level of the requested E-RAB, when deciding on the resource allocation.

- The priority levels and the pre-emption indicators may (individually or in combination) be used to determine whether the E-RAB setup has to be performed unconditionally and immediately. If the requested E-RAB is marked as "may trigger pre-emption" and the resource situation requires so, the eNB may trigger the pre-emption procedure which may then cause the forced release of a lower priority E-RAB which is marked as "pre-emptable". Whilst the process and the extent of the pre-emption procedure is operator-dependent, the pre-emption indicators shall be treated as follows:

1. The values of the last received Pre-emption Vulnerability IE and Priority Level IE shall prevail.

2. If the Pre-emption Capability IE is set to "may trigger pre-emption", then this allocation request may trigger the pre-emption procedure.

3. If the Pre-emption Capability IE is set to "shall not trigger pre-emption", then this allocation request shall not trigger the pre-emption procedure.

4. If the Pre-emption Vulnerability IE is set to "pre-emptable", then this E-RAB shall be included in the pre-emption process.
5. If the Pre-emption Vulnerability IE is set to "not pre-emptable", then this E-RAB shall not be included in the pre-emption process.

6. If the Priority Level IE is set to "no priority" the given values for the Pre-emption Capability IE and Pre-emption Vulnerability IE shall not be considered. Instead the values "shall not trigger pre-emption" and "not pre-emptable" shall prevail.

   - The E-UTRAN pre-emption process shall keep the following rules:
     1. E-UTRAN shall only pre-empt E-RABs with lower priority, in ascending order of priority.
     2. The pre-emption may be done for E-RABs belonging to the same UE or to other UEs.

The eNB shall report to the MME, in the E-RAB SETUP RESPONSE message, the result for all the requested E-RABs.

   - A list of E-RABs which are successfully established shall be included in the E-RAB Setup List IE.
   - A list of E-RABs which failed to be established shall be included in the E-RAB Failed to Setup List IE.

In case of the establishment of an E-RAB the EPC must be prepared to receive user data before the E-RAB SETUP RESPONSE message has been received.

When the eNB reports unsuccessful establishment of an E-RAB, the cause value should be precise enough to enable the MME to know the reason for an unsuccessful establishment e.g.: "Radio resources not available", "Failure in the Radio Interface Procedure".

**Interactions with Handover Preparation procedure:**

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

1. The eNB shall send the E-RAB SETUP RESPONSE message in which the eNB shall indicate, if necessary
   - all the E-RABs fail with an appropriate cause value e.g."S1 intra system Handover Triggered", "S1 inter system Handover Triggered" or "X2 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

If the eNB receives a E-RAB SETUP REQUEST message containing a E-RAB Level QoS Parameters IE which contains a QCI IE indicating a GBR bearer (as defined in [13]), and which does not contain the GBR QoS Information IE, the eNB shall consider the establishment of the corresponding E-RAB as failed.

If the eNB receives an E-RAB SETUP REQUEST message containing several E-RAB ID IEs (in the E-RAB To Be Setup List IE) set to the same value, the eNB shall report the establishment of the corresponding E-RABs as failed in the E-RAB SETUP RESPONSE with the appropriate cause value, e.g. "Multiple E-RAB ID instances".

If the eNB receives an E-RAB SETUP REQUEST message containing a E-RAB ID IE (in the E-RAB To Be Setup List IE) set to the value that identifies an active E-RAB (established before the E-RAB SETUP REQUEST message was received), the eNB shall report the establishment of the new E-RAB as failed in the E-RAB SETUP RESPONSE with the appropriate cause value, e.g. "Multiple E-RAB ID instances".

8.2.2 E-RAB Modify

8.2.2.1 General

The purpose of the E-RAB Modify procedure is to enable modifications of already established E-RABs for a given UE. The procedure uses UE-associated signalling.
8.2.2.2 Successful Operation

The MME initiates the procedure by sending an E-RAB MODIFY REQUEST message to the eNB.

- The E-RAB MODIFY REQUEST message shall contain the information required by the eNB to modify one or several E-RABs of the existing E-RAB configuration.

Information shall be present in the E-RAB MODIFY REQUEST message only when any previously set value for the E-RAB configuration is requested to be modified.

Upon reception of the E-RAB MODIFY REQUEST message, and if resources are available for the requested target configuration, the eNB shall execute the modification of the requested E-RAB configuration. For each E-RAB that shall be modified and based on the new **E-RAB level QoS parameters** IE the eNB shall modify the Data 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 **E-RAB ID** IE received for the E-RAB to the UE when modifying the Data Radio Bearer configuration. The eNB does not send the NAS PDUs associated to the failed Data radio bearers to the UE. The eNB shall change allocation of resources on S1 according to the new resource request.

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

The E-RAB MODIFY REQUEST message may contain the

- the **UE Aggregate Maximum Bit Rate** IE.

If the **UE Aggregate Maximum Bit Rate** IE is included in the E-RAB MODIFY REQUEST the eNB shall

- replace the previously provided UE Aggregate Maximum Bit Rate by the received UE Aggregate Maximum Bit Rate in the UE context; the eNB shall use the received UE Aggregate Maximum Bit Rate for non-GBR Bearers for the concerned UE.

If the **UE Aggregate Maximum Bit Rate** IE is not contained in the E-RAB MODIFY REQUEST message, the eNB shall use the previously provided UE Aggregate Maximum Bit Rate which is stored in the UE context.

The modification of resources according to the values of the **Allocation and Retention Priority** IE shall follow the principles described for the E-RAB Setup procedure.

The eNB shall report to the MME, in the E-RAB MODIFY RESPONSE message, the result for all the requested E-RABs to be modified.

- A list of E-RABs which are successfully modified shall be included in the **E-RAB Modify List** IE.

- A list of E-RABs which failed to be modified shall be included in the **E-RAB Failed to Modify List** IE.

When the eNB reports unsuccessful modification of an E-RAB, the cause value should be precise enough to enable the MME to know the reason for an unsuccessful modification e.g.: "Radio resources not available", "Failure in the Radio Interface Procedure".

In case of a modification of an E-RAB the EPC must be prepared to receive user data according to the modified E-RAB profile prior to the E-RAB MODIFY RESPONSE message.
Interactions with Handover Preparation procedure:

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

1. The eNB shall send the E-RAB MODIFY RESPONSE message in which the eNB shall indicate, if necessary - all the E-RABs fail with an appropriate cause value e.g. ”S1 intra system Handover Triggered”, ”S1 inter system Handover Triggered” or ”X2 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

If the eNB receives a E-RAB MODIFY REQUEST message containing a *E-RAB Level QoS Parameters* IE which contains a *QCI* IE indicating a GBR bearer (as defined in [13]) for a E-RAB previously configured as a non-GBR bearer (as defined in [13]), and which does not contain the *GBR QoS Information* IE, the eNB shall consider the modification of the corresponding E-RAB as failed.

If the eNB receives an E-RAB MODIFY REQUEST message containing several *E-RAB ID* IEs (in the *E-RAB to be Modified List* IE) set to the same value, the eNB shall report the modification of the corresponding E-RABs as failed in the E-RAB MODIFY RESPONSE with the appropriate cause value, e.g. "Multiple E-RAB ID instances".

If the eNB receives an E-RAB MODIFY REQUEST message containing some *E-RAB ID* IEs that eNB does not recognize, the eNB shall report the corresponding invalid E-RABs as failed in the E-RAB MODIFY RESPONSE with the appropriate cause value, e.g. "Unknown E-RAB ID".

8.2.3 E-RAB Release

8.2.3.1 General

The purpose of the E-RAB Release procedure is to enable the release of already established E-RABs for a given UE. The procedure uses UE-associated signalling.

8.2.3.2 Successful Operation

8.2.3.2.1 E-RAB Release - MME initiated

The MME initiates the procedure by sending an E-RAB RELEASE COMMAND message.

The E-RAB RELEASE COMMAND message shall contain the information required by the eNB to release at least one E-RAB in the *E-RAB To Be Released List* IE. It shall also contain a *NAS-PDU* IE that the eNB shall pass to the UE.

![Diagram of E-RAB Release procedure. Successful operation.](image)
Upon reception of the E-RAB RELEASE COMMAND message the eNB shall execute the release of the requested E-RABs. For each E-RAB to be released the eNB shall release the corresponding Data Radio Bearer and release the allocated resources on Uu. The eNB shall pass the value contained in the E-RAB ID IE received for the E-RAB to the radio interface protocol for each Data Radio Bearer to be released. The eNB shall release allocated resources on S1 for the E-RABs requested to be released.

The E-RAB RELEASE COMMAND message may contain

- the UE Aggregate Maximum Bit Rate IE

If the UE Aggregate Maximum Bit Rate IE is included in the E-RAB RELEASE COMMAND the eNB shall

- replace the previously provided UE Aggregate Maximum Bit Rate by the received UE Aggregate Maximum Bit Rate in the UE context; the eNB shall use the received UE Aggregate Maximum Bit Rate for non-GBR Bearers for the concerned UE.

If the UE Aggregate Maximum Bit Rate IE is not contained in the E-RAB RELEASE COMMAND message, the eNB shall use the previously provided UE Aggregate Maximum Bit Rate which is stored in the UE context.

The eNB shall report to the MME, in the E-RAB RELEASE RESPONSE message, the result for all the E-RABs to be released.

- A list of E-RABs which are released successfully shall be included in the E-RAB Release List IE.
- A list of E-RABs which failed to be released shall be included in the E-RAB Failed to Release List IE.

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

After sending an E-RAB RELEASE RESPONSE message containing an E-RAB ID within the E-RAB Release List IE, the eNB shall be prepared to receive an E-RAB SETUP REQUEST message requesting establishment of an E-RAB with this E-RAB ID.

8.2.3.2.2 E-RAB Release Indication - eNB initiated

The eNB initiates the procedure by sending an E-RAB RELEASE INDICATION message towards the MME.

The E-RAB RELEASE INDICATION message shall contain at least one E-RAB released at the eNB, in the E-RAB Released List IE.

Upon reception of the E-RAB RELEASE INDICATION message the MME shall normally initiate the appropriate release procedure on the core network side for the E-RABs identified in the E-RAB RELEASE INDICATION message.

Interaction with UE Context Release Request procedure:

If the eNB wants to remove all remaining E-RABs e.g. for user inactivity, the UE Context Release Request procedure shall be used instead.

---

Figure 8.2.3.2.2-1: E-RAB Release INDICATION procedure. Successful operation.

The eNB initiates the procedure by sending an E-RAB RELEASE INDICATION message towards the MME.

The E-RAB RELEASE INDICATION message shall contain at least one E-RAB released at the eNB, in the E-RAB Released List IE.

Upon reception of the E-RAB RELEASE INDICATION message the MME shall normally initiate the appropriate release procedure on the core network side for the E-RABs identified in the E-RAB RELEASE INDICATION message.

Interaction with UE Context Release Request procedure:

If the eNB wants to remove all remaining E-RABs e.g. for user inactivity, the UE Context Release Request procedure shall be used instead.
8.2.3.3 Abnormal Conditions

If the eNB receives an E-RAB RELEASE COMMAND message containing multiple E-RAB ID IEs (in the E-RAB Released List IE) set to the same value, the eNB shall initiate the release of one corresponding E-RAB of the E-RAB Released List IE and ignore the duplication of the instances of the selected corresponding E-RABs.

If the MME receives an E-RAB RELEASE INDICATION message containing several E-RAB ID IEs (in the E-RAB Released List IE) set to the same value, the MME shall initiate the release of the corresponding E-RAB.

If the eNB receives an E-RAB RELEASE COMMAND message containing some E-RAB ID IEs that eNB does not recognize, the eNB shall report the corresponding invalid E-RABs as failed in the E-RAB RELEASE RESPONSE with the appropriate cause e.g. "Unknown E-RAB ID".

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 E-RAB context, the Security Key, Handover Restriction List, UE Radio capability and UE Security Capabilities etc. The procedure uses UE-associated signalling.

8.3.1.2 Successful Operation

![Initial Context Setup procedure. Successful operation.](image)

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

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

The E-RAB to be Setup List IE may contain:

- the NAS-PDU IE

The INITIAL CONTEXT SETUP REQUEST message may contain

- the Trace Activation IE
- the Handover Restriction List IE, which may contain roaming, area or access restrictions
- the UE Radio Capability IE.
- the Subscriber Profile ID for RAT/Frequency priority IE
- the CS Fallback Indicator IE.
- the SRVCC Operation Possible IE
The INITIAL CONTEXT SETUP REQUEST message shall contain the *Subscriber Profile ID for RAT/Frequency priority* IE, if available in the MME.

Upon receipt of the INITIAL CONTEXT SETUP REQUEST the eNB shall

- attempt to execute the requested E-RAB configuration.
- store the UE Aggregate Maximum Bit Rate in the UE context, and use the received UE Aggregate Maximum Bit Rate for non-GBR Bearers for the concerned UE.
- pass the value contained in the E-RAB ID IE and the NAS-PDU IE received for the E-RAB for each established Data radio bearer to the radio interface protocol. The eNB does not send the NAS PDUs associated to the failed Data radio bearers to the UE.

  store the received Handover restriction List in the UE context.
  store the received UE Radio Capability in the UE context.

- store the received Subscriber Profile ID for RAT/Frequency priority in the UE context and use it as defined in [14].
- store the received SRVCC operation possible in the UE context and use it as defined in [9].
- store the received UE Security Capabilities in the UE context
- store the received Security Key in the UE context and take it into use as defined in [15]

For the Initial Context Setup an initial value for the Next Hop Chaining Count is stored in the UE context.

The allocation of resources according to the values of the *Allocation and Retention Priority* IE shall follow the principles described for the E-RAB Setup procedure.

The eNB shall use the information in *Handover Restriction List* IE if present in the INITIAL CONTEXT SETUP REQUEST message 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 roaming area nor access restriction applies to the UE.

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

If the *CS Fallback Indicator* IE is included in the INITIAL CONTEXT SETUP REQUEST message, it indicates that the UE Context to be set-up is subject to CS Fallback. The eNB shall then act as defined in [17].

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 E-RABs in the following way:

- A list of E-RABs which are successfully established shall be included in the *E-RAB Setup List* IE
- A list of E-RABs which failed to be established shall be included in the *E-RAB Failed to Setup List* IE.

When the eNB reports unsuccessful establishment of an E-RAB, the cause value should be precise enough to enable the MME to know the reason for an unsuccessful establishment e.g.: "Radio resources not available", "Failure in the Radio Interface Procedure".

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

![Diagram](figure83131.png)

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

If the eNB is not able to establish an S1 UE context, or cannot even establish one non GBR bearer it shall consider the procedure as failed and reply with the INITIAL CONTEXT SETUP FAILURE message.

8.3.1.4 Abnormal Conditions

If the eNB receives an INITIAL CONTEXT SETUP REQUEST message containing a E-RAB Level QoS Parameters IE which contains a QCI IE indicating a GBR bearer (as defined in [13]), and which does not contain the GBR QoS Information IE, the eNB shall consider the establishment of the corresponding E-RAB as failed.

If the eNB receives an INITIAL CONTEXT SETUP REQUEST message containing several E-RAB ID IEs (in the E-RAB to Be Setup List IE) set to the same value, the eNB shall consider the establishment of the corresponding E-RABs as failed.

If the supported algorithms for encryption defined in the Encryption Algorithms IE in the UE Security Capabilities IE, plus the mandated support of EEA0 in all UEs [15], do not match any allowed algorithms defined in the configured list of allowed encryption algorithms in the eNB [15], the eNB shall reject the procedure using the INITIAL CONTEXT SETUP FAILURE message.

If the supported algorithms for integrity defined in the Integrity Protection Algorithms IE in the UE Security Capabilities IE, do not match any allowed algorithms defined in the configured list of allowed integrity protection algorithms in the eNB [15] or if all bits in Integrity Protection Algorithms IE are equal to 0, the eNB shall reject the procedure using the INITIAL CONTEXT SETUP FAILURE message.

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 E-UTRAN generated reason (e.g. "TX2RELOCOverall Expiry"). The procedure uses UE-associated signalling.

8.3.2.2 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 e.g. "User Inactivity", "Radio Connection With UE Lost" for the requested UE-associated logical S1-connection release.

**Interactions with UE Context Release procedure:**

The UE Context Release procedure should be initiated upon reception of an UE CONTEXT RELEASE REQUEST message when the cause is different than "User Inactivity".

### 8.3.3 UE Context Release (MME initiated)

#### 8.3.3.1 General

The purpose of the UE Context Release procedure is to enable the 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 or release of the old UE-associated logical S1-connection when two UE-associated logical S1-connections toward the same UE is detected after the UE has initiated establishment of a new UE-associated logical S1-connections. The procedure uses UE-associated S1 connection.

#### 8.3.3.2 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 "UE S1AP ID pair" if available, otherwise the message shall contain MME UE S1AP ID.

The MME provides the *cause* IE set to "Load Balancing TAU Required" in the UE CONTEXT RELEASE COMMAND sent to the eNB for all load balancing and offload cases in the MME.

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.
### 8.3.3.3 Abnormal Conditions

If the UE Context Release procedure is not initiated towards eNB before the expiry of the timer TS1RELOCoverall, the eNB shall request the MME to release the UE context.

If the UE returns to the eNB before the reception of the UE CONTEXT RELEASE COMMAND message or the expiry of the timer TS1RELOCoverall, the eNB shall stop the TS1RELOCoverall and continue to serve the UE.

### 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 the Security Key or Subscriber Profile ID for RAT/Frequency priority). The procedure uses UE-associated signalling.

#### 8.3.4.2 Successful Operation

![Figure 8.3.4.2-1: UE Context Modification procedure. Successful operation.](image)

The UE CONTEXT MODIFICATION REQUEST message may contain

- the Security Key IE
- the Subscriber Profile ID for RAT/Frequency priority IE
- the UE Aggregate Maximum Bit Rate IE
- the CS Fallback Indicator IE.

Upon receipt of the UE CONTEXT MODIFICATION REQUEST the eNB shall

- store the received Security Key IE, take it into use and associate it with the initial value of NCC as defined in [15].
- store the Subscriber Profile ID for RAT/Frequency priority IE and use it as defined in [14].

If the UE Aggregate Maximum Bit Rate IE is included in the UE CONTEXT MODIFICATION REQUEST the eNB shall

- replace the previously provided UE Aggregate Maximum Bit Rate by the received UE Aggregate Maximum Bit Rate in the UE context; the eNB shall use the received UE Aggregate Maximum Bit Rate for non-GBR Bearers for the concerned UE.

If the UE Aggregate Maximum Bit Rate IE is not contained in the UE CONTEXT MODIFICATION REQUEST message, the eNB shall use the previously provided UE Aggregate Maximum Bit Rate which is stored in the UE context.

If the CS Fallback Indicator IE is included in the UE CONTEXT MODIFICATION REQUEST message, it indicates that the concerned UE Context is subject to CS Fallback. The eNB shall then act as defined in [17].
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

![Diagram of UE Context Modification procedure: Unsuccessful operation.](image)

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. There is only one Handover Preparation procedure ongoing at the same time for a certain UE.

8.4.1.2 Successful Operation

![Diagram of Handover preparation: successful operation.](image)

The source eNB initiates the handover preparation by sending the HANDOVER REQUIRED message to the serving MME. When the source eNB sends the HANDOVER REQUIRED message, it shall start the timer TS1_RELOCPREP. The source eNB shall indicate the appropriate cause value for the handover in the *Cause* IE.

The source eNB shall include the *Source to Target Transparent Container* IE in the HANDOVER REQUIRED message.

In case of intra-system handover, the container shall be encoded according to the definition of the *Source eNB to Target eNB Transparent Container* IE. In case of handover to UTRAN, the information in the *Source to Target Transparent Container* IE shall be encoded according to the *Source RNC to Target RNC Transparent Container* IE definition as specified in [19] and the source eNB shall include the *UE History Information* IE in the *Source RNC to Target RNC*
Transparent Container IE. If the handover is to GERAN A/Gb mode then the Source to Target Transparent Container IE shall be encoded according to the definition of the Source BSS to Target BSS Transparent Container IE.

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 eNB.

If the Target to Source 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.

Upon reception of the HANDOVER COMMAND message the source eNB shall stop the timer TS1\_RELOCPREP and start the timer TS1\_RELOC\_Overall.

In case of intra-system handover, the information in the Target to Source Transparent Container IE shall be encoded according to the definition of the Target eNB to Source eNB Transparent Container IE. In case of inter-system handover to UTRAN, the Target to Source Transparent Container IE shall be encoded according to the Target RNC to Source RNC Transparent Container IE definition as specified in [19]. In case of inter-system handover to GERAN A/Gb mode, the Target to Source Transparent Container IE shall be encoded according to the Target BSS to Source BSS Transparent Container IE definition as described in [18].

If there are any E-RABs that could not be admitted in the target, they shall be indicated in the E-RABs to Release List IE.

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

The source eNB 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.

The source eNB shall include the SRVCC HO Indication IE in the HANDOVER REQUIRED message if the SRVCC operation is needed as defined in [9]. The source eNB shall indicate to the MME in the SRVCC HO Indication IE if the handover shall be prepared for PS and CS domain or only for CS domain. In case of inter-system handover from E-UTRAN, the source eNB shall indicate in the Target ID IE, in case of inter-system handover to UTRAN, the Target RNC-ID of the RNC, in case of inter-system handover to GERAN A/Gb mode the Cell Global Identity (including the Routing Area Code) of the cell in the target system.

In case the SRVCC operation is performed, SRVCC HO Indication IE indicates that handover shall be prepared only for CS domain, the source eNB shall include in the HANDOVER REQUIRED message one Source to Target Transparent Container IEs and encode the information in the Source to Target Transparent Container IE according to the definition of the Old BSS to New BSS Information IE as specified in [23].

In case the SRVCC operation is performed, SRVCC HO Indication IE indicates that handover shall be prepared for PS and CS domain, and if

- the target system is GERAN without DTM support then, the source eNB shall include in the HANDOVER REQUIRED message one Source to Target Transparent Container IEs and encode the information in the Source to Target Transparent Container IE according to the definition of the Old BSS to New BSS Information IE as specified in [23].

- the target system is GERAN with DTM support, then the source eNB shall include in the HANDOVER REQUIRED message the Source to Target Transparent Container IE and the Source to Target Transparent Container Secondary IE. The first shall be encoded according to the definition of the Source BSS to Target BSS Transparent Container IE as described in [18]. The second shall be encoded according to the definition of the Old BSS to New BSS Information IE as specified in [23].

In case the SRVCC operation is performed, SRVCC HO Indication IE indicates that handover shall be prepared only for CS domain, the HANDOVER COMMAND message shall contain one Target to Source Transparent Container IE that shall be encoded according to the definition of the Layer 3 Information IE as specified in [23].

In case the SRVCC operation is performed, SRVCC HO Indication IE indicates that handover shall be prepared for PS and CS domain, and if
- the target system is GERAN without DTM support, then the HANDOVER COMMAND message shall contain one Target to Source Transparent Container IE that shall be encoded according to the definition of the Layer 3 Information IE as specified in [23].

- the target system is GERAN with DTM support, then the HANDOVER COMMAND message shall contain the Target to Source Transparent Container IE and the Target to Source Transparent Container Secondary IE. The first IE shall be encoded according to the definition of the Layer 3 Information IE as specified in [23]. The second IE shall be encoded according to the definition of the Target BSS to Source BSS Transparent Container IE as specified in [18].

If the HANDOVER COMMAND message contains DL GTP-TEID IE and DL Transport Layer Address IE for a bearer in E-RABs Subject to Forwarding List IE then the target eNB accepts the forwarding of downlink data for this bearer, proposed by the source eNB.

If the HANDOVER COMMAND message contains UL GTP-TEID IE and UL Transport Layer Address IE for a bearer in E-RABs Subject to Forwarding List IE then the target eNB requests forwarding of uplink data for this bearer.

**Interactions with E-RAB 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 E-RAB 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. After successful completion of the Handover Cancel procedure, the source eNB shall continue the MME initiated E-RAB Management procedure

or

2. terminate the MME initiated E-RAB Management procedure by sending the appropriate response message with an appropriate cause value e.g. "S1 intra system Handover Triggered", "S1 inter system 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](source eNB) – MME

HANOVER REQUIRED

HANOVER PREPARATION FAILURE

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 HANOVER PREPARATION FAILURE message with an appropriate cause value to the source eNB.

**Interaction with Handover Cancel procedure:**

If there is no response from the EPC to the HANDOVER REQUIRED message before timer TS1RELOCPrep expires in the source eNB, the source eNB should cancel the Handover Preparation procedure by initiating the Handover Cancel procedure with the appropriate value for the Cause IE. The source eNB shall ignore any HANDOVER COMMAND or HANOVER PREPARATION FAILURE message received after the initiation of the Handover Cancel procedure.
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 eNB for the handover of a UE.

8.4.2.2 Successful Operation

The MME initiates the procedure by sending the HANDOVER REQUEST message to the target eNB. 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 shall use the information in Handover Restriction List IE if present in the HANDOVER REQUEST message 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.

Upon reception of the HANDOVER REQUEST message the eNB shall store the received UE Security Capabilities IE in the UE context and use it to prepare the configuration of the AS security relation with the UE.

If the SRVCC Operation Possible IE is included in the HANDOVER REQUEST message, the target eNB shall store the received SRVCC operation possible in the UE context and use it as defined in [9].

Upon reception of the HANDOVER REQUEST message the eNB shall store the received Security Context IE in the UE context and the eNB shall use it to derive the security configuration as specified in [15]

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

If the Subscriber Profile ID for RAT/Frequency priority IE is contained in the Source eNB to Target eNB Transparent Container IE, the target eNB shall store the received Subscriber Profile ID for RAT/Frequency priority in the UE context and use it as defined in [14].

Upon reception of the UE History Information IE, which is included within the Source eNB to Target eNB Transparent Container IE in the HANDOVER REQUEST message, the target eNB shall collect the information defined as mandatory in the UE History Information IE, for as long as the UE stays in one of its cells, and store the collected information to be used for future handover preparations.

After all necessary resources for the admitted E-RABs have been allocated the target eNB generates the HANDOVER REQUEST ACKNOWLEDGE message. The target eNB shall include in the E-RABs Admitted List IE the E-RABs for which resources have been prepared at the target cell. The E-RABs that have not been admitted in the target cell shall be included in the E-RABs 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-TEID IE and the DL Transport Layer Address IE within the E-RABs Admitted List IE of the HANDOVER REQUEST ACKNOWLEDGE message indicating that it accepts the proposed forwarding of downlink data for this bearer.

If the HANDOVER REQUEST ACKNOWLEDGE message contains UL GTP-TEID IE and UL Transport Layer Address IE for a bearer in E-RABs Admitted List IE then the target eNB requests forwarding of uplink data for this bearer.

If the Request Type IE is included in the HANDOVER REQUEST message then the target eNB should perform the requested location reporting functionality for the UE as described in section 8.11.

8.4.2.3 Unsuccessful Operation

![Figure 8.4.2.3-1: Handover resource allocation: unsuccessful operation](image)

If the target eNB does not admit at least one non-GBR E-RAB, or a failure occurs during the Handover Preparation, it shall send the HANDOVER FAILURE message to the MME with an appropriate cause value.

If the target eNB receives a HANDOVER REQUEST message containing RRC Container IE that does not include required information as specified in [16], the target eNB shall send the HANDOVER FAILURE message to the MME.

8.4.2.4 Abnormal Conditions

If the eNB receives a HANDOVER REQUEST message containing a E-RAB Level QoS Parameters IE which contains a QCI IE indicating a GBR bearer (as defined in [13]), and which does not contain the GBR QoS Information IE, the eNB shall not admit the corresponding E-RAB.

If the eNB receives a HANDOVER REQUEST message containing several E-RAB ID IEs (in the E-RABs To Be Setup List IE) set to the same value, the eNB shall not admit the corresponding E-RABs.

If the Subscriber Profile ID for RAT/Frequency priority IE is not contained in the Source eNB to Target eNB Transparent Container IE whereas available in the source eNB, the target eNB shall trigger a local error handling.

If the supported algorithms for encryption defined in the Encryption Algorithms IE in the UE Security Capabilities IE, plus the mandated support of EEA0 in all UEs [15], do not match any allowed algorithms defined in the configured list of allowed encryption algorithms in the eNB [15], the eNB shall reject the procedure using the HANDOVER FAILURE message.

If the supported algorithms for integrity defined in the Integrity Protection Algorithms IE in the UE Security Capabilities IE, do not match any allowed algorithms defined in the configured list of allowed integrity protection algorithms in the eNB [15] or if all bits in Integrity Protection Algorithms IE are equal to 0, the eNB shall reject the procedure using the HANDOVER FAILURE message.

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

The target eNB 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

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

If the E-RAB To Be Switched in Downlink List IE in the PATH SWITCH REQUEST message does not include all E-RABs previously included in the UE Context, the MME shall consider the non included E-RABs as implicitly released by the eNB.

After all necessary updates including the UP path switch have been successfully completed in the EPC for at least one of the E-RABs included in the PATH SWITCH REQUEST E-RAB To Be Switched in Downlink List IE, the MME shall send the PATH SWITCH REQUEST ACKNOWLEDGE message to the eNB and the procedure ends.

In case the EPC failed to perform the UP path switch for at least one, but not all, of the E-RABs included in the PATH SWITCH REQUEST E-RAB To Be Switched in Downlink List IE, the MME shall include the E-RABs it failed to perform UP path switch in the PATH SWITCH REQUEST ACKNOWLEDGE E-RAB To Be Released List IE. In this case, the eNB shall release the corresponding data radio bearers, and the eNB shall regard the E-RABs indicated in the E-RAB To Be Released List IE as being fully released.

Upon reception of the PATH SWITCH REQUEST ACKNOWLEDGE message the eNB shall store the received Security Context IE in the UE context and the eNB shall use it for the next X2 handover or Intra eNB handovers as specified in [15].

The PATH SWITCH REQUEST ACKNOWLEDGE message may contain
- the UE Aggregate Maximum Bit Rate IE

If the **UE Aggregate Maximum Bit Rate** IE is included in the **PATH SWITCH REQUEST ACKNOWLEDGE** the eNB shall
- replace the previously provided UE Aggregate Maximum Bit Rate by the received UE Aggregate Maximum Bit Rate in the UE context; the eNB shall use the received UE Aggregate Maximum Bit Rate for non-GBR Bearers for the concerned UE.

If the **UE Aggregate Maximum Bit Rate** IE is not contained in the **PATH SWITCH REQUEST ACKNOWLEDGE** message, the eNB shall use the previously provided UE Aggregate Maximum Bit Rate which is stored in the UE context.

In case the EPC decides to change the uplink termination point of the tunnels it may include the **E-RAB 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 E-RAB for which it wants to change the uplink tunnel termination point.

When the eNB receives the **PATH SWITCH REQUEST ACKNOWLEDGE** message and if this message includes the **E-RAB To Be Switched in Uplink List** IE, the eNB shall start delivering the uplink packets of the concerned E-RABs to the new uplink tunnel endpoints as indicated in the message.

### 8.4.4.3 Unsuccessful Operation

![Figure 8.4.4.3-1: Path switch request: unsuccessful operation](image)

If the EPC fails to switch the downlink GTP tunnel endpoint towards a new GTP tunnel endpoint for all E-RAB included in the **E-RAB To Be Switched in Downlink List** IE during the execution of the Path Switch Request procedure, the MME shall send the **PATH SWITCH REQUEST FAILURE** message to the eNB with an appropriate cause value. In this case, the eNB is expected to decide the subsequent actions.

### 8.4.4.4 Abnormal Conditions

If the MME receives a **PATH SWITCH REQUEST** message containing several **E-RAB ID** IEs (in the **E-RAB To Be Switched in Downlink List** IE) set to the same value, the MME shall send the **PATH SWITCH REQUEST FAILURE** message to the eNB.

### 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 preparation or an already prepared handover.

The procedure uses UE-associated signalling.
8.4.5.2 Successful Operation

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

If the source eNB becomes aware of the fact that an expected HANDOVER CANCEL ACKNOWLEDGE message is missing, the source eNB shall consider the Handover Cancellation as successfully terminated.

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 and HFN receiver status and the downlink PDCP-SN and HFN transmitter status from the source to the target eNB via the MME during an intra LTE S1 handover for each respective E-RAB for which PDCP-SN and HFN status preservation applies.

8.4.6.2 Successful Operation

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

Transmission and reception of an eNB STATUS TRANSFER message terminate the procedure in the MME. After this, the MME does not have a prepared E-RAB for that UE-associated logical S1-connection.

Figure 8.4.6.2-1: eNB Status Transfer procedure
The source eNB 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.

- For each E-RAB for which PDCP-SN and HFN status preservation applies the source eNB shall include the E-RAB ID IE, the UL COUNT value IE and the DL COUNT value IE within the E-RABs Subject to Status Transfer Item IE in the eNB Status Transfer Transparent Container IE of the eNB STATUS TRANSFER message.

The source eNB may also include in the eNB STATUS TRANSFER message the missing and received uplink SDUs in the Receive Status Of UL PDCP SDUs IE for each bearer for which the source eNB has accepted the request from the target eNB for uplink forwarding.

8.4.6.3 Unsuccessful Operation

Not applicable.

8.4.6.4 Abnormal Conditions

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 and HFN receiver status and the downlink PDCP-SN and HFN transmitter status from the source to the target eNB via the MME during an S1 handover for each respective E-RAB for which PDCP SN and HFN status preservation applies.

8.4.7.2 Successful Operation

![Figure 8.4.7.2-1: MME Status Transfer procedure](image)

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

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

If the Receive Status Of UL PDCP SDUs IE is included for at least one bearer in the eNB Status Transfer Transparent Container IE of the MME STATUS TRANSFER message, the target eNB may use it in a Status Report message sent to the UE over the radio.

8.4.7.3 Unsuccessful Operation

Not applicable.
8.4.7.4 Abnormal Conditions

If the target eNB receives this message for a UE for which no prepared handover exists at the target eNB, the target eNB 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

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 CN Domain IE shall be transferred transparently to the UE.

The Paging DRX IE may be included in the PAGING message, and if present the eNB shall use it according to [20].

The Allowed CSG ID List of the paged UE (CSG Id List IE) may be included in the PAGING message if respective subscription information is available for that UE. If present, the E-UTRAN shall, if possible, avoid to send paging UEs within CSG cells for which the UE has no subscription.

For each cell that belongs to any of the TA indicated in the List of TAIs IE, the eNB 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

When the eNB has received from the radio interface the first UL NAS message transmitted on an RRC connection to be forwarded to an MME, 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 UE S1AP ID 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. If the eNB does not support NNSF and the eNB has received from the radio interface the GUMMEI IE, the eNB may include it in the INITIAL UE MESSAGE message.

If the establishment of the UE-associated logical S1-connection towards the CN is performed due to an RRC connection establishment originating from a CSG cell, the CSG Id IE shall be included in the INITIAL UE MESSAGE message.

NOTE: the first UL NAS message is always received in the RRC CONNECTION SETUP COMPLETE message.

8.6.2.2 DOWNLINK NAS TRANSPORT

If the MME only need to send a NAS message transparently via the eNB to the UE and a UE-associated logical S1-connection exists for the UE or if the MME have received the eNB UE S1AP ID 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 UE S1AP ID to be used for the UE and include that in the DOWNLINK NAS TRANSPORT message. By the reception of MME UE S1AP ID 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 shall use the information in Handover Restriction List IE if present in the DOWNLINK NAS TRANSPORT message 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

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 eNB shall include the TAI and ECGI of the current cell in every S1-AP UPLINK NAS TRANSPORT message.

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

8.6.4 NAS NON DELIVERY INDICATION

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 an appropriate Cause IE e.g. "S1 intra system Handover Triggered", "S1 inter system Handover Triggered" or "X2 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

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

![Diagram of Reset procedure initiated from the MME. Successful operation.](image)

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 which 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 be 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 \textit{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 \textit{UE-associated logical S1-connection Item} IE for a UE association, the eNB shall include the \textit{MME UE S1AP ID} IE in the corresponding \textit{UE-associated logical S1-connection Item} IE in the RESET ACKNOWLEDGE message.

- If the eNB UE S1AP ID IE is included in the \textit{UE-associated logical S1-connection Item} IE for a UE association, the eNB shall include the \textit{eNB UE S1AP ID} IE in the corresponding \textit{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.](image)

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 which 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 \textit{UE-associated logical S1-connection list} IE, then:

- The MME shall use the \textit{MME UE S1AP ID} IE and/or the \textit{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 be reset, the \textit{UE-associated logical S1-connection Item} IE in the \textit{UE-associated logical S1-connection list} IE. The \textit{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 \textit{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 \textit{UE-associated logical S1-connection Item} IE for a UE association, the MME shall include the \textit{MME UE S1AP ID} IE in the corresponding \textit{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 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 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.](image-url)
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 eNB 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. The procedure uses non-UE associated signalling.

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, and clears MME overload state information at the eNB. If the eNB or Home eNB initiating the S1 Setup procedure supports a CSG cell, the procedure shall report the CSG ID(s) of the supported CSGs.

8.7.3.2 Successful Operation

The eNB 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.

If the eNB initiating the S1 SETUP procedure supports one (or more) CSG cell(s), the S1 SETUP REQUEST shall contain the CSG ID(s) of the supported CSG(s).
If the S1 SETUP REQUEST message contains the *eNB Name* IE the MME may use this IE as a human readable name of the eNB.

If the S1 SETUP RESPONSE message contains the *MME Name* IE the eNB may use this IE as a human readable name of the MME.

8.7.3.3 Unsuccessful Operation

![Figure 8.7.3.3-1: S1 Setup procedure: Unsuccessful Operation.](image)

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 eNB 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 none of the PLMNs provided by the eNB is identified by the MME, 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 does not affect existing UE-related contexts, if any.

8.7.4.2 Successful Operation

![Figure 8.7.4.2-1: ENB Configuration Update procedure: Successful Operation.](image)

The eNB initiates the procedure by sending an ENB CONFIGURATION UPDATE message to the MME including an appropriate set of updated configuration data that it has just taken into operational use. The MME responds with ENB CONFIGURATION UPDATE ACKNOWLEDGE message 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 that are not to be updated shall be included in the Supported TAs IE. The MME shall overwrite the whole list of TAs.

If the supported CSG ID(s) is(are) to be updated, the whole list of supported CSG IDs including those that are not to be updated shall be included in the CSG Id List IE. The MME shall overwrite the whole list of CSG IDs.

If the ENB CONFIGURATION UPDATE message contains the *eNB Name* IE the MME may use this IE as a human readable name of the eNB.

If the *Default Paging DRX* IE is included, the MME shall overwrite any previously stored default paging DRX value for the eNB.

The updated configuration data shall be stored in both eNB and MME and used for the duration of the TNL association or until any further update is triggered by the eNB.

The eNB may initiate a further eNB Configuration Update procedure only after a previous eNB Configuration Update procedure has been completed.

### 8.7.4.3 Unsuccessful Operation

![ENB Configuration Update procedure: Unsuccessful Operation](image)

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 ENB Configuration Update procedure towards the same MME. Both nodes shall continue to operate the S1 with their respective configuration data.

### 8.7.4.4 Abnormal Conditions

If the eNB after initiating eNB Configuration Update procedure receives neither an ENB CONFIGURATION UPDATE ACKOWLEDGE nor an ENB CONFIGURATION UPDATE FAILURE message, the eNB may reinitiate a further eNB Configuration Update procedure towards the same MME provided that the content of the new ENB CONFIGURATION UPDATE message is identical to the content of the previously unacknowledged ENB CONFIGURATION UPDATE message.

### 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

![Diagram](image)

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.

If the served PLMNs is(are) to be updated, the eNB shall overwrite the whole list of PLMNs.

If the MME CONFIGURATION UPDATE message contains the MME Name IE the eNB may use this IE as a human readable name of the MME.

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.

The MME may initiate a further MME Configuration Update procedure only after a previous MME Configuration Update procedure has been completed.

8.7.5.3 Unsuccessful Operation

![Diagram](image)

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

If the MME neither receives a MME CONFIGURATION UPDATE ACKNOWLEDGE nor a MME CONFIGURATION UPDATE FAILURE message, the MME may reinitiate MME Configuration Update procedure towards the same eNB provided that the content of the new MME CONFIGURATION UPDATE message is identical to the content of the previously unacknowledged MME CONFIGURATION UPDATE message.
8.7.6 Overload Start

8.7.6.1 General

The purpose of the Overload Start procedure is to inform an eNB to reduce the signalling load towards the concerned MME.

The procedure uses non-UE associated signalling.

8.7.6.2 Successful Operation

![Figure 8.7.6.2-1: Overload Start procedure](image)

The eNB receiving the OVERLOAD START message shall assume the MME from which it receives the message as being in an overloaded state.

If the Overload Action IE in the OVERLOAD START message is set to

- "reject all RRC connection establishments for non-emergency mobile originated data transfer ", or
- "reject all RRC connection establishments for signalling ", or
- "only permit RRC connection establishments for emergency sessions".

the eNB shall ensure that only signalling traffic corresponding to permitted RRC connections is sent to the MME.

8.7.6.3 Unsuccessful Operation

Not applicable.

8.7.7 Overload Stop

8.7.7.1 General

The purpose of the Overload Stop procedure is to signal to an eNB the MME is connected to that the overload situation at the MME has ended and normal operation shall resume.

The procedure uses non-UE associated signalling.
8.7.7.2 Successful Operation

The eNB receiving the OVERLOAD STOP message shall assume that the overload situation at the MME from which it receives the message has ended and shall resume normal operation towards this MME.

8.7.7.3 Unsuccessful Operation

Not applicable.

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 and pre-registration and paging of UE with CDMA2000 1xRTT CS system. 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 eNB 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

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 to the UE along with an indication of the RAT Type associated with the CDMA2000-PDU IE based on the CDMA2000 RAT Type IE.

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 E-RABs Subject to Forwarding List IE it indicates that DL forwarding is available for the indicated E-RABs towards the tunnel endpoint identified by the DL GTP TEID IE for those E-RABs.

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](image)

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 any of the CDMA2000 1xRTT SRVCC InfoIE, or the CDMA2000 1xRTT RAND IE in the UPLINK S1 CDMA2000 TUNNELING message the MME should forward the received information to the CDMA2000 1xRTT RAT.

**Interactions with E-RAB 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 E-RAB Management procedure on the same UE associated signaling connection, the source eNB shall terminate the MME initiated E-RAB Management procedure by sending the appropriate response message with an appropriate cause value e.g. "S1 intra system Handover Triggered", "S1 inter system 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 to enable the eNB to provide to the MME UE capability-related information.

8.9.2  Successful Operation

![Diagram showing UE Capability Info Indication procedure.]

The eNB controlling a UE-associated logical S1-connection initiates the procedure by sending an UE CAPABILITY INFO INDICATION message to the MME including the UE capability information. The UE capability information received by the MME shall replace any previously stored UE capability information in the MME for the UE.

8.10  Trace Procedures

8.10.1  Trace Start

8.10.1.1  General

The purpose of the Trace Start procedure is to allow the MME to request the eNB to start a trace session for a UE in ECM_CONNECTED mode. The procedure uses UE-associated signalling. If no UE-associated logical S1-connection exists, the UE-associated logical S1-connection shall be established as part of the procedure.

8.10.1.2  Successful Operation

![Diagram showing Trace Start procedure.]

The MME initiates the procedure by sending a TRACE START message. On receipt of a TRACE START message, the eNB shall initiate the requested trace function as described in [10].

Interactions with other procedures:

If the eNB is not able to initiate the trace session due to ongoing handover of the UE to another eNB, the eNB shall initiate a Trace Failure Indication procedure with appropriate cause value.
8.10.2 Trace Failure Indication

8.10.2.1 General
The purpose of the Trace Failure Indication procedure is to allow the eNB to inform the MME that a Trace Start procedure or a Deactivate Trace procedure has failed due to an interaction with a handover procedure. The procedure uses UE-associated signalling.

8.10.2.2 Successful Operation

![Figure 8.10.2.2-1: Trace Failure Indication procedure.](image)

The eNB initiates the procedure by sending a TRACE FAILURE INDICATION message. Upon reception of the TRACE FAILURE INDICATION message, the MME shall take appropriate action based on the failure reason indicated by the Cause IE.

8.10.3 Deactivate Trace

8.10.3.1 General
The purpose of the Deactivate Trace procedure is to allow the MME to request the eNB to stop the trace session, for the indicated trace reference.

8.10.3.2 Successful Operation

![Figure 8.10.3.2-1: Deactivate Trace procedure. Successful operation.](image)

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

Upon reception of this message, the eNB shall stop the trace session for the indicated trace reference in the E-UTRAN Trace ID IE.

Interactions with other procedures:
If the eNB is not able to stop the trace session due to ongoing handover of the UE to another eNB, the eNB shall initiate a Trace Failure Indication procedure with appropriate cause value.
8.10.4 Cell Traffic Trace

8.10.4.1 General

The purpose of the Cell Traffic Trace procedure is to send the allocated Trace Recording Session Reference and the Trace Reference to MME. The procedure uses UE-associated signalling.

8.10.4.2 Successful Operation

![Diagram of Cell Traffic Trace procedure]

Figure 8.10.4.2-1: Cell Traffic Trace procedure. Successful operation.

The procedure is initiated with a CELL TRAFFIC TRACE message sent from the eNB to the MME.

8.11 Location Reporting Procedures

8.11.1 Location Reporting Control

8.11.1.1 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.

8.11.1.2 Successful Operation

![Diagram of Location Reporting Control procedure]

Figure 8.11.1.2-1: 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 changes its serving cell to another cell belonging to the eNB.
The Request Type IE also indicates what type of location information the eNB shall report. The location information is E-UTRAN CGI and TAI.

8.11.1.3 Abnormal Conditions

Not applicable.

8.11.2 Location Report Failure Indication

8.11.2.1 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.

8.11.2.2 Successful Operation

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

8.11.3 Location Report

8.11.3.1 General

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

8.11.3.2 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.

In case reporting at change of serving cell has been requested, the eNB shall send a LOCATION REPORT message whenever the information given to the EPC in any S1AP message is not anymore valid.
8.11.3.3 Abnormal Conditions

Not applicable.

8.12 Warning Message Transmission Procedures

8.12.1 Write-Replace Warning

8.12.1.1 General

The purpose of Write-Replace Warning procedure is to start and overwrite the broadcasting of warning message.

The procedure uses non UE-associated signalling.

8.12.1.2 Successful Operation

![Diagram of Write-Replace Warning procedure](image)

The MME initiates the procedure by sending a WRITE-REPLACE WARNING REQUEST message to the eNB.

Upon receipt of the WRITE-REPLACE WARNING REQUEST, eNB shall prioritise its resources to process the warning message.

If, in a certain area, broadcast of a warning message is already ongoing and the eNB receives a WRITE-REPLACE WARNING REQUEST message with Message Identifier IE and/or Serial Number IE which are different from those in the warning message being broadcast, the eNB shall replace the warning message being broadcast with the newly received one for that area.

If the eNB receives two or more WRITE-REPLACE WARNING REQUEST messages with the same Message Identifier IE and Serial Number IE, the eNB shall broadcast only one of the warning message.

If Warning Area List IE is not included in the WRITE-REPLACE WARNING REQUEST message, the eNB shall broadcast the indicated message in all of the cells within the eNB.

If Warning Type IE is included in WRITE-REPLACE WARNING REQUEST message, the eNB shall broadcast the Primary Notification the same way as if the Repetition Period IE is set as "0" and the Number of Broadcasts Requested IE is set as "1", and process it according to [16].

If the Warning Security Information IE is included in the WRITE-REPLACE WARNING REQUEST message, the eNB shall send this IE together with the Warning Type IE in the Primary Notification.

If the Data Coding Scheme IE and the Warning Message Contents IE are both included in the WRITE-REPLACE WARNING REQUEST message, the eNB shall broadcast the Secondary Notification according to the value of the Repetition Period IE and Number of Broadcasts Requested IE and process the Secondary Notification according to [16].

The eNB ends the procedure by sending a WRITE-REPLACE WARNING RESPONSE to the MME.

If the Broadcast Completed Area List IE is not included in WRITE-REPLACE WARNING RESPONSE, the MME shall consider that the broadcast is unsuccessful in all the cells within the eNB.
8.13 eNB Direct Information Transfer

8.13.1 General

The purpose of the eNB Direct Information Transfer procedure is to transfer RAN information from the eNB to the MME in unacknowledged mode. The MME does not interpret the transferred RAN information.

This procedure uses non-UE associated signalling.

8.13.2 Successful Operation

8.13.2.1 eNB Direct Information Transfer

![Diagram](enb-dit.png)

Figure 8.13.1.2-1: ENB Direct Information Transfer procedure. Successful operation.

The procedure is initiated with an ENB DIRECT INFORMATION TRANSFER message sent from the eNB to the MME.

The RIM Transfer IE shall contain RIM Routing Address IE that identifies the final RAN destination node where the RIM information needs to be transferred by the core network.

8.13.3 Abnormal Conditions

Not applicable.

8.14 MME Direct Information Transfer

8.14.1 General

The purpose of the MME Direct Information Transfer procedure is to transfer RAN information from the MME to the eNB in unacknowledged mode.

This procedure uses non-UE associated signalling.
8.14.2 Successful Operation

8.14.2.1 MME Direct Information Transfer

Figure 8.14.1.2-1: MME Direct Information Transfer procedure. Successful operation.

The procedure is initiated with a DIRECT INFORMATION TRANSFER message sent from the MME to the eNB.

8.14.3 Abnormal Conditions

Not applicable.

8.15 eNB Configuration Transfer

8.15.1 General

The purpose of the eNB Configuration Transfer procedure is to transfer RAN configuration information from the eNB to the MME in unacknowledged mode. The MME does not interpret the transferred RAN configuration information.

This procedure uses non-UE associated signalling.

8.15.2 Successful Operation

8.15.2.1 eNB Configuration Transfer

Figure 8.15.2.1-1: eNB Configuration Transfer procedure. Successful operation.

The procedure is initiated with an ENB CONFIGURATION TRANSFER message sent from the eNB to the MME.

If the MME receives the SON Configuration Transfer IE it shall transparently transfer the SON Configuration Transfer IE towards the eNB indicated in the Target eNB-ID IE which is included in the SON Configuration Transfer IE.

8.15.3 Abnormal Conditions

Not applicable.
8.16 MME Configuration Transfer

8.16.1 General

The purpose of the MME Configuration Transfer procedure is to transfer RAN configuration information from the MME to the eNB in unacknowledged mode.

This procedure uses non-UE associated signalling.

8.16.2 Successful Operation

8.16.2.1 MME Configuration Transfer

![Diagram of MME Configuration Transfer procedure]

The procedure is initiated with an MME CONFIGURATION TRANSFER message sent from the MME to the eNB. If the eNB receives the SON Information IE containing the SON Information Request IE set to "X2 TNL Configuration Info", it may transfer back the requested information towards the eNB indicated in the Source eNB-ID IE of the SON Configuration Transfer IE by initiating the eNB Configuration Transfer procedure.

If the eNB receives the SON Information IE containing the SON Information Reply IE containing the X2 transport layer addresses as an answer to a former request, it may use it to initiate the X2 TNL establishment.

8.16.3 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>
<thead>
<tr>
<th>Abbreviation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>IEs marked as Mandatory (M) shall always be included in the message.</td>
</tr>
<tr>
<td>O</td>
<td>IEs marked as Optional (O) may or may not be included in the message.</td>
</tr>
<tr>
<td>C</td>
<td>IEs marked as Conditional (C) shall be included in a message only if the condition is satisfied. Otherwise the IE shall not be included.</td>
</tr>
</tbody>
</table>

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>
<thead>
<tr>
<th>Abbreviation</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>–</td>
<td>No criticality information is applied explicitly.</td>
</tr>
<tr>
<td>YES</td>
<td>Criticality information is applied. This is usable only for non-repeatable IEs.</td>
</tr>
<tr>
<td>GLOBAL</td>
<td>The IE and all its repetitions together have one common criticality information. This is usable only for repeatable IEs.</td>
</tr>
<tr>
<td>EACH</td>
<td>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.</td>
</tr>
</tbody>
</table>

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 E-RAB Management Messages

9.1.3.1 E-RAB SETUP REQUEST

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

Direction: MME → eNB

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>UE Aggregate Maximum Bit Rate</td>
<td>O</td>
<td></td>
<td>9.2.1.20</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
</tbody>
</table>

| E-RAB to be Setup List        | M        |       |                       |                       | YES         | reject              |

| >E-RAB To Be Setup Item IEs   | 1 to <maxno of E-RABs> | EACH | YES         | reject |

  | >> E-RAB ID                   | M        |       | 9.2.1.2               |                       | -           |                     |
  | >> E-RAB Level QoS Parameters | M        |       | 9.2.1.15             | Includes necessary QoS parameters | -           |                     |
  | >> Transport Layer Address    | M        |       | 9.2.2.1               |                       | -           |                     |
  | >> NAS-PEID                   | M        |       | 9.2.2.2               | EPC TEID              | -           |                     |

<table>
<thead>
<tr>
<th>Range bound</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>maxno of E-RABs</td>
<td>Maximum no. of E-RAB allowed towards one UE; the maximum value is 256.</td>
</tr>
</tbody>
</table>

9.1.3.2 E-RAB SETUP RESPONSE

This message is sent by the eNB and is used to report the outcome of the request from the E-RAB SETUP REQUEST message.

Direction: eNB → MME

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>E-RAB Setup List</td>
<td>O</td>
<td></td>
<td></td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

| >E-RAB Setup Item IEs         | 1 to <maxno of E-RABs> | EACH | YES         | ignore |

  | >> E-RAB ID                   | M        |       | 9.2.1.2               |                       | -           |                     |
  | >> Transport Layer Address    | M        |       | 9.2.2.1               |                       | -           |                     |
  | >> GTP-TEID                   | M        |       | 9.2.2.2               | eNB TEID              | -           |                     |

| E-RAB Failed to Setup List    | O        |       | E-RAB List 9.2.1.36   | a value for E-RAB ID shall only be present once in E-RAB Failed to Setup List IE | YES         | ignore              |

| Criticality Diagnostics       | O        |       | 9.2.1.21              |                       | YES         | ignore              |
### 9.1.3.3 E-RAB MODIFY REQUEST

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

Direction: MME → eNB

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>UE Aggregate Maximum Bit Rate</td>
<td>O</td>
<td></td>
<td>9.2.1.20</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>E-RAB to be Modified List</td>
<td>M</td>
<td></td>
<td></td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
</tbody>
</table>

**Range bound Explanation**
maxnoofE-RABs Maximum no. of E-RAB allowed towards one UE, the maximum value is 256.

### 9.1.3.4 E-RAB MODIFY RESPONSE

This message is sent by the eNB and is used to report the outcome of the request from the E-RAB MODIFY REQUEST message.

Direction: eNB → MME

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>E-RAB Modify List</td>
<td>O</td>
<td></td>
<td></td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

**Range bound Explanation**
maxnoofE-RABs Maximum no. of E-RAB allowed towards one UE, the maximum value is 256.
### 9.1.3.5 E-RAB 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 E-RABs.

Direction: MME → eNB

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td>9.2.1.1</td>
<td>YES</td>
<td>reject</td>
<td></td>
<td>reject</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td>9.2.3.3</td>
<td>YES</td>
<td>reject</td>
<td></td>
<td>reject</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td>9.2.3.4</td>
<td>YES</td>
<td>reject</td>
<td></td>
<td>reject</td>
</tr>
<tr>
<td>UE Aggregate Maximum Bit Rate</td>
<td>O</td>
<td>9.2.1.20</td>
<td>YES</td>
<td>reject</td>
<td></td>
<td>reject</td>
</tr>
<tr>
<td>E-RAB To Be Released List</td>
<td>M</td>
<td>E-RAB List 9.2.1.36</td>
<td>YES</td>
<td>ignore</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NAS-PDU</td>
<td>O</td>
<td>9.2.3.5</td>
<td>YES</td>
<td>ignore</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Range bound

| maxnoofE-RABs | Maximum no. of E-RAB allowed towards one UE, the maximum value is 256. |

### 9.1.3.6 E-RAB RELEASE RESPONSE

This message is sent by the eNB and is used to report the outcome of the request from the E-RAB RELEASE COMMAND message.

Direction: eNB → MME

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td>9.2.1.1</td>
<td>YES</td>
<td>reject</td>
<td></td>
<td>reject</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td>9.2.3.3</td>
<td>YES</td>
<td>ignore</td>
<td></td>
<td>ignore</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td>9.2.3.4</td>
<td>YES</td>
<td>ignore</td>
<td></td>
<td>ignore</td>
</tr>
<tr>
<td>E-RAB Release List</td>
<td>O</td>
<td>E-RAB List 9.2.1.36</td>
<td>EACH</td>
<td>ignore</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; E-RAB ID</td>
<td>M</td>
<td>9.2.1.2</td>
<td>-</td>
<td></td>
<td></td>
<td>ignore</td>
</tr>
<tr>
<td>E-RAB Failed to Release List</td>
<td>O</td>
<td>E-RAB List 9.2.1.36</td>
<td>YES</td>
<td>ignore</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Criticality Diagnostics</td>
<td>O</td>
<td>9.2.1.21</td>
<td>YES</td>
<td>ignore</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
9.1.3.7 E-RAB RELEASE INDICATION

This message is sent by the eNB and is used to indicate the MME to release one or several E-RABs for one UE.

Direction: eNB → MME

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>E-RAB Released List</td>
<td>M</td>
<td></td>
<td>E-RAB List</td>
<td>a value for E-RAB ID</td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

Range bound explanation:

maxnoofE-RABs: Maximum no. of E-RAB allowed towards one UE, the maximum value is 256.

9.1.4 Context Management Messages

9.1.4.1 INITIAL CONTEXT SETUP REQUEST

This message is sent by the MME to request a setup of a UE context.

Direction: MME → eNB
<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td>YES reject</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td>YES reject</td>
<td></td>
<td></td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td>YES reject</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UE Aggregate Maximum Bit Rate</td>
<td>M</td>
<td></td>
<td>9.2.1.20</td>
<td>YES reject</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>E-RAB to Be Setup List</strong></td>
<td>M</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>reject</td>
</tr>
<tr>
<td>&gt; E-RAB to Be Setup Item IEs</td>
<td></td>
<td>1 to &lt;maxnoofE-RABs&gt;</td>
<td></td>
<td></td>
<td></td>
<td>reject</td>
</tr>
<tr>
<td>&gt;&gt;&gt;E-RAB ID</td>
<td>M</td>
<td>9.2.1.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt;&gt;E-RAB Level QoS Parameters</td>
<td>M</td>
<td>9.2.1.15</td>
<td>Includes necessary QoS parameters</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; Transport Layer Address</td>
<td>M</td>
<td>9.2.2.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; GTP TEID</td>
<td>M</td>
<td>9.2.2.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; NAS-PDU</td>
<td>O</td>
<td>9.2.3.5</td>
<td>YES ignore</td>
<td></td>
<td></td>
<td>ignore</td>
</tr>
<tr>
<td>UE Security Capabilities</td>
<td>M</td>
<td>9.2.1.40</td>
<td>YES reject</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Security Key</td>
<td>M</td>
<td>9.2.1.41</td>
<td>The KeNB is provided after the key-generation in the MME, see [15]</td>
<td>YES</td>
<td></td>
<td>reject</td>
</tr>
<tr>
<td>Trace Activation</td>
<td>O</td>
<td>9.2.1.4</td>
<td>YES ignore</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Handover Restriction List</td>
<td>O</td>
<td>9.2.1.22</td>
<td>YES ignore</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UE Radio Capability</td>
<td>O</td>
<td>9.2.1.27</td>
<td>YES ignore</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subscriber Profile ID for RAT/Frequency priority</td>
<td>O</td>
<td>9.2.1.39</td>
<td>YES ignore</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CS Fallback Indicator</td>
<td>O</td>
<td>9.2.3.21</td>
<td>YES reject</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SRVCC Operation Possible</td>
<td>O</td>
<td>9.2.1.58</td>
<td>YES ignore</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Range bound</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>maxnoofE-RABs</td>
<td>Maximum no. of E-RAB allowed towards one UE, the maximum value is 256.</td>
</tr>
</tbody>
</table>

### 9.1.4.3 INITIAL CONTEXT SETUP RESPONSE

This message is sent by the eNB to confirm the setup of a UE context.

Direction: eNB → MME
9.1.4.4 INITIAL CONTEXT SETUP FAILURE

This message is sent by the eNB to indicate that the setup of the UE context was unsuccessful.

Direction: eNB → MME

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

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

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Cause</td>
<td>M</td>
<td></td>
<td>9.2.1.3</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Message Type</th>
<th>M</th>
<th>9.2.1.1</th>
<th>YES</th>
<th>reject</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHOICE UE S1AP IDs</td>
<td>M</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;UE S1AP ID pair</td>
<td>M</td>
<td>9.2.3.18</td>
<td></td>
<td>reject</td>
</tr>
<tr>
<td>&gt;MME UE S1AP ID</td>
<td>M</td>
<td>9.2.3.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cause</td>
<td>M</td>
<td>9.2.1.3</td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

### 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                   | ignore                      |
| eNB UE S1AP ID           | M       | 9.2.3.4             | YES                   | ignore                      |
| Cause                    | 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 Key             | O       | 9.2.1.41            | A fresh KeNB is provided after performing a key-change on the fly procedure in the MME, see [15] | YES | reject |
| Subscriber Profile ID for RAT/Frequency priority | O       | 9.2.1.39            | YES                   | ignore                      |
| UE Aggregate Maximum Bit Rate | O     | 9.2.1.20            | YES                   | ignore                      |
| CS Fallback Indicator    | O       | 9.2.3.21            | 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                   | ignore                      |
| eNB UE S1AP ID           | M       | 9.2.3.4             | YES                   | ignore                      |
| Cause                    | 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

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

9.1.5 Handover Signalling Messages

9.1.5.1 HANDOVER REQUIRED

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

Direction: eNB → MME.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td>YES</td>
<td>reject</td>
<td></td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td>YES</td>
<td>reject</td>
<td></td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td>YES</td>
<td>reject</td>
<td></td>
</tr>
<tr>
<td>Handover Type</td>
<td>M</td>
<td></td>
<td>9.2.1.13</td>
<td>YES</td>
<td>reject</td>
<td></td>
</tr>
<tr>
<td>Cause</td>
<td>M</td>
<td></td>
<td>9.2.1.3</td>
<td>YES</td>
<td>ignore</td>
<td></td>
</tr>
<tr>
<td>Target ID</td>
<td>M</td>
<td></td>
<td>9.2.1.6</td>
<td>YES</td>
<td>reject</td>
<td></td>
</tr>
<tr>
<td>Direct Forwarding Path</td>
<td>O</td>
<td></td>
<td>9.2.3.15</td>
<td>YES</td>
<td>ignore</td>
<td></td>
</tr>
<tr>
<td>Availability</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SRVCC HO Indication</td>
<td>O</td>
<td></td>
<td>9.2.1.59</td>
<td>YES</td>
<td>reject</td>
<td></td>
</tr>
<tr>
<td>Source to Target Transparent Container</td>
<td>M</td>
<td></td>
<td>9.2.1.56</td>
<td>YES</td>
<td>reject</td>
<td></td>
</tr>
<tr>
<td>Source to Target Transparent Container Secondary</td>
<td>O</td>
<td></td>
<td>Source to Target Transparent Container 9.2.1.56</td>
<td>YES</td>
<td>reject</td>
<td></td>
</tr>
<tr>
<td>MS Classmark 2</td>
<td></td>
<td></td>
<td>C- iSRVCCtoGERAN</td>
<td>9.2.1.64</td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>MS Classmark 3</td>
<td></td>
<td></td>
<td>C- iSRVCCtoGERAN</td>
<td>9.2.1.65</td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

Condition Explanation

<table>
<thead>
<tr>
<th>Condition</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>iSRVCCtoGERAN</td>
<td>This IE shall be present if the Handover Type IE is set to the &quot;Value&quot; LTEtoGERAN and the SRVCC HO Indication IE is present.</td>
</tr>
</tbody>
</table>
9.1.5.2 HANDOVER COMMAND

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

Direction: MME → eNB.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Handover Type</td>
<td>M</td>
<td></td>
<td>9.2.1.13</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>NAS Security Parameters from E-UTRAN</td>
<td>C-iftoUTRANGERAN</td>
<td>9.2.3.30</td>
<td>The eNB shall use this IE as specified in [15].</td>
<td>YES</td>
<td>reject</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>E-RABs Subject to Forwarding List</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;E-RABs Subject to Forwarding Item IEs</td>
<td>1 to &lt;maxnoof E-RABs&gt;</td>
<td>EACH</td>
<td></td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>&gt;&gt; E-RAB ID</td>
<td>M</td>
<td>9.2.1.2</td>
<td></td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; DL Transport Layer Address</td>
<td>O</td>
<td>9.2.2.1</td>
<td></td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; DL GTP-TEID</td>
<td>O</td>
<td>9.2.2.2</td>
<td>To deliver forwarded DL PDCP SDUs</td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; UL Transport Layer Address</td>
<td>O</td>
<td>9.2.2.1</td>
<td></td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; UL GTP-TEID</td>
<td>O</td>
<td>9.2.2.2</td>
<td>To deliver forwarded UL PDCP SDUs</td>
<td></td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>E-RABs to Release List</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>O</td>
<td>E-RAB List</td>
<td>9.2.1.36</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>Target to Source Transparent Container</td>
<td>M</td>
<td>9.2.1.57</td>
<td></td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Target to Source Transparent Container Secondary</td>
<td>O</td>
<td>Target to Source Transparent Container</td>
<td>9.2.1.57</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Criticality Diagnostics</td>
<td>O</td>
<td>9.2.1.21</td>
<td></td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

**Condition** | **Explanation**  
iftoUTRANGERAN | This IE shall be present if the Handover Type IE is set to the value "LTEtoUTRAN " or "LTEtoGERAN"

**Range bound** | **Explanation**  
maxnoofE-RABs | Maximum no. of E-RABs for one UE. Value is 256.
9.1.5.3  HANDOVER PREPARATION FAILURE

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

Direction: MME → eNB.

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

9.1.5.4  HANDOVER REQUEST

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

Direction: MME → eNB.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Handover Type</td>
<td>M</td>
<td></td>
<td>9.2.1.13</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Cause</td>
<td>M</td>
<td></td>
<td>9.2.1.3</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>UE Aggregate Maximum Bit Rate</td>
<td>M</td>
<td></td>
<td>9.2.1.20</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>E-RABs To Be Setup List</td>
<td>M</td>
<td></td>
<td>1 to &lt;maxnoof E-RABs&gt;</td>
<td>EACH</td>
<td>reject</td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; E-RAB ID</td>
<td>M</td>
<td></td>
<td>9.2.1.2</td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; Transport Layer Address</td>
<td>M</td>
<td></td>
<td>9.2.2.1</td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; GTP TEID</td>
<td>M</td>
<td></td>
<td>9.2.2.2</td>
<td>To deliver UL PDUs</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; E-RAB Level QoS Parameters</td>
<td>M</td>
<td></td>
<td>9.2.1.15</td>
<td>Includes necessary QoS parameters</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Source to Target Transparent Container</td>
<td>M</td>
<td></td>
<td>9.2.1.56</td>
<td>YES</td>
<td>reject</td>
<td></td>
</tr>
<tr>
<td>UE Security Capabilities</td>
<td>M</td>
<td></td>
<td>9.2.1.40</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Handover Restriction List</td>
<td>O</td>
<td></td>
<td>9.2.1.22</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>Trace Activation</td>
<td>O</td>
<td></td>
<td>9.2.1.4</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>Request Type</td>
<td>O</td>
<td></td>
<td>9.2.1.34</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>SRVCC Operation Possible</td>
<td>O</td>
<td></td>
<td>9.2.1.58</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>Security Context</td>
<td>M</td>
<td></td>
<td>9.2.1.26</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>NAS Security Parameters to E-UTRAN</td>
<td>C-</td>
<td></td>
<td>9.2.3.31</td>
<td>The eNB shall use this IE as specified in [15].</td>
<td>YES</td>
<td>reject</td>
</tr>
</tbody>
</table>
Editor’s Note: The details of required IEs to indicate security parameters in the message (e.g., encryption and integrity protection information) are FFS.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-iffromUTRANGERAN</td>
<td>This IE shall be present if the Handover Type IE is set to the value &quot;UTRANtoLTE&quot; or &quot;GERANtoLTE&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Range bound</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>maxnoofE-RABs</td>
<td>Maximum no. of E-RABs for one UE. Value is 256.</td>
</tr>
</tbody>
</table>

### 9.1.5.5 HANDOVER REQUEST ACKNOWLEDGE

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

Direction: eNB → MME.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td>allocated at the target eNB</td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>E-RABs Admitted List</td>
<td>M</td>
<td></td>
<td></td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>E-RABs Failed to Setup List</td>
<td>O</td>
<td></td>
<td>E-RAB List 9.2.1.36</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>Target to Source Transparent Container</td>
<td>M</td>
<td></td>
<td>9.2.1.57</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Criticality Diagnostics</td>
<td>O</td>
<td></td>
<td>9.2.1.21</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

| >> E-RAB ID | M |       | 9.2.1.2 | - |
| >> Transport Layer Address | M |       | 9.2.2.1 | - |
| >> GTP-TEID | M |       | 9.2.2.2 | - |
| >> DL Transport Layer Address | O |       | 9.2.2.1 | - |
| >> DL GTP-TEID | O |       | 9.2.2.2 | - |
| >> UL Transport Layer Address | O |       | 9.2.2.1 | - |
| >> UL GTP-TEID | O |       | 9.2.2.2 | - |

Range bound | Explanation |
maxnoofE-RABs | Maximum no. of E-RABs for one UE. Value is 256. |
9.1.5.6 HANDOVER FAILURE

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

Direction: eNB → MME.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>Cause</td>
<td>M</td>
<td></td>
<td>9.2.1.3</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>Criticality Diagnostics</td>
<td>O</td>
<td></td>
<td>9.2.1.21</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

9.1.5.7 HANDOVER NOTIFY

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

Direction: eNB → MME.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>E-UTRAN CGI</td>
<td>M</td>
<td></td>
<td>9.2.1.38</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>TAI</td>
<td>M</td>
<td></td>
<td>9.2.3.16</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

9.1.5.8 PATH SWITCH REQUEST

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

Direction: eNB → MME.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>E-RAB To Be Switched in Downlink List</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>&gt;E-RABs Switched Downlink Item IEs</td>
<td>1 to &lt;maxnoof E-RABs&gt;</td>
<td></td>
<td></td>
<td></td>
<td>EACH</td>
<td>reject</td>
</tr>
<tr>
<td>&gt;&gt; E-RAB ID</td>
<td>M</td>
<td></td>
<td>9.2.1.2</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>&gt;&gt; Transport layer address</td>
<td>M</td>
<td></td>
<td>9.2.2.1</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>&gt;&gt; GTP-TEID</td>
<td>M</td>
<td></td>
<td>9.2.2.2</td>
<td>To deliver DL PDUs</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Source MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>E-UTRAN CGI</td>
<td>M</td>
<td></td>
<td>9.2.1.38</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>TAI</td>
<td>M</td>
<td></td>
<td>9.2.3.16</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>UE Security Capabilities</td>
<td>M</td>
<td></td>
<td>9.2.1.40</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

Range bound | Explanation
--- | ---
maxnoofE-RABs | Maximum no. of E-RABs for one UE. Value is 256.
9.1.5.9 PATH SWITCH REQUEST ACKNOWLEDGE

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

Direction: MME → eNB.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>UE Aggregate Maximum Bit Rate</td>
<td>O</td>
<td></td>
<td>9.2.1.20</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>E-RAB To Be Switched in Uplink List</td>
<td>O</td>
<td></td>
<td></td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>&gt; E-RABs Switched in Uplink Item IEs</td>
<td></td>
<td></td>
<td></td>
<td>EACH</td>
<td>ignore</td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; E-RAB ID</td>
<td>M</td>
<td></td>
<td>9.2.1.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; Transport Layer Address</td>
<td>M</td>
<td></td>
<td>9.2.2.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; GTP-TEID</td>
<td>M</td>
<td></td>
<td>9.2.2.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E-RAB To Be Released List</td>
<td>O</td>
<td></td>
<td>E-RAB List</td>
<td>9.2.1.36</td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Security Context</td>
<td>M</td>
<td></td>
<td>9.2.1.26</td>
<td>One pair of {NCC, NH} is provided</td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Criticality Diagnostics</td>
<td>O</td>
<td></td>
<td>9.2.1.21</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

Range bound | Explanation
maxnoofE-RABs | Maximum no. of E-RABs for one UE. Value is 256.

9.1.5.10 PATH SWITCH REQUEST FAILURE

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

Direction: MME → eNB.

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

9.1.5.11 HANDOVER CANCEL

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

Direction: eNB → MME.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Cause</td>
<td>M</td>
<td></td>
<td>9.2.1.3</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>
9.1.5.12  HANDOVER CANCEL ACKNOWLEDGE

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

Direction: MME → eNB.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>Criticality Diagnostics</td>
<td>O</td>
<td></td>
<td>9.2.1.21</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

9.1.5.13  eNB STATUS TRANSFER

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

Direction: eNB → MME.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>eNB Status Transfer</td>
<td>M</td>
<td></td>
<td>9.2.1.31</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Transparent Container</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 → eNB

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>eNB Status Transfer</td>
<td>M</td>
<td></td>
<td>9.2.1.31</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Transparent Container</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9.1.6  PAGING

This message is sent by the MME and is used to page a UE in one or several tracking areas.

Direction: MME → eNB
### 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

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>NAS-PDU</td>
<td>M</td>
<td></td>
<td>9.2.3.5</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>TAI</td>
<td>M</td>
<td></td>
<td>9.2.3.16</td>
<td>Indicating the Tracking Area from which the UE has sent the NAS message.</td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>E-UTRAN CGI</td>
<td>M</td>
<td></td>
<td>9.2.1.38</td>
<td>Indicating the E-UTRAN CGI from which the UE has sent the NAS message.</td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>S-TMSI</td>
<td>O</td>
<td></td>
<td>9.2.3.6</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>CSG Id</td>
<td>O</td>
<td></td>
<td>9.2.1.62</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>RRC Establishment cause</td>
<td>M</td>
<td></td>
<td>9.2.1.3a</td>
<td></td>
<td>YES</td>
<td>Ignore</td>
</tr>
<tr>
<td>GUMMEI</td>
<td>O</td>
<td></td>
<td>9.2.3.9</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
</tbody>
</table>

**Range bound**

<table>
<thead>
<tr>
<th>maxnoofTAIs</th>
<th>Maximum no. of TAIs. Value is 256.</th>
</tr>
</thead>
<tbody>
<tr>
<td>maxnoofCSGIds</td>
<td>Maximum no. of CSG Ids within the CSG Id List. Value is 256.</td>
</tr>
</tbody>
</table>

---

**3GPP TS 36.413 version 8.6.1 Release 8**

ETSI TS 136 413 V8.6.1 (2009-07)
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

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

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

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>NAS-PDU</td>
<td>M</td>
<td></td>
<td>9.2.3.5</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>E-UTRAN CGI</td>
<td>M</td>
<td></td>
<td>9.2.1.38</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>TAI</td>
<td>M</td>
<td></td>
<td>9.2.3.16</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

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

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

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
***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.

---

**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
9.1.8.4 S1 SETUP REQUEST

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

Direction: eNB → MME

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>O</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>O</td>
<td></td>
<td>9.2.3.4</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>Cause</td>
<td>O</td>
<td></td>
<td>9.2.1.3</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>Criticality Diagnostics</td>
<td>O</td>
<td></td>
<td>9.2.1.21</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

9.1.8.5 S1 SETUP RESPONSE

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

Direction: MME → eNB

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Global eNB ID</td>
<td>M</td>
<td></td>
<td>9.2.1.37</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>eNB Name</td>
<td>O</td>
<td></td>
<td>PrintaStri ng(1..150,...)</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>Supported TAs</td>
<td>1..&lt;maxnoofTACs</td>
<td></td>
<td>Supported TAs in the eNB</td>
<td>GLOBAL</td>
<td>reject</td>
<td></td>
</tr>
<tr>
<td>&gt;TAC</td>
<td>M</td>
<td></td>
<td>9.2.3.7</td>
<td>Broadcasted TAC</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>&gt;Broadcast PLMNs</td>
<td>1..&lt;maxnoofBPLMN s</td>
<td></td>
<td>Broadcasted PLMNs</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>&gt;&gt;PLMN Identity</td>
<td>M</td>
<td></td>
<td>9.2.3.8</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>CSG Id List</td>
<td>0 to &lt; maxnoofCSGIds</td>
<td></td>
<td></td>
<td>GLOBAL</td>
<td>reject</td>
<td></td>
</tr>
<tr>
<td>&gt;CSG Id</td>
<td>M</td>
<td></td>
<td>9.2.1.62</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Default paging DRX</td>
<td>M</td>
<td></td>
<td>9.2.1.16</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Range bound</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>maxnoofTACs</td>
<td>Maximum no. of TACs. Value is 256.</td>
</tr>
<tr>
<td>maxnoofBPLMNs</td>
<td>Maximum no. of Broadcasted PLMNs. Value is 6.</td>
</tr>
<tr>
<td>maxnoofCSGIds</td>
<td>Maximum no. of CSG Ids within the CSG Id List. Value is 256.</td>
</tr>
</tbody>
</table>
### 9.1.8.6 S1 SETUP FAILURE

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

Direction: MME → eNB

### 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
### 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

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td>9.2.1.1</td>
<td></td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Criticality Diagnostics</td>
<td>O</td>
<td>9.2.1.21</td>
<td></td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

**Range bound**
- maxnoofTACs: Maximum no. of TACs. Value is 256.
- maxnoofBPLMNs: Maximum no. of Broadcasted PLMNs. Value is 6.
- maxnoofCSGIds: Maximum no. of CSG Ids within the CSG Id List. Value is 256.

### 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

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td>9.2.1.1</td>
<td></td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Cause</td>
<td>M</td>
<td>9.2.1.3</td>
<td></td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>Time to wait</td>
<td>O</td>
<td>9.2.1.61</td>
<td></td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>Criticality Diagnostics</td>
<td>O</td>
<td>9.2.1.21</td>
<td></td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td>9.2.1.1</td>
<td></td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
</tbody>
</table>
### 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 | PrintableString(1..150,...) | YES | ignore |
| Served GUMMEIs | 0..<maxnoofRATs | The LTE related pool configuration is included on the first place in the list. | GLOBAL | reject |
| >Served PLMNs | 1..<maxnoofPLMNsPerMME | - |
| >>PLMN Identity | M | 9.2.3.8 | - |
| >Served GroupIDs | 1..<maxnoofGroupIDs | - |
| >>MME GroupID | M | OCTETSTRING(2) | - |
| >Served MMECs | 1..<maxnoofMMECs | - |
| >> MME Code | M | 9.2.3.12 | - |
| Relative MME Capacity | O | 9.2.3.17 | YES | reject |

<table>
<thead>
<tr>
<th>Range bound</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>maxnoofPLMNsPerMME</td>
<td>Maximum no. of PLMNs per MME. Value is 32.</td>
</tr>
<tr>
<td>maxnoofRATs</td>
<td>Maximum no. of RATs. Value is 8.</td>
</tr>
<tr>
<td>maxnoofGroupIDs</td>
<td>Maximum no. of GroupIDs per node per RAT. Value is 65535.</td>
</tr>
<tr>
<td>maxnoofMMECs</td>
<td>Maximum no. of MMECs per node per RAT. Value is 256.</td>
</tr>
</tbody>
</table>

### 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 | 9.2.1.61 | YES | ignore |
| Criticality Diagnostics | O | 9.2.1.21 | YES | ignore |

### 9.1.8.13 OVERLOAD START

This message is sent by the MME and is used to indicate to the eNB that the MME is overloaded.
### 9.1.8.14 OVERLOAD STOP

This message is sent by the MME and is used to indicate that the MME is no longer overloaded.

**Direction:** MME → eNB

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>Overload Response</td>
<td>M</td>
<td></td>
<td>9.2.3.19</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>E-RABs Subject to Forwarding List</td>
<td>O</td>
<td></td>
<td></td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>&gt;E-RABs Subject to Forwarding Item IEs</td>
<td>1 to &lt;maxnoof E-RABs&gt;</td>
<td></td>
<td>EACH</td>
<td></td>
<td>ignore</td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; E-RAB ID</td>
<td>M</td>
<td></td>
<td>9.2.1.2</td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; DL Transport Layer Address</td>
<td>M</td>
<td></td>
<td>9.2.2.1</td>
<td></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; DL GTP-TEID</td>
<td>M</td>
<td></td>
<td>9.2.2.2</td>
<td>This IE indicates the tunnel endpoint for forwarding of DL data.</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>CDMA2000 HO Status</td>
<td>O</td>
<td></td>
<td>9.2.1.28</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>CDMA2000 RAT Type</td>
<td>M</td>
<td></td>
<td>9.2.1.24</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>CDMA2000-PDU</td>
<td>M</td>
<td></td>
<td>9.2.1.23</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
</tbody>
</table>

**Range bound**

`maxnoofE-RABs` = Maximum no. of E-RABs for one UE. Value is 256.

#### 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
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

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td>YES</td>
<td>ignore</td>
<td></td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td>YES</td>
<td>reject</td>
<td></td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td>YES</td>
<td>reject</td>
<td></td>
</tr>
<tr>
<td>CDMA2000 RAT Type</td>
<td>M</td>
<td></td>
<td>9.2.1.24</td>
<td>YES</td>
<td>reject</td>
<td></td>
</tr>
<tr>
<td>CDMA2000 Sector ID</td>
<td>M</td>
<td></td>
<td>9.2.1.25</td>
<td>YES</td>
<td>reject</td>
<td></td>
</tr>
<tr>
<td>CDMA2000 HO Required Indication</td>
<td>O</td>
<td></td>
<td>9.2.1.29</td>
<td>YES</td>
<td>ignore</td>
<td></td>
</tr>
<tr>
<td>CDMA2000 1xRTT SRVCC Info</td>
<td>O</td>
<td></td>
<td>9.2.1.35</td>
<td>YES</td>
<td>reject</td>
<td></td>
</tr>
<tr>
<td>CDMA2000 1xRTT RAND</td>
<td>O</td>
<td></td>
<td>9.2.1.33</td>
<td>YES</td>
<td>reject</td>
<td></td>
</tr>
<tr>
<td>CDMA2000-PDU</td>
<td>M</td>
<td></td>
<td>9.2.1.23</td>
<td>YES</td>
<td>reject</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td>YES</td>
<td>ignore</td>
<td></td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td>YES</td>
<td>reject</td>
<td></td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td>YES</td>
<td>reject</td>
<td></td>
</tr>
<tr>
<td>UE Radio Capability</td>
<td>M</td>
<td></td>
<td>9.2.1.27</td>
<td>YES</td>
<td>ignore</td>
<td></td>
</tr>
</tbody>
</table>

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
### 9.1.11.3 DEACTIVATE TRACE

This message is sent by the MME to deactivate trace.

Direction: MME → eNB

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>E-UTRAN Trace ID</td>
<td>M</td>
<td></td>
<td>OCTET STRING (8)</td>
<td>As per E-UTRAN Trace ID IE in Trace Activation IE (9.2.1.4)</td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>Cause</td>
<td>M</td>
<td></td>
<td>9.2.1.3</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

### 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

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Request Type</td>
<td>M</td>
<td></td>
<td>9.2.1.34</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

#### 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

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Cause</td>
<td>M</td>
<td></td>
<td>9.2.1.3</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>
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

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>E-UTRAN CGI</td>
<td>M</td>
<td></td>
<td>9.2.1.38</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>TAI</td>
<td>M</td>
<td></td>
<td>9.2.3.16</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>Request Type</td>
<td>M</td>
<td></td>
<td>9.2.1.34</td>
<td>The Request Type IE is sent as it has been provided.</td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

9.1.13 Warning Message Transmission Messages

9.1.13.1 WRITE-REPLACE WARNING REQUEST

This message is sent by the MME to request the start or overwrite the broadcast of a warning message.

Direction: MME → eNB

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Message Identifier</td>
<td>M</td>
<td></td>
<td>9.2.1.44</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Serial Number</td>
<td>M</td>
<td></td>
<td>9.2.1.45</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Warning Area List</td>
<td>O</td>
<td></td>
<td>9.2.1.46</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>Repetition Period</td>
<td>M</td>
<td></td>
<td>9.2.1.48</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Number of Broadcasts Requested</td>
<td>M</td>
<td></td>
<td>9.2.1.49</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Warning Type</td>
<td>O</td>
<td></td>
<td>9.2.1.50</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>Warning Security Information</td>
<td>O</td>
<td></td>
<td>9.2.1.51</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>Data Coding Scheme</td>
<td>O</td>
<td></td>
<td>9.2.1.52</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>Warning Message Contents</td>
<td>O</td>
<td></td>
<td>9.2.1.53</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

9.1.13.2 WRITE-REPLACE WARNING RESPONSE

This message is sent by the eNB to acknowledge the MME on the start or overwrite request of a warning message.

Direction: eNB → MME

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Message Identifier</td>
<td>M</td>
<td></td>
<td>9.2.1.44</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Serial Number</td>
<td>M</td>
<td></td>
<td>9.2.1.45</td>
<td></td>
<td>YES</td>
<td>reject</td>
</tr>
<tr>
<td>Broadcast Completed Area List</td>
<td>O</td>
<td></td>
<td>9.2.1.54</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>Criticality Diagnostics</td>
<td>O</td>
<td></td>
<td>9.2.1.21</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>
9.1.14 eNB DIRECT INFORMATION TRANSFER

This message is sent by the eNB in order to transfer specific information.

Direction: eNB → MME.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>Inter-system Information</td>
<td>M</td>
<td></td>
<td>9.2.1.55</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

9.1.15 MME DIRECT INFORMATION TRANSFER

This message is sent by the MME in order to transfer specific information.

Direction: MME → eNB.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>Inter-system Information</td>
<td>M</td>
<td></td>
<td>9.2.1.55</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

9.1.16 eNB CONFIGURATION TRANSFER

This message is sent by the eNB in order to transfer RAN configuration information.

Direction: eNB → MME.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>SON Configuration Transfer</td>
<td>O</td>
<td></td>
<td>9.2.3.26</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

9.1.17 MME CONFIGURATION TRANSFER

This message is sent by the MME in order to transfer RAN configuration information.

Direction: MME → eNB.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Type</td>
<td>M</td>
<td></td>
<td>9.2.1.1</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
<tr>
<td>SON Configuration Transfer</td>
<td>O</td>
<td></td>
<td>9.2.3.26</td>
<td></td>
<td>YES</td>
<td>ignore</td>
</tr>
</tbody>
</table>

9.1.18 CELL TRAFFIC TRACE

This message is sent by eNB to transfer specific information.

Direction: eNB → MME
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.
### E-RAB ID

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

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-RAB ID</td>
<td>M</td>
<td></td>
<td>INTEGER (0..15, ...)</td>
<td></td>
</tr>
</tbody>
</table>

### Cause

The purpose of the Cause IE is to indicate the reason for a particular event for the S1AP protocol.
<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE Type and Reference</th>
<th>Semantics Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CHOICE Cause Group</strong></td>
<td>M</td>
<td></td>
<td><strong>GROUP</strong></td>
<td></td>
</tr>
<tr>
<td>&gt;Radio Network Layer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt;Radio Network Layer</td>
<td>M</td>
<td></td>
<td><strong>ENUMERATED</strong></td>
<td></td>
</tr>
<tr>
<td>Cause</td>
<td></td>
<td></td>
<td>(Unspecified, TX2RELOCoverall 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, TS1RELOCoverall Expiry, TS1RELOCprep Expiry, Cell not available, Unknown Target ID, No Radio Resources Available in Target Cell, Unknown or already allocated MME UE S1AP ID, Unknown or already allocated eNB UE S1AP ID, Unknown or inconsistent pair of UE S1AP ID, Handover desirable for radio reasons, Time critical handover, Resource optimisation handover, Reduce load in serving cell, User inactivity, Radio Connection With UE Lost, Load Balancing TAU Required, CS Fallback Triggered, UE Not Available For PS Service, Radio resources not available, Failure in the Radio Interface Procedure, Invalid QoS combination, Inter-RAT redirection, Interaction with other procedure, Unknown E-RAB ID, Multiple E-RAB ID instances, Encryption and/or integrity protection algorithms not supported, S1 intra system Handover triggered, S1 inter system Handover triggered, X2 Handover triggered, ..., Redirection towards 1xRTT)</td>
<td></td>
</tr>
<tr>
<td>&gt;Transport Layer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt;Transport Layer Cause</td>
<td>M</td>
<td></td>
<td><strong>ENUMERATED</strong></td>
<td></td>
</tr>
<tr>
<td>Cause</td>
<td></td>
<td></td>
<td>(Transport Resource Unavailable, Unspecified, ...)</td>
<td></td>
</tr>
<tr>
<td>&gt; NAS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; NAS Cause</td>
<td>M</td>
<td></td>
<td><strong>ENUMERATED</strong></td>
<td></td>
</tr>
<tr>
<td>Cause</td>
<td></td>
<td></td>
<td>(Normal Release, Authentication failure, Detach, Unspecified, ...)</td>
<td></td>
</tr>
<tr>
<td>&gt;Protocol</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt;Protocol Cause</td>
<td>M</td>
<td></td>
<td><strong>ENUMERATED</strong></td>
<td></td>
</tr>
<tr>
<td>Cause</td>
<td></td>
<td></td>
<td>(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, ...)</td>
<td></td>
</tr>
<tr>
<td>&gt;Misc</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt;Miscellaneous Cause</td>
<td>M</td>
<td></td>
<td><strong>ENUMERATED</strong></td>
<td></td>
</tr>
<tr>
<td>Cause</td>
<td></td>
<td></td>
<td>(Control Processing Overload, Not enough User Plane Processing Resources, Hardware Failure, O&amp;M Intervention, Unspecified, Unknown PLMN, ...)</td>
<td></td>
</tr>
</tbody>
</table>
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.

<table>
<thead>
<tr>
<th>Radio Network Layer cause</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unspecified</td>
<td>Sent for radio network layer cause when none of the specified cause values applies</td>
</tr>
<tr>
<td>TX2RELOCOverall Expiry</td>
<td>The timer guarding the handover that takes place over X2 has abnormally expired.</td>
</tr>
<tr>
<td>Successful Handover</td>
<td>Successful handover.</td>
</tr>
<tr>
<td>Release due to E-UTRAN generated reason</td>
<td>Release is initiated due to E-UTRAN generated reason.</td>
</tr>
<tr>
<td>Handover Cancelled</td>
<td>The reason for the action is cancellation of Handover</td>
</tr>
<tr>
<td>Partial Handover</td>
<td>Provides a reason for the handover cancellation. The HANDOVER COMMAND message from MME contained E-RABs 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.</td>
</tr>
<tr>
<td>Handover Failure In Target EPC/eNB Or Target System</td>
<td>The handover failed due to a failure in target EPC/eNB or target system.</td>
</tr>
<tr>
<td>Handover Target not allowed</td>
<td>Handover to the indicated target cell is not allowed for the UE in question.</td>
</tr>
<tr>
<td>TS1RELOCoverall Expiry</td>
<td>The reason for the action is expiry of timer TS1RELOCoverall.</td>
</tr>
<tr>
<td>TS1RELOCprep Expiry</td>
<td>Handover Preparation procedure is cancelled when timer TS1RELOCprep expires.</td>
</tr>
<tr>
<td>Cell not available</td>
<td>The concerned cell is not available.</td>
</tr>
<tr>
<td>Unknown Target ID</td>
<td>Handover rejected because the target ID is not known to the EPC.</td>
</tr>
<tr>
<td>No radio resources available in target cell</td>
<td>Load on target cell is too high.</td>
</tr>
<tr>
<td>Unknown or already allocated MME UE S1AP ID</td>
<td>The action failed because the MME UE S1AP ID is either unknown, or (for a first message received at the eNB) is known and already allocated to an existing context.</td>
</tr>
<tr>
<td>Unknown or already allocated eNB UE S1AP ID</td>
<td>The action failed because the eNB UE S1AP ID is either unknown, or (for a first message received at the MME) is known and already allocated to an existing context.</td>
</tr>
<tr>
<td>Unknown or inconsistent pair of UE S1AP ID</td>
<td>The action failed because both UE S1AP IDs are unknown, or are known but do not define a single UE context.</td>
</tr>
<tr>
<td>Handover Desirable for Radio Reasons</td>
<td>The reason for requesting handover is radio related.</td>
</tr>
<tr>
<td>Time Critical Handover</td>
<td>Handover is requested for time critical reason i.e. this cause value is reserved to represent all critical cases where the connection is likely to be dropped if handover is not performed.</td>
</tr>
<tr>
<td>Resource Optimisation Handover</td>
<td>The reason for requesting handover is to improve the load distribution with the neighbour cells.</td>
</tr>
<tr>
<td>Reduce Load in Serving Cell</td>
<td>Load on serving cell needs to be reduced.</td>
</tr>
<tr>
<td>Cause</td>
<td>Meaning</td>
</tr>
<tr>
<td>--------------------------------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>User Inactivity</td>
<td>The action is requested due to user inactivity on all E-RABs e.g. S1 is requested to be released in order to optimise the radio resources.</td>
</tr>
<tr>
<td>Radio Connection With UE Lost</td>
<td>The action is requested due to loosing the radio connection to the UE.</td>
</tr>
<tr>
<td>Load Balancing TAU Required</td>
<td>The action is requested for all load balancing and offload cases in the MME.</td>
</tr>
<tr>
<td>CS Fallback triggered</td>
<td>The action is due to a CS fallback that has been triggered.</td>
</tr>
<tr>
<td>UE Not Available for PS Service</td>
<td>The action is requested due to a Cell Change Order that has been triggered.</td>
</tr>
<tr>
<td>Radio resources not available</td>
<td>No requested radio resources are available</td>
</tr>
<tr>
<td>Invalid QoS combination</td>
<td>The action was failed because of invalid QoS combination.</td>
</tr>
<tr>
<td>Inter-RAT Redirection</td>
<td>The release is requested due to inter-RAT redirection.</td>
</tr>
<tr>
<td>Failure in the Radio Interface Procedure</td>
<td>Radio interface procedure has failed</td>
</tr>
<tr>
<td>Interaction with other procedure</td>
<td>The action is due to an ongoing interaction with another procedure</td>
</tr>
<tr>
<td>Unknown E-RAB ID</td>
<td>The action failed because the E-RAB ID is unknown in the eNB</td>
</tr>
<tr>
<td>Multiple E-RAB ID Instances</td>
<td>The action failed because multiple instance of the same E-RAB had been provided to the eNB</td>
</tr>
<tr>
<td>Encryption and/or integrity protection algorithms not supported</td>
<td>The eNB is unable to support any of the encryption and/or integrity protection algorithms supported by the UE.</td>
</tr>
<tr>
<td>S1 Intra system Handover triggered</td>
<td>The action is due to a S1 intra system handover that has been triggered.</td>
</tr>
<tr>
<td>S1 Inter system Handover triggered</td>
<td>The action is due to a S1 inter system handover that has been triggered.</td>
</tr>
<tr>
<td>X2 Handover triggered</td>
<td>The action is due to a X2 handover that has been triggered.</td>
</tr>
<tr>
<td>Redirection towards 1xRTT</td>
<td>The release is requested due to redirection towards a 1xRTT system.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transport Layer cause</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport Resource Unavailable</td>
<td>The required transport resources are not available</td>
</tr>
<tr>
<td>Unspecified</td>
<td>Sent when none of the above cause values applies but still the cause is Transport Network Layer related</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NAS cause</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Release</td>
<td>The release is normal</td>
</tr>
<tr>
<td>Authentication Failure</td>
<td>The action is due to authentication failure.</td>
</tr>
<tr>
<td>Detach</td>
<td>The action is due to detach.</td>
</tr>
<tr>
<td>Unspecified</td>
<td>Sent when none of the above cause values applies but still the cause is NAS related</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Miscellaneous cause</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Processing Overload</td>
<td>Control processing overload</td>
</tr>
<tr>
<td>Not Enough User Plane Processing Resources Available</td>
<td>No enough resources are available related to user plane processing.</td>
</tr>
<tr>
<td>Hardware Failure</td>
<td>Action related to hardware failure</td>
</tr>
</tbody>
</table>
### 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 any of the PLMN provided by the eNB.

### 9.2.1.3a RRC Establishment Cause

The purpose of the *RRC Establishment Cause* IE is to indicate to the MME the reason for RRC Connection Establishment. The encoding is the same as that of the Establishment Cause IE defined in [16].

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RRC Establishment Cause</td>
<td>M</td>
<td></td>
<td>ENUMERATED(emergency, highPriorityAccess, mt-Access, mo-Signalling, mo-Data...)</td>
<td></td>
</tr>
</tbody>
</table>

### 9.2.1.4 Trace activation

Defines parameters related to a trace activation.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-UTRAN Trace ID</td>
<td>M</td>
<td>OCTET STRING (8)</td>
<td></td>
<td>The E-UTRAN Trace ID IE is composed of the following: Trace Reference defined in [10] (leftmost 6 octets), and Trace Recording Session Reference defined in [10] (last 2 octets)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interfaces To Trace</td>
<td>M</td>
<td>BIT STRING (8)</td>
<td>Each position in the bitmap represents a eNB interface first bit =S1-MME, second bit =X2, third bit =Uu other bits reserved for future use.. Value &quot;1&quot; indicates &quot;should be traced&quot; . Value &quot;0&quot; indicates &quot;should not be trace&quot;.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trace depth</td>
<td>M</td>
<td>ENUMERATED( minimum, medium, maximum, MinimumWithoutVendorSpecificExtension, MediumWithoutVendorSpecificExtension, MaximumWithoutVendorSpecificExtension,...)</td>
<td>Defined in [10]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trace Collection Entity IP Address</td>
<td>M</td>
<td>Transport Layer Address 9.2.2.1</td>
<td>Defined in [10]</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
9.2.1.5 Source ID

Void.

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

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choice Target ID</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;Target eNB-ID</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; Global eNB ID</td>
<td>M</td>
<td></td>
<td>9.2.1.37</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; Selected TAI</td>
<td>M</td>
<td></td>
<td>TAI</td>
<td>9.2.3.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;Target RNC-ID</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; LAI</td>
<td>M</td>
<td></td>
<td>9.2.3.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; RAC</td>
<td>O</td>
<td></td>
<td>9.2.3.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; RNC-ID</td>
<td>M</td>
<td></td>
<td>INTEGER (0..4095)</td>
<td>If the Extended RNC-ID IE is included in the Target ID IE, the RNC-ID IE shall be ignored.</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>&gt;&gt; Extended RNC-ID</td>
<td>O</td>
<td></td>
<td>9.2.1.14</td>
<td>The Extended RNC-ID IE shall be used if the RNC identity has a value larger than 4095.</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>&gt; CGI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; PLMN identity</td>
<td>M</td>
<td></td>
<td>OCTET STRING (SIZE (3))</td>
<td>- 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).</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>&gt;&gt; LAC</td>
<td>M</td>
<td></td>
<td>OCTET STRING (2)</td>
<td>0000 and FFFE not allowed.</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>&gt;&gt; CI</td>
<td>M</td>
<td></td>
<td>OCTET STRING (2)</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>&gt;&gt; RAC</td>
<td>O</td>
<td></td>
<td>9.2.3.2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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. For inter-system handovers to E-UTRAN, the IE is transmitted from the external handover source to the target eNB.

This IE is transparent to the EPC.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>RRC Container</td>
<td>M</td>
<td></td>
<td>OCTET STRING</td>
<td>Includes the RRC Handover Information message as defined in subclause 10.2.2 of [16].</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Target Cell ID</td>
<td>M</td>
<td></td>
<td>E-UTRAN CGI</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Subscriber Profile ID for RAT/Frequency priority</td>
<td>O</td>
<td>9.2.1.39</td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>E-RABs Information List</td>
<td>O</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; E-RABs Information Item</td>
<td>1 to &lt;maxnof E-RABs&gt;</td>
<td>EACH</td>
<td></td>
<td></td>
<td>ignore</td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; E-RAB ID</td>
<td>M</td>
<td>9.2.1.2</td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>&gt;&gt; DL Forwarding</td>
<td>O</td>
<td>9.2.3.14</td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>UE History Information</td>
<td>M</td>
<td></td>
<td>9.2.1.42</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Range bound</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>maxnofE-RABs</td>
<td>Maximum no. of E-RABs for one UE. Value is 256.</td>
</tr>
</tbody>
</table>

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. For inter-system handovers to E-UTRAN, the IE is transmitted from the target eNB to the external relocation source.

This IE is transparent to EPC.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>RRC Container</td>
<td>M</td>
<td></td>
<td>OCTET STRING</td>
<td>Includes the RRC E-UTRA Handover Command message as defined in subclause 10.2.2 of [16].</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

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.

This IE defined in [19].
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 for inter 3GPP RAT handovers from SAE/LTE to UTRAN.

This IE is defined in [19].

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.

This IE is defined in [18].

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.

This IE is defined in [18].

9.2.1.13  Handover Type

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

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handover Type</td>
<td>M</td>
<td></td>
<td>ENUMERATED (IntraLTE, LTEtoUTRAN, LTEtoGERAN, UTRANtoLTE, GERANtoLTE)</td>
<td></td>
</tr>
</tbody>
</table>

9.2.1.14  Extended RNC-ID

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

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extended RNC-ID</td>
<td>M</td>
<td></td>
<td>INTEGER (4096..65535)</td>
<td>The Extended RNC-ID IE shall be used if the RNC identity has a value larger than 4095.</td>
</tr>
</tbody>
</table>

9.2.1.15  E-RAB Level QoS Parameters

This IE defines the QoS to be applied to an E-RAB.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-RAB Level QoS Parameters</td>
<td></td>
<td></td>
<td>INTEGER (0..255)</td>
<td>QoS Class Identifier defined in [11]. Logical range and coding specified in [13]</td>
</tr>
<tr>
<td>&gt;QCI</td>
<td>M</td>
<td></td>
<td>INTEGER (0..255)</td>
<td></td>
</tr>
<tr>
<td>&gt;Allocation and Retention Priority</td>
<td>M</td>
<td></td>
<td>9.2.1.60</td>
<td></td>
</tr>
<tr>
<td>&gt;GBR QoS Information</td>
<td>O</td>
<td></td>
<td>9.2.1.18</td>
<td>This IE applies to GBR bearers only and shall be ignored otherwise.</td>
</tr>
</tbody>
</table>
9.2.1.16 Paging DRX

This IE indicates the Paging DRX as defined in [20].

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paging DRX</td>
<td>M</td>
<td></td>
<td>ENUMERATED (32, 64, 128, 256, ...)</td>
<td></td>
</tr>
</tbody>
</table>

9.2.1.17 Paging Cause

Void

9.2.1.18 GBR QoS Information

This IE indicates the maximum and guaranteed bit rates of a GBR bearer for downlink and uplink.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-RAB Maximum Bit Rate Downlink</td>
<td>M</td>
<td></td>
<td>Bit Rate 9.2.1.19</td>
<td>Desc.: This IE indicates the maximum downlink E-RAB Bit Rate (i.e. from the EPC to E-UTRAN) for this bearer.</td>
</tr>
<tr>
<td>E-RAB Maximum Bit Rate Uplink</td>
<td>M</td>
<td></td>
<td>Bit Rate 9.2.1.19</td>
<td>Desc.: This IE indicates the maximum uplink E-RAB Bit Rate (i.e. from the E-UTRAN to the EPC) for this bearer.</td>
</tr>
<tr>
<td>E-RAB Guaranteed Bit Rate Downlink</td>
<td>M</td>
<td></td>
<td>Bit Rate 9.2.1.19</td>
<td>Desc.: This IE indicates the downlink guaranteed E-RAB Bit Rate (provided that there is data to deliver) from the EPC to the E-UTRAN for this bearer.</td>
</tr>
<tr>
<td>E-RAB Guaranteed Bit Rate Uplink</td>
<td>M</td>
<td></td>
<td>Bit Rate 9.2.1.19</td>
<td>Desc.: This IE indicates the uplink guaranteed E-RAB Bit Rate (provided that there is data to deliver) from the E-UTRAN to the EPC for this bearer.</td>
</tr>
</tbody>
</table>

9.2.1.19 Bit Rate

This IE indicates the number of bits delivered by E-UTRAN in UL or to E-UTRAN in DL within a period of time, divided by the duration of the period. It is used, for example, to indicate the maximum or guaranteed bit rate for a GBR bearer, or an aggregated maximum bit rate.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit Rate</td>
<td></td>
<td></td>
<td>INTEGER (0..10,000,000)</td>
<td>The unit is: bit/s</td>
</tr>
</tbody>
</table>

9.2.1.20 UE Aggregate Maximum Bit Rate

The UE Aggregate Maximum Bitrate is applicable for all Non-GBR bearers per UE which is defined for the Downlink and the Uplink direction and provided by the MME to the eNB.
<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UE Aggregate Maximum Bit Rate</td>
<td></td>
<td></td>
<td></td>
<td>Desc.: Applicable for non-GBR E-RABs</td>
</tr>
<tr>
<td>&gt;UE Aggregate Maximum Bit Rate Downlink</td>
<td>M</td>
<td></td>
<td>Bit Rate</td>
<td>Desc.: This IE indicates the UE Aggregate Maximum Bit Rate in the downlink direction</td>
</tr>
<tr>
<td>&gt;UE Aggregate Maximum Bit Rate Uplink</td>
<td>M</td>
<td></td>
<td>Bit Rate</td>
<td>Desc.: This IE indicates the UE Aggregate Maximum Bit Rate in the uplink direction</td>
</tr>
</tbody>
</table>

### 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 section 10).

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

<table>
<thead>
<tr>
<th>Range bound</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>maxnooferrors</td>
<td>Maximum no. of IE errors allowed to be reported with a single message. The value for maxnooferrors is 256.</td>
</tr>
</tbody>
</table>

### 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 | Allowed PLMNs in addition to Serving PLMN. This list corresponds to the list of "equivalent PLMNs" as defined in [TS 24.008]. |
| Equivalent PLMNs | | 0..<maxnoofEPLMNs> | 9.2.3.8 |
| >PLMN Identity | M | 9.2.3.8 | intra LTE roaming restrictions |
| >Forbidden TAs | | 0..<maxnoofEPLMNsPlusOne> | 9.2.3.8 |
| >PLMN Identity | M | 9.2.3.8 | The PLMN of forbidden TACs |
| >>TAC | M | 9.2.3.7 | The TAC of the forbidden TAI |
| Forbidden LAs | | 0..<maxnoofEPLMNsPlusOne> | 9.2.3.8 |
| >PLMN Identity | M | 9.2.3.8 | inter-3GPP RAT roaming restrictions |
| >Forbidden LACs | | 1..<maxnoofForbLACs> | |
| >>LAC | M | OCTET STRING(2) | |
| Forbidden inter RATs | O | ENUMERATED( ALL, GERAN, UTRAN, CDMA2000, …) | Inter-3GPP and 3GPP2 RAT access restrictions |

#### Range bound

| maxnoofEPLMNs | Maximum no. of equivalent PLMN ids. Value is 15. |
| maxnoofEPLMNsPlusOne | Maximum no. of equivalent PLMN ids plus one. Value is 16. |
| maxnoofForbTACs | Maximum no. of forbidden Tracking Area Codes. Value is 4096. |
| maxnoofForbLACs | Maximum no. of forbidden Location Area Codes. Value is 4096. |

#### 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 used by the eNB to provide an indication of the RAT Type associated with the tunnelled CDMA2000 message to the UE to help it route the tunnelled downlink CDMA2000 message to the appropriate CDMA upper layer.
### CDMA2000 RAT Type

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDMA2000 RAT Type</td>
<td>M</td>
<td></td>
<td>ENUMERATED (HRPD, 1xRTT,…)</td>
<td>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.</td>
</tr>
</tbody>
</table>

### 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.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDMA2000 Sector ID</td>
<td>M</td>
<td></td>
<td>OCTET STRING</td>
<td>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.</td>
</tr>
</tbody>
</table>

### 9.2.1.26 Security Context

The purpose of the Security Context IE is to provide security related parameters to the eNB which are used to derive security keys for user plane traffic and RRC signalling messages and for security parameter generation for subsequent X2 or intra-eNB Handovers, or for the security parameters for the current S1 Handover. For intra-LTE S1 Handover one pair of \( \{ \text{NCC}, \text{NH} \} \) is provided for 1-hop security, see [15].

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE Type and Reference</th>
<th>Semantics Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Next Hop Chaining Count</td>
<td>M</td>
<td></td>
<td>INTEGER (0..7)</td>
<td>Next Hop Chaining Counter (NCC) defined in [15]. For inter-RAT Handover into LTE the Next Hop Chaining Count IE takes the value defined for NCC at initial setup, i.e. Next Hop Chaining Count IE = &quot;0&quot;.</td>
</tr>
<tr>
<td>Next-Hop NH</td>
<td>M</td>
<td></td>
<td>Security Key</td>
<td>The NH together with the NCC is used to derive the security configuration as defined in [15]. For inter-RAT Handover the Next-Hop NH IE is the KeNB to be used in the new configuration.</td>
</tr>
</tbody>
</table>
9.2.1.27 UE Radio Capability

This IE contains UE Radio Capability information.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE Type and Reference</th>
<th>Semantics Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UE Radio Capability</td>
<td>M</td>
<td></td>
<td>OCTET STRING</td>
<td>Includes the UERadioAccessCapabilityInf ormation message as defined in 10.2.2 of [16]</td>
</tr>
</tbody>
</table>

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.

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

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.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDMA2000 HO Required Indication</td>
<td>M</td>
<td></td>
<td>ENUMERATED</td>
<td>(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.</td>
</tr>
</tbody>
</table>

9.2.1.30 1xRTT MEID

Void.

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.
<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-RABs Subject to Status Transfer List</td>
<td>M</td>
<td></td>
<td></td>
<td></td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>&gt;E-RABs Subject to Status Transfer Item</td>
<td>1 to &lt;maxnoof E-RABs&gt;</td>
<td>EACH</td>
<td>ignore</td>
<td></td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>&gt;&gt; E-RAB ID</td>
<td>M</td>
<td>9.2.1.2</td>
<td></td>
<td></td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>&gt;&gt; UL COUNT value</td>
<td>M</td>
<td>COUNT Value 9.2.1.32</td>
<td>PDCP-SN and HFN of first missing UL PDCP SDU</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; DL COUNT value</td>
<td>M</td>
<td>COUNT Value 9.2.1.32</td>
<td>PDCP-SN and HFN that the target eNB should assign for the next DL SDU not having an SN yet</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; Receive Status Of UL PDCP SDUs</td>
<td>O</td>
<td>BIT STRING (4096)</td>
<td>PDCP Sequence Number = (First Missing SDU Number + bit position) modulo 4096 0: PDCP SDU has not been received. 1: PDCP SDU has been received correctly.</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Range bound</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>maxnoofE-RABs</td>
<td>Maximum no. of E-RABs for one UE. Value is 256.</td>
</tr>
</tbody>
</table>
9.2.1.32 Count Value

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

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE Type and Reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDCP-SN</td>
<td>M</td>
<td></td>
<td>INTEGER (0..4095)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>HFN</td>
<td>M</td>
<td></td>
<td>INTEGER (0..1048575)</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE Type and Reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CDMA2000 1xRTT RAND</td>
<td>M</td>
<td></td>
<td>OCTET STRING</td>
<td>This IE is a Random Challenge that is used for authentication of UE during handover from E-UTRAN to CDMA2000 1xRTT RAT.</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE Type and Reference</th>
<th>Semantics Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Request Type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; Event</td>
<td>M</td>
<td></td>
<td>ENUMERATED(Direct, Change of service cell, Stop Change of service cell)</td>
<td></td>
</tr>
<tr>
<td>&gt; Report Area</td>
<td>M</td>
<td></td>
<td>ENUMERATED(ECGI, ...)</td>
<td></td>
</tr>
</tbody>
</table>

9.2.1.35 CDMA2000 1xRTT SRVCC Info

This IE defines SRVCC related information elements that are assembled by the MME to be tunnelled transparently to the 1xCS IWS [8] system.
IE/Group Name | Presence | Range | IE type and reference | Semantics description
---|---|---|---|---
CDMA2000 1xRTT SRVCC Info | | | OCTET STRING | This information element is the Mobile Equipment Identifier or Hardware ID that is tunnelled from the UE and is transparent to the eNB. This IE is used to derive a MEID-based PLCM that is used for channelization in CDMA2000 1xRTT network.

>CDMA2000 1xRTT MEID | M | | STRING | This information element is the Mobile Equipment Identifier or Hardware ID that is tunnelled from the UE and is transparent to the eNB. This IE is used to derive a MEID-based PLCM that is used for channelization in CDMA2000 1xRTT network.

>CDMA2000 1xRTT Mobile Subscription Information | M | | OCTET STRING | This IE provides the list of UE supported 1x RTT Band classes and Band Subclasses. It is provided by the UE to the eNB as part of the UE capability. It is transparent to the eNB.

>CDMA2000 1xRTT Pilot List | M | | OCTET STRING | This IE provides the measured pilot information.

### 9.2.1.36 E-RAB List

This IE contains a list of E-RAB IDs with a cause value. It is used for example to indicate failed bearers or bearers to be released.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-RAB List Item</td>
<td></td>
<td>1 to &lt;maxnoofE-RABs&gt;</td>
<td>EACH</td>
<td></td>
<td>ignore</td>
<td></td>
</tr>
</tbody>
</table>

> E-RAB ID | M | 9.2.1.2 | – | | – |

> Cause | M | 9.2.1.3 | – | | – |

<table>
<thead>
<tr>
<th>Range bound</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>maxnoofE-RABs</td>
<td>Maximum no. of E-RAB allowed towards one UE, the maximum value is 256.</td>
</tr>
</tbody>
</table>

### 9.2.1.37 Global eNB ID

This information element is used to globally identify an eNB (see [2]).

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLMN Identity</td>
<td>M</td>
<td></td>
<td>OCTET STRING</td>
<td>Equal to the 20 leftmost bits of the Cell Identity IE contained in the E-UTRAN CGI/IE (see section 9.2.1.38) of each cell served by the eNB</td>
</tr>
</tbody>
</table>

CHOICE eNB ID | M | | BIT STRING (20) | Equal to the 20 leftmost bits of the Cell Identity IE contained in the E-UTRAN CGI/IE (see section 9.2.1.38) of each cell served by the eNB |

>| Macro eNB ID | M | | BIT STRING (20) | Equal to the 20 leftmost bits of the Cell Identity IE contained in the E-UTRAN CGI/IE (see section 9.2.1.38) of each cell served by the eNB |

>| Home eNB ID | M | | BIT STRING (28) | Equal to the 20 leftmost bits of the Cell Identity IE contained in the E-UTRAN CGI/IE (see section 9.2.1.38) of each cell served by the eNB |
9.2.1.38 E-UTRAN CGI

This information element is used to globally identify a cell (see [2]).

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLMN Identity</td>
<td>M</td>
<td></td>
<td>9.2.3.8</td>
<td></td>
</tr>
<tr>
<td>Cell Identity</td>
<td>M</td>
<td></td>
<td>BIT STRING (28)</td>
<td>The leftmost bits of the Cell Identity correspond to the eNB ID (defined in section 9.2.1.37).</td>
</tr>
</tbody>
</table>

9.2.1.39 Subscriber Profile ID for RAT/Frequency priority

The *Subscriber Profile ID* IE for RAT/Frequency Selection Priority is used to define camp priorities in Idle mode and to control inter-RAT/inter-frequency handover in Active mode [14].

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subscriber Profile ID for RAT/Frequency Priority</td>
<td>M</td>
<td>INTEGER (1..256)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9.2.1.40 UE Security Capabilities

The *UE Security Capabilities* IE defines the supported algorithms for encryption and integrity protection in the UE.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE Type and Reference</th>
<th>Semantics Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; Encryption Algorithms</td>
<td>M</td>
<td>BIT STRING (16, ...)</td>
<td></td>
<td>Each position in the bitmap represents an encryption algorithm: &quot;all bits equal to 0&quot; - UE supports no other algorithm than EEA0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&quot;first bit&quot; - 128-EIA1, second bit&quot; - 128-EIA2, other bits reserved for future use. Value &quot;1&quot; indicates support and value '0' indicates no support of the algorithm. Algorithms are defined in [15]</td>
</tr>
</tbody>
</table>

| > Integrity Protection Algorithms               | M        | BIT STRING (16, ...) |                        | Each position in the bitmap represents an integrity protection algorithm: "first bit" - 128-EIA1, second bit" - 128-EIA2, other bits reserved for future use. Value "1" indicates support and value '0' indicates no support of the algorithm. Algorithms are defined in [15]. |

9.2.1.41 Security Key

The *Security Key* IE is used to apply security in the eNB for different scenarios as defined in [15].
9.2.1.42 UE History Information

The UE History Information IE contains information about cells that a UE has been served by in active state prior to the target cell.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE Type and Reference</th>
<th>Semantics Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Security Key</td>
<td>M</td>
<td></td>
<td>BIT STRING (SIZE(256))</td>
<td>Key material for KeNB or Next Hop Key as defined in [15]</td>
</tr>
</tbody>
</table>

### Example

9.2.1.43 Last Visited Cell Information

The Last Visited Cell Information may contain E-UTRAN or UTRAN cell specific information.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE Type and Reference</th>
<th>Semantics Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Last Visited Cell List</td>
<td></td>
<td>1 to MaxNrOfCells</td>
<td></td>
<td>Most recent information is added to the top of this list</td>
</tr>
<tr>
<td>&gt;Last Visited Cell Information</td>
<td>M</td>
<td>9.2.1.43</td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>

### Example

#### Range bound

<table>
<thead>
<tr>
<th>MaxNrOfCells</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum length of the list. Value is 16.</td>
</tr>
</tbody>
</table>

9.2.1.43a Last Visited E-UTRAN Cell Information

The Last Visited E-UTRAN Cell Information contains information about a cell that is to be used for RRM purposes.
### 9.2.1.43b Last Visited GERAN Cell Information

The Last Visited Cell Information for GERAN is currently undefined.

**NOTE:** If in later Releases this is defined, the choice type may be extended with the actual GERAN specific information.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choice Last Visited GERAN Cell Information</td>
<td>M</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>&gt;Undefined</td>
<td>M</td>
<td>NULL</td>
<td></td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

### 9.2.1.44 Message Identifier

The purpose of the *Message Identifier* IE is to indentify the warning message. Message Identifier IE is set by the EPC and transfered to the UE by the eNB.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE Type and Reference</th>
<th>Semantics Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Message Identifier</td>
<td>M</td>
<td></td>
<td>BIT STRING (16)</td>
<td>This IE is set by the EPC, transferred to the UE by the eNB. The eNB shall treat it as an identifier of the message.</td>
</tr>
</tbody>
</table>

### 9.2.1.45 Serial Number

The Serial Number IE identifies a particular message from the source and type indicated by the Message Identifier and is altered every time the message with a given Message Identifier is changed.
### 9.2.1.46 Warning Area List

The *Warning Area List* IE indicates the areas where the warning message needs to be broadcast.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE Type and Reference</th>
<th>Semantics Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial Number</td>
<td>M</td>
<td>BIT STRING(16)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 9.2.1.47 Emergency Area ID

The *Emergency Area ID* IE is used to indicate the area which has the emergency impact.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE Type and Reference</th>
<th>Semantics Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Area ID</td>
<td>M</td>
<td>OCTET STRING(3)</td>
<td></td>
<td>Emergency Area ID may consist of several cells. Emergency Area ID is defined by the operator.</td>
</tr>
</tbody>
</table>

### 9.2.1.48 Repetition Period

The *Repetition Period* IE indicates the periodicity of the warning message to be broadcast.

<table>
<thead>
<tr>
<th>Range bound</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>maxnoofCellID</td>
<td>Maximum no. of Cell ID subject for warning message broadcast. Value is 65535.</td>
</tr>
<tr>
<td>maxnoofTAI</td>
<td>Maximum no. of TAI subject for warning message broadcast. Value is 65535.</td>
</tr>
<tr>
<td>maxnoofEmergencyAreaID</td>
<td>Maximum no. of Emergency Area ID subject for warning message broadcast. Value is 65535.</td>
</tr>
</tbody>
</table>
### 9.2.1.49 Number of Broadcasts Requested

The *Number of Broadcast Requested* IE indicates the number of times a message is to be broadcast.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE Type and Reference</th>
<th>Semantics Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Broadcasts Requested</td>
<td>M</td>
<td></td>
<td>INTEGER (0..65535)</td>
<td>This specifies the number of times the message is to be broadcast.</td>
</tr>
</tbody>
</table>

### 9.2.1.50 Warning Type

The *Warning Type* IE indicates types of the disaster. This IE also indicates that a Primary Notification is included. This IE can be used by the UE to differentiate the type of alert according to the type of disaster.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE Type and Reference</th>
<th>Semantics Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warning Type</td>
<td>M</td>
<td></td>
<td>OCTET STRING(2)</td>
<td></td>
</tr>
</tbody>
</table>

### 9.2.1.51 Warning Security Information

The *Warning Security Information* IE provides the security information needed for securing the Primary Notification.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE Type and Reference</th>
<th>Semantics Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warning Security Information</td>
<td>M</td>
<td></td>
<td>OCTET STRING(50)</td>
<td></td>
</tr>
</tbody>
</table>

### 9.2.1.52 Data Coding Scheme

The *Data Coding Scheme* IE identifies the alphabet or coding employed for the message characters and message handling at the UE (it is passed transparently from the EPC to the UE).

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE Type and Reference</th>
<th>Semantics Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data Coding Scheme</td>
<td>M</td>
<td></td>
<td>BIT STRING(8)</td>
<td></td>
</tr>
</tbody>
</table>

### 9.2.1.53 Warning Message Contents

The *Warning Message Content* IE contains user information e.g. the message with warning contents, and will be broadcast over the radio interface.
IE/Group Name | Presence | Range | IE Type and Reference | Semantics Description
---|---|---|---|---
Warning Message Contents | M | | OCTET STRING (SIZE(1..9600)) | The length of this IE varies between 1 to 9600 bytes.

**9.2.1.54 Broadcast Completed Area List**

The *Broadcast Completed Area List* IE indicates the areas where broadcast was performed successfully.

<table>
<thead>
<tr>
<th>Choice</th>
<th>Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE Type and Reference</th>
<th>Semantics Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Broadcast Completed Area</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;</td>
<td>Cell ID Broadcast</td>
<td>1 to &lt;maxnoofCellID&gt;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;</td>
<td>E-CGI</td>
<td>M</td>
<td>9.2.1.38</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;</td>
<td>TAI Broadcast</td>
<td>1 to &lt;maxnoofTAs&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;&gt;</td>
<td>TAI</td>
<td>M</td>
<td>9.2.3.16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;&gt;</td>
<td>Completed Cell in TAI List</td>
<td>1 to &lt;maxnoofCellIDinTA&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;&gt;&gt;</td>
<td>E-CGI</td>
<td>M</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;</td>
<td>Emergency Area ID Broadcast</td>
<td>1 to &lt;maxnoofEmergencyAreaID&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;&gt;</td>
<td>Emergency Area ID</td>
<td>M</td>
<td>9.2.1.47</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;&gt;</td>
<td>Completed Cell in Emergency Area ID List</td>
<td>1 to &lt;maxnoofCellIDinEA&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;&gt;&gt;&gt;</td>
<td>E-CGI</td>
<td>M</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Range bound</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>maxnoofCellID</td>
<td>Maximum no. of Cell ID subject for warning message broadcast. Value is 65535.</td>
</tr>
<tr>
<td>maxnoofTAI</td>
<td>Maximum no. of TAI subject for warning message broadcast. Value is 65535.</td>
</tr>
<tr>
<td>maxnoofEmergencyAreaID</td>
<td>Maximum no. of Emergency Area ID subject for warning message broadcast. Value is 65535.</td>
</tr>
<tr>
<td>maxnoofCellIDinTA</td>
<td>Maximum no. of Cell ID within a TAI. Value is 65535.</td>
</tr>
<tr>
<td>maxnoofCellIDinEA</td>
<td>Maximum no. of Cell ID within an Emergency Area. Value is 65535.</td>
</tr>
</tbody>
</table>

**9.2.1.55 Inter-system Information Transfer Type**

The *Inter-system Information Type* IE indicates the type of information that the eNB requests to transfer.

<table>
<thead>
<tr>
<th>Choice</th>
<th>Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inter-system Information Transfer Type</td>
<td></td>
<td></td>
<td>9.2.3.23</td>
<td></td>
</tr>
</tbody>
</table>
9.2.1.56 Source To Target Transparent Container

The Source to Target Transparent Container IE is an information element that is used to transparently pass radio related information from the handover source to the handover target through the EPC; it is produced by the source RAN node and is transmitted to the target RAN node.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source to Target Transparent Container</td>
<td>M</td>
<td></td>
<td>OCTET STRING</td>
<td>This IE includes a transparent container from the source RAN node to the target RAN node. In inter-system handovers from E-UTRAN, the IE is encoded according to the specifications of the target system.</td>
</tr>
</tbody>
</table>

9.2.1.57 Target To Source Transparent Container

The Target to Source Transparent Container IE is an information element that is used to transparently pass radio related information from the handover target to the handover source through the EPC; it is produced by the target RAN node and is transmitted to the source RAN node.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target to Source Transparent Container</td>
<td>M</td>
<td></td>
<td>OCTET STRING</td>
<td></td>
</tr>
</tbody>
</table>

9.2.1.58 SRVCC Operation Possible

This element indicates that both UE and MME are SRVCC-capable. E-UTRAN behaviour on receipt of this IE is specified in [9].

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRVCC operation possible</td>
<td>M</td>
<td></td>
<td>ENUMERATED</td>
<td>(Possible, …)</td>
</tr>
</tbody>
</table>

9.2.1.59 SRVCC HO Indication

This information element is set by the source eNB to provide an indication that E-RAB may be subjected to handover via SRVCC means.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRVCC HO Indication</td>
<td>M</td>
<td></td>
<td>ENUMERATED</td>
<td>(PS and CS, CS only,…)</td>
</tr>
</tbody>
</table>

9.2.1.60 Allocation and Retention Priority

This IE specifies the relative importance compared to other E-RABs for allocation and retention of the E-UTRAN Radio Access Bearer.
### 9.2.1.61 Time to wait

This IE defines the minimum allowed waiting times.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to wait</td>
<td>M</td>
<td></td>
<td>ENUMERATED(1s, 2s, 5s, 10s, 20s, 60s)</td>
<td></td>
</tr>
</tbody>
</table>

### 9.2.1.62 CSG Id

This information element indicates the identifier of the Closed Subscriber Group, as defined in [21].
IE/Group Name | Presence | Range | IE type and reference | Semantics description
--- | --- | --- | --- | ---
CSG Id | M |  | BIT STRING (SIZE (27)) | 

9.2.1.63 CSG Id List

Void

9.2.1.64 MS Classmark 2

The coding of this element is described in [23].

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE Type and Reference</th>
<th>Semantics Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS Classmark 2</td>
<td>M</td>
<td></td>
<td>OCTET STRING</td>
<td>Coded same way as the Mobile Station Classmark 2 IE defined in [23]</td>
</tr>
</tbody>
</table>

9.2.1.65 MS Classmark 3

The coding of this element is described in [23].

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE Type and Reference</th>
<th>Semantics Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS Classmark 3</td>
<td>M</td>
<td></td>
<td>OCTET STRING</td>
<td>Coded same way as the Mobile Station Classmark 3 IE defined in [23]</td>
</tr>
</tbody>
</table>

9.2.1.66 Cell Type

The cell type provides the cell coverage area.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell Size</td>
<td>M</td>
<td></td>
<td>ENUMERATED (verysmall, small, medium, large, …)</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

9.2.1.67 Old BSS to New BSS Information

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.

This IE is defined in [23].

9.2.1.68 Layer 3 Information

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 for inter 3GPP RAT handovers from SAE/LTE to GERAN A/Gb mode.

This IE is defined in [23].
9.2.2 Transport Network Layer Related IEs

9.2.2.1 Transport Layer Address

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

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport Layer Address</td>
<td>M</td>
<td></td>
<td>BIT STRING (1..160, ...)</td>
<td>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].</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GTP TEID</td>
<td>M</td>
<td></td>
<td>OCTET STRING (4)</td>
<td></td>
</tr>
</tbody>
</table>

9.2.3 NAS Related IEs

9.2.3.1 LAI

This information element is used to uniquely identify a Location Area.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
</table>
| LAI           | 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). |
| >PLMN identity | M        |       | OCTET STRING (2)      | 0000 and FFFE not allowed.                                                             |

9.2.3.2 RAC

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

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>INTEGER (0 .. 2^31-1)</td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>INTEGER (0 .. 2^31-1)</td>
<td></td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAS-PDU</td>
<td>M</td>
<td></td>
<td>OCTET STRING</td>
<td></td>
</tr>
</tbody>
</table>

9.2.3.6 S-TMSI

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

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

9.2.3.7 TAC

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

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAC</td>
<td>M</td>
<td></td>
<td>OCTET STRING (SIZE (2))</td>
<td></td>
</tr>
</tbody>
</table>
### 9.2.3.8 PLMN Identity

This information element indicates the PLMN Identity.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLMN identity</td>
<td>M</td>
<td></td>
<td>OCTET STRING (SIZE (3))</td>
<td>- 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).</td>
</tr>
</tbody>
</table>

### 9.2.3.9 GUMMEI

This information element indicates the globally unique MME identity.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GUMMEI</td>
<td>M</td>
<td></td>
<td>OCTET STRING (SIZE (3))</td>
<td>- 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).</td>
</tr>
<tr>
<td>&gt;PLMN identity</td>
<td>M</td>
<td></td>
<td>OCTET STRING (SIZE (3))</td>
<td>- 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).</td>
</tr>
<tr>
<td>&gt;MME Group ID</td>
<td>M</td>
<td></td>
<td>OCTET STRING (2)</td>
<td></td>
</tr>
<tr>
<td>&gt;MME code</td>
<td>M</td>
<td></td>
<td>9.2.3.12</td>
<td></td>
</tr>
</tbody>
</table>

### 9.2.3.10 UE Identity Index value

The *UE Identity Index value* IE is used by the eNB to calculate the Paging Frame [20].

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UE Identity Index Value</td>
<td>M</td>
<td></td>
<td>BIT STRING (10)</td>
<td>Coded as specified in [20]</td>
</tr>
</tbody>
</table>
9.2.3.11  IMSI

This information element contains an International Mobile Subscriber Identity, which is commonly used to identify the UE in the CN.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMSI</td>
<td>M</td>
<td></td>
<td>OCTET STRING (SIZE (3..8))</td>
<td>- 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.</td>
</tr>
</tbody>
</table>

9.2.3.12  MMEC

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

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMEC</td>
<td>M</td>
<td></td>
<td>OCTET STRING (SIZE (1))</td>
<td></td>
</tr>
</tbody>
</table>

9.2.3.13  UE Paging Identity

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

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choice UE Paging Identity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;IMSI</td>
<td>M</td>
<td></td>
<td></td>
<td>9.2.3.11</td>
</tr>
<tr>
<td>&gt;S-TMSI</td>
<td>M</td>
<td></td>
<td></td>
<td>9.2.3.6</td>
</tr>
</tbody>
</table>

9.2.3.14  DL Forwarding

This information element indicates that the E-RAB is proposed for forwarding of downlink packets.
### 9.2.3.15 Direct Forwarding Path Availability

The availability of a direct forwarding path shall be determined by the source eNB. The EPC behaviour on receipt of this IE is specified in [11].

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Forwarding Path Availability</td>
<td>M</td>
<td></td>
<td>ENUMERATED</td>
<td>(Direct Path Available, …)</td>
</tr>
</tbody>
</table>

### 9.2.3.16 TAI

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

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAI</td>
<td>M</td>
<td></td>
<td>9.2.3.8</td>
<td></td>
</tr>
<tr>
<td>&gt;PLMN identity</td>
<td>M</td>
<td></td>
<td>9.2.3.8</td>
<td></td>
</tr>
<tr>
<td>&gt;TAC</td>
<td>M</td>
<td></td>
<td>9.2.3.7</td>
<td></td>
</tr>
</tbody>
</table>

### 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].

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relative MME Capacity</td>
<td>M</td>
<td></td>
<td>INTEGER</td>
<td>(0..255)</td>
</tr>
</tbody>
</table>

### 9.2.3.18 UE S1AP ID pair

This IE contains a pair of UE S1AP identities.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
<th>Criticality</th>
<th>Assigned Criticality</th>
</tr>
</thead>
<tbody>
<tr>
<td>MME UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.3</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>eNB UE S1AP ID</td>
<td>M</td>
<td></td>
<td>9.2.3.4</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

### 9.2.3.19 Overload Response

The *Overload Response* IE indicates the required behaviour of the eNB in an overload situation.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choice Overload Response</td>
<td>M</td>
<td></td>
<td>9.2.3.20</td>
<td></td>
</tr>
</tbody>
</table>
9.2.3.20 Overload Action

The *Overload Action* IE indicates which signalling traffic needs to be rejected/permited by the eNB in an MME overload situation as defined in [11].

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overload Action</td>
<td>M</td>
<td></td>
<td>ENUMERATED</td>
<td>(Reject all RRC connection establishments for non-emergency MO DT, Reject all RRC connection establishments for Signalling. Permit Emergency Sessions only, …)</td>
</tr>
</tbody>
</table>

9.2.3.21 CS Fallback Indicator

The IE indicates that a fallback to the CS domain is needed.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS Fallback Indicator</td>
<td>M</td>
<td></td>
<td>ENUMERATED</td>
<td>(CS Fallback required, … , CS Fallback High Priority)</td>
</tr>
</tbody>
</table>

9.2.3.22 CN Domain

This IE indicates whether Paging is originated from the CS or PS domain.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN Domain</td>
<td>M</td>
<td></td>
<td>ENUMERATED</td>
<td>(PS, CS)</td>
</tr>
</tbody>
</table>

9.2.3.23 RIM Transfer

This IE contains the RIM Information (e.g. NACC information) and additionally in uplink transfer the RIM routing address of the destination of this RIM information.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RIM Transfer</td>
<td></td>
<td></td>
<td>9.2.3.24</td>
<td></td>
</tr>
<tr>
<td>&gt;RIM Information</td>
<td>M</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;RIM Routing Address</td>
<td>O</td>
<td></td>
<td>9.2.3.25</td>
<td></td>
</tr>
</tbody>
</table>

9.2.3.24 RIM Information

This IE contains the RIM Information (e.g. NACC information) i.e. the BSSGP RIM PDU from the RIM application part contained in the eNB, or the BSSGP RIM PDU to be forwarded to the RIM application part in the eNB.
### 9.2.3.25 RIM Routing Address

This IE identifies the destination node where the RIM Information needs to be routed by the CN.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choice RIM Routing Address</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;GERAN-Cell-ID</td>
<td>M</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt;LAI</td>
<td>M</td>
<td>9.2.3.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt;RAC</td>
<td>M</td>
<td>9.2.3.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt;CI</td>
<td>M</td>
<td>OCTET STRING (2)</td>
<td>Contains the BSSGP RIM PDU as defined in ref [18].</td>
<td></td>
</tr>
</tbody>
</table>

### 9.2.3.26 SON ConfigurationTransfer

This IE contains the SON Information and additionally includes the eNB identifier of the destination of this SON information and the eNB identifier of the source of this information.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SON Configuration Transfer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;Target eNB-ID</td>
<td>M</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; Global eNB ID</td>
<td>M</td>
<td>9.2.1.37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; Selected TAI</td>
<td>M</td>
<td>TAI 9.2.3.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;Source eNB-ID</td>
<td>M</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; Global eNB ID</td>
<td>M</td>
<td>9.2.1.37</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt; Selected TAI</td>
<td>M</td>
<td>TAI 9.2.3.16</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;SON Information</td>
<td>M</td>
<td></td>
<td>9.2.3.27</td>
<td></td>
</tr>
</tbody>
</table>

### 9.2.3.27 SON Information

This IE identifies the nature of the SON information transferred i.e. a request or a reply.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choice SON Information</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;SON Information Request</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;&gt;SON Information Request</td>
<td></td>
<td></td>
<td>ENUMERATED[X 2 TNL Configuration Info, ...]</td>
<td></td>
</tr>
<tr>
<td>&gt;SON Information Reply</td>
<td></td>
<td></td>
<td>9.2.3.28</td>
<td></td>
</tr>
</tbody>
</table>

### 9.2.3.28 SON Information Reply

This IE contains the SON Information to be replied to the eNB.
9.2.3.29  X2 TNL Configuration Info

The X2 TNL Configuration Info IE is used for signalling X2 TNL Configuration information for automatic X2 SCTP association establishment.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;X2 TNL Configuration Info</td>
<td></td>
<td></td>
<td>9.2.3.29</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE type and reference</th>
<th>Semantics description</th>
</tr>
</thead>
<tbody>
<tr>
<td>eNB X2 Transport Layer Addresses</td>
<td></td>
<td>1 to &lt;maxnoofeNBX2TLAs&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; Transport Layer Address</td>
<td>M</td>
<td></td>
<td>9.2.2.1</td>
<td>Transport Layer Addresses for X2 SCTP end-point.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Range bound</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>maxnoofeNBX2TLAs</td>
<td>Maximum no. of eNB X2 Transport Layer Addresses for an SCTP end-point. Value is 2.</td>
</tr>
</tbody>
</table>

9.2.3.30  NAS Security Parameters from E-UTRAN

The purpose of the NAS Security Parameters from E-UTRAN IE is to provide security related parameters for I-RAT handovers from E-UTRAN via the eNB to the UE.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE Type and Reference</th>
<th>Semantics Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAS Security Parameters from E-UTRAN</td>
<td>M</td>
<td></td>
<td>OCTET STRING</td>
<td>Coded as the value part of NAS security parameters from E-UTRA IE defined in [24].</td>
</tr>
</tbody>
</table>

9.2.3.31  NAS Security Parameters to E-UTRAN

The purpose of the NAS Security Parameters to E-UTRAN IE is to provide security related parameters for I-RAT handovers to E-UTRAN via the RNC or BSS to the UE.

<table>
<thead>
<tr>
<th>IE/Group Name</th>
<th>Presence</th>
<th>Range</th>
<th>IE Type and Reference</th>
<th>Semantics Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAS Security Parameters to E-UTRAN</td>
<td>M</td>
<td></td>
<td>OCTET STRING</td>
<td>Coded as the value part of NAS security parameters to E-UTRA IE defined in [24].</td>
</tr>
</tbody>
</table>
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) slap (1) version1 (1) slap-PDU-Descriptions (0)}

DEFINITIONS AUTOMATIC TAGS ::= BEGIN

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

IMPORTS
Criticality,
ProcedureCode
FROM S1AP-CommonDataTypes

CellTrafficTrace,
DeactivateTrace,
DownlinkNASTransport,
DownlinkS1cdma2000tunneling,
ENBDirectInformationTransfer,
ENBStatusTransfer,
ENBConfigurationUpdate,
ENBConfigurationUpdateAcknowledge,
ENBConfigurationUpdateFailure,
ErrorIndication,
HandoverCancel,
HandoverCancelAcknowledge,
HandoverCommand,
HandoverFailure,
HandoverNotify,
HandoverPreparationFailure,
HandoverRequest,
HandoverRequestAcknowledge,
HandoverRequired,
InitialContextSetupFailure,
InitialContextSetupRequest,
InitialContextSetupResponse,
InitialUEMessage,
LocationReportingControl,
LocationReportingFailureIndication,
LocationReport,
MMConfigurationUpdate,  
MMConfigurationUpdateAcknowledge,  
MMConfigurationUpdateFailure,  
MMEDirectInformationTransfer,  
MMEConfigurationTransfer,  
NASNonDeliveryIndication,  
OverloadStart,  
OverloadStop,  
Paging,  
PathSwitchRequest,  
PathSwitchRequestAcknowledge,  
PathSwitchRequestFailure,  
PrivateMessage,  
Reset,  
ResetAcknowledge,  
S1SetupFailure,  
S1SetupRequest,  
S1SetupResponse,  
E-RABModifyRequest,  
E-RABModifyResponse,  
E-RABReleaseCommand,  
E-RABReleaseResponse,  
E-RABReleaseIndication,  
E-RABSetupRequest,  
E-RABSetupResponse,  
TraceFailureIndication,  
TraceStart,  
UECapabilityInfoIndication,  
UEContextModificationFailure,  
UEContextModificationRequest,  
UEContextModificationResponse,  
UEContextReleaseCommand,  
UEContextReleaseComplete,  
UEContextReleaseRequest,  
UplinkNASTransport,  
UplinkS1cdma2000tunneling,  
WriteReplaceWarningRequest,  
WriteReplaceWarningResponse,  
ENBConfigurationTransfer,  
MMConfigurationTransfer

FROM S1AP-PDU-Contents

id-CellTrafficTrace,  
id-DeactivateTrace,  
id-downlinkNASTransport,  
id-DownlinkS1cdma2000tunneling,  
id-eNBStatusTransfer,  
id-ErrorIndication,  
id-HandoverCancel,  
id-HandoverNotification,  
id-HandoverPreparation,  
id-HandoverResourceAllocation,
id-InitialContextSetup,
id-initialUEMessage,
id-eNBBConfigurationUpdate,
id-LocationReportingControl,
id-LocationReportingFailureIndication,
id-LocationReport,
id-eNBDirectInformationTransfer,
id-MMEConfigurationUpdate,
id-MMEDirectInformationTransfer,
id-MMEStatusTransfer,
id-NASNonDeliveryIndication,
id-OverloadStart,
id-OverloadStop,
id-Paging,
id-PathSwitchRequest,
id-PrivateMessage,
id-Reset,
id-SISetup,
id-E-RABModify,
id-E-RABRelease,
id-E-RABReleaseIndication,
id-E-RABSetup,
id-TraceFailureIndication,
id-TraceStart,
id-UECapabilityInfoIndication,
id-UEContextModification,
id-UEContextRelease,
id-UEContextReleaseRequest,
id-uplinkNASTransport,
id-UplinkS1cdma2000tunneling,
id-WriteReplaceWarning,
id-eNBBConfigurationTransfer,
id-MMEConfigurationTransfer
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

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})
}
initialContextSetup  reset  s1Setup  uEContextModification  uEContextRelease  eNBConfigurationUpdate  mMMEConfigurationUpdate  writeReplaceWarning  ...

S1AP-ELEMENTARY-PROCEDURES-CLASS-2  S1AP-ELEMENTARY-PROCEDURE ::= {
handoverNotification  e-RABReleaseIndication  paging  downlinkNASTransport  initialUEMessage  uplinkNASTransport  errorIndication  NASNonDeliveryIndication  uEContextReleaseRequest  downlinkS1cdma2000tunneling  uplinkS1cdma2000tunneling  uECapabilityInfoIndication  eNBStatusTransfer  mMMEStatusTransfer  deactivateTrace  traceStart  traceFailureIndication  cellTrafficTrace  locationReportingControl  locationReportingFailureIndication  locationReport  overloadStart  overloadStop  eNBDirectInformationTransfer  mMBDirectInformationTransfer  eNBConfigurationTransfer  mMMEConfigurationTransfer  privateMessage  ...

-- ************************************************************
-- 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
}

e-RABSetup S1AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE E-RABSetupRequest
  SUCCESSFUL OUTCOME E-RABSetupResponse
  PROCEDURE CODE id-E-RABSetup
  CRITICALITY reject
}

e-RABModify S1AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE E-RABModifyRequest
  SUCCESSFUL OUTCOME E-RABModifyResponse
  PROCEDURE CODE id-E-RABModify
  CRITICALITY reject
}

e-RABRelease S1AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE E-RABReleaseCommand
  SUCCESSFUL OUTCOME E-RABReleaseResponse
  PROCEDURE CODE id-E-RABRelease
  CRITICALITY reject
}

e-RABReleaseIndication S1AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE E-RABReleaseIndication
  PROCEDURE CODE id-E-RABReleaseIndication
  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 ResetAcknowledgement
  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     UEContextReleaseCommand
PROCEDURE CODE         id-UEContextRelease
CRITICALITY           reject

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
}

mMStatusTransfer S1AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE     mMStatusTransfer
  PROCEDURE CODE         id-mMStatusTransfer
  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
}

cellTrafficTrace S1AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE     CellTrafficTrace
  PROCEDURE CODE         id-CellTrafficTrace
  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
}

overloadStart S1AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE OverloadStart
  PROCEDURE CODE id-OverloadStart
  CRITICALITY ignore
}

overloadStop S1AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE OverloadStop
  PROCEDURE CODE id-OverloadStop
  CRITICALITY reject
}

writeReplaceWarning S1AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE WriteReplaceWarningRequest
  SUCCESSFUL OUTCOME WriteReplaceWarningResponse
  PROCEDURE CODE id-WriteReplaceWarning
  CRITICALITY reject
}

eNBDirectInformationTransfer S1AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE ENBDirectInformationTransfer
  PROCEDURE CODE id-eNBDirectInformationTransfer
  CRITICALITY ignore
}

mMEDirectInformationTransfer S1AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE MMEDirectInformationTransfer
  PROCEDURE CODE id-MMEDirectInformationTransfer
  CRITICALITY ignore
}

eNBConfigurationTransfer S1AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE ENBConfigurationTransfer
  PROCEDURE CODE id-eNBConfigurationTransfer
  CRITICALITY ignore
}

mMEConfigurationTransfer S1AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE MMEConfigurationTransfer
  PROCEDURE CODE id-MMEConfigurationTransfer
  CRITICALITY ignore
}
privateMessage S1AP-ELEMENTARY-PROCEDURE ::= {
   INITIATING MESSAGE PrivateMessage
   PROCEDURE CODE  id-PrivateMessage
   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) slap (1) version1 (1) slap-PDU-Contents (1) }

DEFINITIONS AUTOMATIC TAGS ::= 
BEGIN

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

IMPORTS

UEAggregateMaximumBitrate,
Cause,
Cdma2000HOREquiredIndication,
Cdma2000HOSstatus,
Cdma2000OneXSRVCCInfo,
Cdma2000OneXRAND,
Cdma2000PDU,
Cdma2000RATTtype,
Cdma2000SectorID,
CNDomain,
CriticalityDiagnostics,
CSFallbackIndicator,
CSG-Id,
CSG-IdList,
Direct-Forwarding-Path-Availability,
Global-ENB-ID,
EUTRAN-CGI,
ENBname,
ENB-StatusTransfer-TransparentContainer,
ENB-UE-S1AP-ID,
GTP-TEID,
GUMMEI,
HandoverRestrictionList,
HandoverType,
MMEname,
MM-UE-S1AP-ID,
MSClassmark2,
MSClassmark3,
NAS-PDU,
NASSecurityParametersfromE-UTRAN,
NASSecurityParameterstoE-UTRAN,
OverloadResponse,
PagingDRX,
PLMNIdentity,
RIMTransfer,
RelativeMMECapacity,
RequestType,
E-RAB-ID,
E-RABLevelQoSParameters,
E-RABList,
SecurityKey,
SecurityContext,
ServedGUMMEIs,
SONConfigurationTransfer,
Source-ToTarget-TransparentContainer,
SourceBSS-ToTargetBSS-TransparentContainer,
SourceeNB-ToTargeteNB-TransparentContainer,
SourceRNC-ToTargetRNC-TransparentContainer,
SubscriberProfileIDforRFP,
SRVCCOperationPossible,
SRVCCHOIndication,
SupportedTAs,
TAI,
Target-ToSource-TransparentContainer,
TargetBSS-ToSourceBSS-TransparentContainer,
TargeteNB-ToSourceeNB-TransparentContainer,
TargetRNC-ToSourceRNC-TransparentContainer,
TimeToWait,
TraceActivation,
E-UTRAN-Trace-ID,
TransportLayerAddress,
UEIdentityIndexValue,
UEPagingID,
UERadioCapability,
UE-S1AP-IDs,
UE-associatedLogicalS1-ConnectionItem,
UESecurityCapabilities,
S-TMSI,
MessageIdentifier,
SerialNumber,
WarningAreaList,
RepetitionPeriod,
NumberofBroadcastRequest,
WarningType,
WarningSecurityInfo,
DataCodingScheme,
WarningMessageContents,
BroadcastCompletedAreaList,
RRC-Establishment-Cause

FROM S1AP-IEs
FROM SIAP-Containers

id-uEaggregateMaximumBitrate,
id-Cause,
id-cdma2000HORequiredIndication,
id-cdma2000HOSuccess,
id-cdma2000OneXSRVCCInfo,
id-cdma2000OneXRAND,
id-cdma2000PDU,
id-cdma2000RATType,
id-cdma2000SectorID,
id-CNDomain,
id-CriticalityDiagnostics,
id-CSFallbackIndicator,
id-CSG-Id,
id-CSG-IDList,
id-DefaultPagingDRX,
id-Direct-Forwarding-Path-Availability,
id-Global-ENB-ID,
id-EUTRAN-CGI,
id-eNBname,
id-eNB-StatusTransfer-TransparentContainer,
id-eNB-UR-SIAP-ID,
id-GERANtoLTEHOInformationRes,
id-GUMMEI-ID,
id-HandoverRestrictionList,
id-HandoverType,
id-InitialContextSetup,
id-Inter-SystemInformationTransferTypeEDT,
id-Inter-SystemInformationTransferTypeMDT,
id-NAS-DownlinkCount,
id-MMEname,
id-MME-UR-SIAP-ID,
id-MSClassmark2,
id-MSClassmark3,
id-NAS-PDU,
id-NASSecurityParametersfromE-UTRAN,
id-NASSecurityParametersstoE-UTRAN,
id-OverloadResponse,
id-pagingDRX,
id-RelativeMMECapacity,
id-RequestType,
id-E-RABAdmittedItem,
id-E-RABAdmittedList,
id-E-RABDataForwardingItem,
id-E-RABFailedToModifyList,
id-E-RABFailedToReleaseList,
id-E-RABFailedToSetupItemHOReqAck,
id-E-RABFailedToSetupListBearerSURES,
id-E-RABFailedToSetupListCtxtSURES,
id-E-RABFailedToSetupListHOReqAck,
id-E-RABFailedToBeReleasedList,
id-E-RAModify,
id-E-RAModifyItemBearerModRes,
id-E-RAModifyListBearerModRes,
id-E-RABRelease,
id-E-RABReleaseItemBearerRelComp,
id-E-RABReleaseItemHOCmd,
id-E-RABReleaseListBearerRelComp,
id-E-RABReleaseIndication,
id-E-RABSetup,
id-E-RABSetupItemBearerSURES,
id-E-RABSetupItemCtxtSURES,
id-E-RABSetupListBearerSURES,
id-E-RABSetupListCtxtSURES,
id-E-RABSubsetDataForwardingList,
id-E-RABToBeModifiedItemBearerModReq,
id-E-RABToBeModifiedListBearerModReq,
id-E-RABToBeModifiedListHOReqAck,
id-E-RABToBeReleasedList,
id-E-RABReleasedList,
id-E-RABToBeSetupItemBearerSUReq,
id-E-RABToBeSetupItemCtxtSUReq,
id-E-RABToBeSetupItemHOReq,
id-E-RABToBeSetupListBearerSUReq,
id-E-RABToBeSetupListCtxtSUReq,
id-E-RABToBeSetupListHOReq,
id-E-RABToBeSwitchedDListItem,
id-E-RABToBeSwitchedDListList,
id-E-RABToBeSwitchedULItem,
id-E-RABToBeSwitchedULList,
id-E-RABReleaseListHOCmd,
id-SecurityKey,
id-SecurityContext,
id-ServedGUMMEIs,
id-SONConfigurationTransferECT,
id-SONConfigurationTransferMCT,
id-Source-ToTarget-TransparentContainer,
id-Source-ToTarget-TransparentContainer-Secondary,
id-SourceMME-UE-S1AP-ID,
id-SRVCCHOperationPossible,
id-SRVCCHOIndication,
id-SubscriberProfileIDforRFP,
id-SupportedTAs,
id-S-TMSI,
id-TAI,
id-TAIItem,
FROM SIAP-Constants;

-- *******************************************************

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

B-RAB-IE-ContainerList { SIAP-PROTOCOL-IBS : IEsSetParam } ::= ProtocolIE-ContainerList { 1, maxNrOfE-RABs, [IEsSetParam] }
B-RAB-IE-ContainerPairList { SIAP-PROTOCOL-IBS-PAIR : IEsSetParam } ::= ProtocolIE-ContainerPairList { 1, maxNrOfE-RABs, [IEsSetParam] }
ProtocolError-IE-ContainerList { SIAP-PROTOCOL-IBS : IEsSetParam } ::= ProtocolIE-ContainerList { 1, maxNrOfE-RABs, [IEsSetParam] }

-- *******************************************************

-- HANOVER PREPARATION ELEMENTARY 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-eNB-UE-S1AP-ID       CRITICALITY reject TYPE ENB-UE-S1AP-ID           PRESENCE mandatory } |
  { ID id-HandoverType       CRITICALITY reject TYPE HandoverType            PRESENCE mandatory } |
  { ID id-Cause         CRITICALITY reject TYPE Cause            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-SRVCCCHOIndication  CRITICALITY Reject TYPE SRVCCCHOIndication     PRESENCE optional } |
  { ID id-Source-ToTarget-TransparentContainer CRITICALITY reject TYPE Source-ToTarget-TransparentContainer PRESENCE mandatory } |
  { ID id-Target-ToSource-TransparentContainer-Secondary CRITICALITY reject TYPE Target-ToSource-TransparentContainer PRESENCE optional } |
  { ID id-MSClassmark2       CRITICALITY reject TYPE MSClassmark2         PRESENCE conditional } |
  { ID id-MSClassmark3       CRITICALITY reject TYPE MSClassmark3         PRESENCE conditional } |
...}

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

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

HandoverCommandIEs 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-NASSecurityParametersfromE-UTRAN  CRITICALITY reject TYPE NASSecurityParametersfromE-UTRAN     PRESENCE conditional } |
  { ID id-E-RABSubjecttoDataForwardingList CRITICALITY ignore TYPE E-RABSubjecttoDataForwardingList PRESENCE optional } |
  { ID id-E-RABtoReleaseListHOCmd CRITICALITY ignore TYPE E-RABtoReleaseListHOCmd PRESENCE optional } |
  { ID id-Target-ToSource-TransparentContainer CRITICALITY reject TYPE Target-ToSource-TransparentContainer PRESENCE mandatory } |
  { ID id-Target-ToSource-TransparentContainer-Secondary CRITICALITY reject TYPE Target-ToSource-TransparentContainer PRESENCE optional } |
  { ID id-CriticalityDiagnostics CRITICALITY ignore TYPE CriticalityDiagnostics PRESENCE optional },
...}
E-RABSubjectToDataForwardingList ::= E-RAB-IE-ContainerList { {E-RABDataForwardingItemIEs} }

E-RABDataForwardingItemIEs S1AP-PROTOCOL-IES ::= {
    { ID id-E-RABDataForwardingItem CRITICALITY ignore TYPE E-RABDataForwardingItem PRESENCE mandatory },
    ...
}

E-RABDataForwardingItem ::= SEQUENCE {
    e-RAB-ID E-RAB-ID,
    dl-transportLayerAddress TransportLayerAddress OPTIONAL,
    dl-gTP-TEID GTP-TEID OPTIONAL,
    ul-TransportLayerAddress TransportLayerAddress OPTIONAL,
    ul-GTP-TEID GTP-TEID OPTIONAL,
    iE-Extensions ProtocolExtensionContainer { { E-RABDataForwardingItem-ExtIEs} } OPTIONAL,
    ...
}

E-RABDataForwardingItem-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

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

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

HandoverPreparationFailureIEs 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-Cause CRITICALITY ignore TYPE Cause PRESENCE mandatory } |
    { ID id-CriticalityDiagnostics CRITICALITY ignore TYPE CriticalityDiagnostics PRESENCE optional },
    ...
}

-- *****************************************************
-- HANDOVER RESOURCE ALLOCATION ELEMENTARY 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-UEAggregateMaximumBitrate CRITICALITY reject TYPE UEAggregateMaximumBitrate PRESENCE mandatory |
  ID id-E-RABToBeSetupListHOReq CRITICALITY reject TYPE E-RABToBeSetupListHOReq PRESENCE mandatory |
  ID id-Source-ToTarget-TransparentContainer CRITICALITY reject TYPE Source-ToTarget-TransparentContainer PRESENCE mandatory |
  ID id-UESecurityCapabilities CRITICALITY reject TYPE UESecurityCapabilities PRESENCE mandatory |
  ID id-HandoverRestrictionList CRITICALITY ignore TYPE HandoverRestrictionList PRESENCE optional |
  ID id-TraceActivation CRITICALITY ignore TYPE TraceActivation PRESENCE optional |
  ID id-RequestType CRITICALITY ignore TYPE RequestType PRESENCE optional |
  ID id-SRVCCOperationPossible CRITICALITY ignore TYPE SRVCCOperationPossible PRESENCE optional |
  ID id-SecurityContext CRITICALITY reject TYPE SecurityContext PRESENCE mandatory |
  ID id-NASSecurityParameterstoE-UTRAN CRITICALITY reject TYPE NASSecurityParameterstoE-UTRAN PRESENCE conditional
-- This IE shall be present if the Handover Type IE is set to the value "UTRANtoLTE" or "GERANtoLTE" -- |
  ...
}

E-RABToBeSetupListHOReq ::= E-RAB-IE-ContainerList { {E-RABToBeSetupItemHOReqIEs} }

E-RABToBeSetupItemHOReqIEs S1AP-PROTOCOL-IES ::= {
  ID id-E-RABToBeSetupItemHOReq CRITICALITY reject TYPE E-RABToBeSetupItemHOReq PRESENCE mandatory },
  ...
}

E-RABToBeSetupItemHOReq ::= SEQUENCE {
  e-RAB-ID E-RAB-ID,
  transportLayerAddress TransportLayerAddress,
  gTP-TEID GTP-TEID,
  e-RABLevelQoSParameters E-RABLevelQoSParameters,
  iE-Extensions ProtocolExtensionContainer { {E-RABToBeSetupItemHOReq-ExtIEs} } OPTIONAL,
  ...
}

E-RABToBeSetupItemHOReq-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...
}

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

HandoverRequestAcknowledge ::= SEQUENCE {
  protocolIEs  ProtocolIE-Container { {HandoverRequestAcknowledgeIEs} },
  ...
}
HandoverRequestAcknowledgeIEs 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-E-RABAdmittedList       CRITICALITY ignore TYPE E-RABAdmittedList      PRESENCE mandatory } |
  { ID id-E-RABFailedToSetupListHOReqAck CRITICALITY ignore TYPE E-RABFailedToSetupListHOReqAck  PRESENCE optional } |
  { ID id-Target-ToSource-TransparentContainer CRITICALITY reject TYPE Target-ToSource-TransparentContainer  PRESENCE mandatory } |
  { ID id-CriticalityDiagnostics      CRITICALITY ignore TYPE CriticalityDiagnostics      PRESENCE optional },
}

E-RABAdmittedList ::= E-RAB-IE-ContainerList { {E-RABAdmittedItemIEs} }

E-RABAdmittedItemIEs S1AP-PROTOCOL-IEs ::= {
  { ID id-E-RABAdmittedItem  CRITICALITY ignore TYPE E-RABAdmittedItem  PRESENCE mandatory },
  ...
}

E-RABAdmittedItem ::= SEQUENCE {
  e-RAB-ID            E-RAB-ID,
  transportLayerAddress  TransportLayerAddress,
  gTP-TEID            GTP-TEID,
  dl-transportLayerAddress  TransportLayerAddress OPTIONAL,
  dl-gTP-TEID        GTP-TEID OPTIONAL,
  ul-TransportLayerAddress  TransportLayerAddress OPTIONAL,
  ul-GTP-TEID        GTP-TEID OPTIONAL,
  iE-Extensions     ProtocolExtensionContainer { {E-RABAdmittedItem-ExtIEs} } OPTIONAL,
  ...
}

E-RABAdmittedItem-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...
}

E-RABFailedtoSetupListHOReqAck ::= E-RAB-IE-ContainerList { {E-RABFailedtoSetupItemHOReqAckIEs} }

E-RABFailedtoSetupItemHOReqAckIEs S1AP-PROTOCOL-IEs ::= {
  { ID id-E-RABFailedtoSetupItemHOReqAck  CRITICALITY ignore TYPE E-RABFailedToSetupItemHOReqAck  PRESENCE mandatory },
  ...
}

E-RABFailedToSetupItemHOReqAck ::= SEQUENCE {
  e-RAB-ID              E-RAB-ID,
  cause      Cause,
  iE-Extensions     ProtocolExtensionContainer { {E-RABFailedToSetupItemHOReqAckExtIEs} } OPTIONAL,
  ...
}

E-RABFailedToSetupItemHOReqAckExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...
}

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

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

HandoverFailureIEs S1AP-PROTOCOL-IES ::= {
  { ID id-MME-UE-S1AP-ID CRITICALITY ignore 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 ELEMENTARY 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-EUTRAN-CGI CRITICALITY ignore TYPE EUTRAN-CGI PRESENCE mandatory} |
  { ID id-TAI CRITICALITY ignore TYPE TAI PRESENCE mandatory},
  ...  
}

---
-- PATH SWITCH REQUEST ELEMENTARY PROCEDURE
---
-- *********************************************

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

---

ETSI
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-E-RABToBeSwitchedDLLList  CRITICALITY reject  TYPE E-RABToBeSwitchedDLLList  PRESENCE mandatory },
  { ID id-MME-UE-S1AP-ID  CRITICALITY reject  TYPE MME-UE-S1AP-ID  PRESENCE mandatory },
  { ID id-UEAggregateMaximumBitrate  CRITICALITY ignore  TYPE UEAggregateMaximumBitrate  PRESENCE optional },
  { ID id-UESecurityCapabilities  CRITICALITY ignore  TYPE UESecurityCapabilities  PRESENCE mandatory },
  ...
}

E-RABToBeSwitchedDLLList ::= E-RAB-IE-ContainerList  {{ E-RABToBeSwitchedDLLItemIEs} }

E-RABToBeSwitchedDLLItemIEs S1AP-PROTOCOL-IES ::= {
  { ID id-E-RABToBeSwitchedDLLItem  CRITICALITY reject  TYPE E-RABToBeSwitchedDLLItem  PRESENCE mandatory },
  ...
}

E-RABToBeSwitchedDLLItem ::= SEQUENCE {
  e-RAB-ID  E-RAB-ID,
  transportLayerAddress  TransportLayerAddress,
  gTP-TEID  GTP-TEID,
  iE-Extensions  ProtocolExtensionContainer  {{ E-RABToBeSwitchedDLLItem-ExtIEs} } OPTIONAL,
  ...
}

E-RABToBeSwitchedDLLItem-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 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-UEAggregateMaximumBitrate  CRITICALITY ignore  TYPE UEAggregateMaximumBitrate  PRESENCE optional },
  { ID id-E-RABToBeSwitchedDLLList  CRITICALITY ignore  TYPE E-RABToBeSwitchedDLLList  PRESENCE optional },
  { ID id-UESecurityCapabilities  CRITICALITY ignore  TYPE UESecurityCapabilities  PRESENCE mandatory },
  { ID id-DiagnosticInformation  CRITICALITY reject  TYPE SecurityContext  PRESENCE mandatory },
  ...
}
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E-RABToBeSwitchedULList ::= E-RAB-IE-ContainerList {E-RABToBeSwitchedULItemIEs}

E-RABToBeSwitchedULItemIEs S1AP-PROTOCOL-IES ::= {
  {ID id-E-RABToBeSwitchedULItem CRITICALITY ignore TYPE E-RABToBeSwitchedULItem PRESENCE mandatory },
  ...
}

E-RABToBeSwitchedULItem ::= SEQUENCE {
  e-RAB-ID E-RAB-ID,
  transportLayerAddress TransportLayerAddress,
  gTP-TEID GTP-TEID,
  iE-Extensions ProtocolExtensionContainer { { E-RABToBeSwitchedULItem-ExtIEs} } OPTIONAL,
  ...
}

E-RABToBeSwitchedULItem-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...
}

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

PathSwitchRequestFailureIEs 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-Cause CRITICALITY ignore TYPE Cause PRESENCE mandatory } |
  {ID id-CriticalityDiagnostics CRITICALITY ignore TYPE CriticalityDiagnostics PRESENCE optional },
  ...
}

HandoverCancel ::= SEQUENCE {
  ...
}
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 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-CriticalityDiagnostics CRITICALITY ignore TYPE CriticalityDiagnostics PRESENCE optional },
  ...
}

- E-RAB SETUP ELEMTNARY PROCEDURE

E-RABSetupRequest ::= SEQUENCE {
  protocolIEs    ProtocolIE-Container    {
    E-RABSetupRequestIEs,
    ...
  }
}

E-RABSetupRequestIEs 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-UEaggregateMaximumBitrate CRITICALITY reject TYPE UEAggregateMaximumBitrate PRESENCE optional },
  { ID id-E-RABToBeSetupListBearerSUReq CRITICALITY reject TYPE E-RABToBeSetupListBearerSUReq PRESENCE mandatory },
  ...
}
E-RABToBeSetupListBearerSUReq ::= SEQUENCE (SIZE(1.. maxNrOfE-RABs)) OF ProtocolIE-SingleContainer { {E-RABToBeSetupItemBearerSUReqIEs} }

E-RABToBeSetupItemBearerSUReqIEs S1AP-PROTOCOL-IES ::= {
  { ID id-E-RABToBeSetupItemBearerSUReq CRITICALITY reject TYPE E-RABToBeSetupItemBearerSUReq PRESENCE mandatory },
  ...
}

E-RABToBeSetupItemBearerSUReq ::= SEQUENCE {
  e-RAB-Id E-RAB-Id,
  e-RABlevelQoSParameters E-RABLevelQoSParameters,
  transportLayerAddress TransportLayerAddress,
  gTP-TEID GTP-TEID,
  nAS-PDU NAS-PDU,
  iE-Extensions ProtocolExtensionContainer { {E-RABToBeSetupItemBearerSUReqExtIEs} } OPTIONAL,
  ...
}

E-RABToBeSetupItemBearerSUReqExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...
}

E-RABSetupResponse ::= SEQUENCE {
  protocolIEs ProtocolIE-Container { {E-RABSetupResponseIEs} },
  ...
}

E-RABSetupResponseIEs 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-E-RABSetupListBearerSURes CRITICALITY ignore TYPE E-RABSetupListBearerSURes PRESENCE optional }|
  { ID id-E-RABFailedToSetupListBearerSURes CRITICALITY ignore TYPE E-RABList PRESENCE optional }|
  { ID id-CriticalityDiagnostics CRITICALITY ignore TYPE CriticalityDiagnostics PRESENCE optional },
  ...
}

E-RABSetupListBearerSURes ::= SEQUENCE (SIZE(1.. maxNrOfE-RABs)) OF ProtocolIE-SingleContainer { {E-RABSetupItemBearerSUResIEs} }

E-RABSetupItemBearerSUResIEs S1AP-PROTOCOL-IES ::= {
  { ID id-E-RABSetupItemBearerSURes CRITICALITY ignore TYPE E-RABSetupItemBearerSURes PRESENCE mandatory },
  ...
}

E-RABSetupItemBearerSURes ::= SEQUENCE {
  e-RAB-ID E-RAB-Id,
  transportLayerAddress TransportLayerAddress,
  ...
-- ************************************************************
-- E-RAB MODIFY ELEMENTARY PROCEDURE
-- ************************************************************
-- E-RAB Modify Request
-- ************************************************************

E-RABModifyRequest ::= SEQUENCE {  protocolIEs   ProtocolIE-Container       { {E-RABModifyRequestIEs} },

E-RABModifyRequestIEs 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-uEaggregateMaximumBitrate   CRITICALITY reject TYPE UEAggregateMaximumBitrate    PRESENCE optional }||
{ ID id-E-RABToBeModifiedListBearerModReq CRITICALITY reject TYPE E-RABToBeModifiedListBearerModReq PRESENCE mandatory },

E-RABToBeModifiedListBearerModReq ::= SEQUENCE (SIZE(1.. maxNrOfE-RABs)) OF ProtocolIE-SingleContainer { {E-RABToBeModifiedItemBearerModReqIEs} }  
E-RABToBeModifiedItemBearerModReqIEs  S1AP-PROTOCOL-IES ::= {  
{ ID id-E-RABToBeModifiedItemBearerModReq  CRITICALITY reject  TYPE E-RABToBeModifiedItemBearerModReq  PRESENCE mandatory },

E-RABToBeModifiedItemBearerModReq ::= SEQUENCE {  
e-RAB-ID      E-RAB-ID,  
e-RABLevelQoSParameters E-RABLevelQoSParameters,  
nAS-PDU       NAS-PDU,  
iE-Extensions   ProtocolExtensionContainer { {E-RABToBeModifyItemBearerModReqExtIEs} } OPTIONAL,

E-RABToBeModifyItemBearerModReqExtIEs S1AP-PROTOCOL-EXTENSION ::= {  
}
E-RABModifyResponse ::= SEQUENCE {
    protocolIEs  ProtocolIE-Container { {E-RABModifyResponseIEs} },
    ...
}

E-RABModifyResponseIEs  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-E-RABModifyListBearerModRes CRITICALITY ignore TYPE E-RABModifyListBearerModRes   PRESENCE optional }|
    { ID id-E-RABFailedToModifyList  CRITICALITY ignore TYPE E-RABList   PRESENCE optional },
    ...
}

E-RABModifyListBearerModRes ::= SEQUENCE (SIZE(1.. maxNrOfE-RABs)) OF ProtocolIE-SingleContainer { {E-RABModifyItemBearerModResIEs} }

E-RABModifyItemBearerModResIEs  S1AP-PROTOCOL-IES ::= {
    { ID id-E-RABModifyItemBearerModRes CRITICALITY ignore TYPE E-RABModifyItemBearerModRes      PRESENCE mandatory },
    ...
}

E-RABModifyItemBearerModRes ::= SEQUENCE {
    e-RAB-ID     E-RAB-ID,
    iE-Extensions     ProtocolExtensionContainer { {E-RABModifyItemBearerModResExtIEs} } OPTIONAL,
    ...
}

E-RABModifyItemBearerModResExtIEs  S1AP-PROTOCOL-EXTENSION ::= {
    ...
}
E-RAB Release Command

---

**E-RAB Release Command**

---

```
E-RABReleaseCommand ::= SEQUENCE {
  protocolIEs   ProtocolIE-Container  { {E-RABReleaseCommandIEs} },
  ...
}
```

**E-RAB Release Command IE S1AP-PROTOCOL-IES**

```
E-RABReleaseCommandIEs 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-uEaggregateMaximumBitrate  CRITICALITY reject TYPE UEAggregateMaximumBitrate  PRESENCE optional }|
  { ID id-E-RABToBeReleasedList  CRITICALITY ignore TYPE E-RABList     PRESENCE mandatory }|
  { ID id-NAS-PDU       CRITICALITY ignore TYPE NAS-PDU      PRESENCE optional },
  ...
}
```

---

E-RAB Release Response

---

**E-RAB Release Response**

---

```
E-RABReleaseResponse ::= SEQUENCE {
  protocolIEs   ProtocolIE-Container       { { E-RABReleaseResponseIEs } },
  ...
}
```

**E-RAB Release Response IE S1AP-PROTOCOL-IES**

```
E-RABReleaseResponseIEs 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-E-RABReleaseListBearerRelComp    CRITICALITY ignore TYPE E-RABReleaseListBearerRelComp  PRESENCE optional }|
  { ID id-E-RABFailedToReleaseList  CRITICALITY ignore TYPE E-RABList     PRESENCE optional }|
  { ID id-CriticalityDiagnostics  CRITICALITY ignore TYPE CriticalityDiagnostics   PRESENCE optional },
  ...
}
```

---

E-RAB Release List Bearer Rel Comp

```
E-RABReleaseListBearerRelComp ::= SEQUENCE (SIZE(1.. maxNrOfE-RABs)) OF ProtocolIE-SingleContainer { {E-RABReleaseItemBearerRelCompIEs} }
```

---

**E-RAB Release Item Bearer Rel Comp IE S1AP-PROTOCOL-IES**

```
E-RABReleaseItemBearerRelCompIEs S1AP-PROTOCOL-IES ::= {
  { ID id-E-RABReleaseItemBearerRelComp  CRITICALITY ignore TYPE E-RABReleaseItemBearerRelComp  PRESENCE mandatory },
  ...
}
```
E-RABReleaseItemBearerRelComp ::= SEQUENCE {
  e-RAB-ID E-RAB-ID,
iE-Extensions ProtocolExtensionContainer { {E-RABReleaseItemBearerRelCompExtIEs} } OPTIONAL,
  ...}

E-RABReleaseItemBearerRelCompExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...}

-- ************************************************************
-- -- E-RAB RELEASE INDICATION ELEMENTARY PROCEDURE
-- -- ************************************************************
-- E-RAB Release Indication
-- -- ************************************************************

E-RABReleaseIndication ::= SEQUENCE {
  protocolIEs ProtocolIE-Container { {E-RABReleaseIndicationIEs} },
  ...}

E-RABReleaseIndicationIEs 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-E-RABReleasedList CRITICALITY ignore TYPE E-RABList PRESENCE mandatory },
  ...}

-- ************************************************************
-- -- INITIAL CONTEXT SETUP ELEMENTARY PROCEDURE
-- -- ************************************************************

InitialContextSetupRequest ::= SEQUENCE {
  protocolIEs ProtocolIE-Container { {InitialContextSetupRequestIEs} },
  ...}
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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-uAggregateMaximumBitrate CRITICALITY reject TYPE U AggregateMaximumBitrate PRESENCE mandatory },
    { ID id-E-RABToBeSetupListCtxtSUReq CRITICALITY reject TYPE E-RABToBeSetupListCtxtSUReq PRESENCE mandatory },
    { ID id-UESecurityCapabilities CRITICALITY reject TYPE UE SecurityCapabilities PRESENCE mandatory },
    { ID id-SecurityKey CRITICALITY reject TYPE SecurityKey PRESENCE optional },
    { ID id-HandoverRestrictionList CRITICALITY ignore TYPE HandoverRestrictionList PRESENCE optional },
    { ID id-UERadioCapability CRITICALITY ignore TYPE UERadioCapability PRESENCE optional },
    { ID id-SubscriberProfileIDforRFP CRITICALITY ignore TYPE SubscriberProfileIDforRFP PRESENCE optional },
    { ID id-CSFallbackIndicator CRITICALITY reject TYPE CSFallbackIndicator PRESENCE optional },
    { ID id-SRVCCOperationPossible CRITICALITY ignore TYPE SRVCCOperationPossible PRESENCE optional },
}

E-RABToBeSetupListCtxtSUReq ::= SEQUENCE (SIZE(1.. maxNrOfE-RABs)) OF ProtocolIE-SingleContainer { {E-RABToBeSetupItemCtxtSUReqIEs} }

E-RABToBeSetupItemCtxtSUReqIEs S1AP-PROTOCOL-IES ::= {
    { ID id-E-RABToBeSetupItemCtxtSUReq CRITICALITY reject TYPE E-RABToBeSetupItemCtxtSUReq PRESENCE mandatory },
}

E-RABToBeSetupItemCtxtSUReq ::= SEQUENCE {
    e-RAB-ID E-RAB-ID,
    e-RABlevelQoSParameters E-RABLevelQoSParameters,
    transportLayerAddress TransportLayerAddress,
    gTP-TEID GTP-TEID,
    nAS-PDU NAS-PDU OPTIONAL,
    iE-Extensions ProtocolExtensionContainer { {E-RABToBeSetupItemCtxtSUReqExtIEs} } OPTIONAL,
}

E-RABToBeSetupItemCtxtSUReqExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...}

---

--- Initial Context Setup Response
---

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

InitialContextSetupResponseIEs 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-E-RABSetupListCtxtSUESes CRITICALITY ignore TYPE E-RABSetupListCtxtSUESes PRESENCE mandatory }|
{ ID id-E-RABFailedToSetupListCtxtSUESes CRITICALITY ignore TYPE E-RABList PRESENCE optional }|
{ ID id-CriticalityDiagnostics CRITICALITY ignore TYPE CriticalityDiagnostics PRESENCE optional },
...

E-RABSetupListCtxtSUESes ::= SEQUENCE {SIZE(1.. maxNrOfE-RABs)) OF ProtocolIE-SingleContainer { {E-RABSetupItemCtxtSUESes} }
E-RABSetupItemCtxtSUESes S1AP-PROTOCOL-IES ::= {
{ ID id-E-RABSetupItemCtxtSUESes CRITICALITY ignore TYPE E-RABSetupItemCtxtSUESes PRESENCE mandatory },
...
}
E-RABSetupItemCtxtSUESes ::= SEQUENCE {
e-RAB-ID E-RAB-ID, transportLayerAddress TransportLayerAddress, gTP-TEID GTP-TEID, iE-Extensions ProtocolExtensionContainer { {E-RABSetupItemCtxtSUESesExtIEs} } OPTIONAL,
...
}
E-RABSetupItemCtxtSUESesExtIEs S1AP-PROTOCOL-EXTENSION ::= {
...

-- ************************************************************** --
PAGING ELEMENTARY PROCEDURE
-- ************************************************************** --
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 optional } |
  { ID id-CNDomain     CRITICALITY ignore  TYPE CNDomain  PRESENCE mandatory } |
  { ID id-TAIList     CRITICALITY ignore TYPE TAIList    PRESENCE mandatory } |
  { ID id-CSG-IdList    CRITICALITY ignore TYPE CSG-IdList  PRESENCE optional },
  ...
}

TAIList ::= SEQUENCE (SIZE(1.. maxnoofTAIs)) 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 ::= {
  ...
}

UEContextReleaseRequest ::= SEQUENCE {
  ...
}
UEContextReleaseRequest-IEs S1AP-PROTOCOL-IEs ::= {
   { ID id-MM-E-UE-S1AP-ID   CRITICALITY reject TYPE MM-E-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} ,

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} ,

UEContextReleaseComplete ::= SEQUENCE {
   protocolIEs                     ProtocolIE-Container       {{UEContextReleaseComplete-IEs}},

UEContextReleaseComplete-IEs S1AP-PROTOCOL-IEs ::= {
   { ID id-MM-E-UE-S1AP-ID   CRITICALITY ignore TYPE MM-E-UE-S1AP-ID    PRESENCE mandatory} |
   { ID id-eNB-UE-S1AP-ID   CRITICALITY ignore TYPE ENB-UE-S1AP-ID    PRESENCE mandatory} |
   { ID id-CriticalityDiagnostics  CRITICALITY ignore TYPE CriticalityDiagnostics   PRESENCE optional },

-- **********************************************************************
-- -- UE CONTEXT MODIFICATION ELEMENTARY PROCEDURE
-- **********************************************************************
-- *******************************************************
-- 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-SecurityKey        CRITICALITY reject TYPE SecurityKey      PRESENCE optional } |
  { ID id-SubscriberProfileIDforRFP  CRITICALITY ignore TYPE SubscriberProfileIDforRFP PRESENCE optional } |
  { ID id-UEaggregateMaximumBitrate   CRITICALITY ignore TYPE UEAggregateMaximumBitrate PRESENCE optional } |
  { ID id-CSFallbackIndicator     CRITICALITY reject TYPE CSFallbackIndicator PRESENCE optional },
...  }

-- *******************************************************
-- UE Context Modification Response
-- *******************************************************

UEContextModificationResponse ::= SEQUENCE {
  protocolIEs ProtocolIE-Container { { UEContextModificationResponseIEs} },
...  }

UEContextModificationResponseIEs 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-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 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-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 ignore 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-EUTRAN-CGI     CRITICALITY ignore TYPE EUTRAN-CGI     PRESENCE mandatory },
  { ID id-RRC-Establishment-Cause  CRITICALITY ignore TYPE RRC-Establishment-Cause  PRESENCE mandatory },
  { ID id-S-TMSI     CRITICALITY reject TYPE S-TMSI     PRESENCE optional },
  { ID id-CSG-Id     CRITICALITY reject TYPE CSG-Id     PRESENCE optional },
  { ID id-GUMMEI-ID     CRITICALITY reject TYPE GUMMEI     PRESENCE optional },
  ...
}

--- ************************************************************
--- UPLINK NAS TRANSPORT
--- ************************************************************
UplinkNATransport ::= SEQUENCE {
  protocolIEs ProtocolIE-Container {{UplinkNATransport-IEs}},
  ...
}

UplinkNATransport-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-EUTRAN-CGI CRITICALITY ignore TYPE EUTRAN-CGI PRESENCE mandatory },
  { ID id-TAI CRITICALITY ignore TYPE TAI PRESENCE mandatory },
  ...
}

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 ::= SEQUENCE {
  protocolIEs ProtocolIE-Container {{ResetIEs}},
  ...
}

ResetIEs S1AP-PROTOCOL-IES ::= {
  { ID id-Cause CRITICALITY ignore TYPE Cause 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 },
  ...
}

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
--
-- ***********************************************************************

S1SetupRequest ::= SEQUENCE {
    protocolIEs ProtocolIE-Container { {S1SetupRequestIEs} }, ...
}

S1SetupRequestIEs S1AP-PROTOCOL-IES ::= {

    { ID id-Global-ENB-ID CRITICALITY reject TYPE Global-ENB-ID PRESENCE mandatory },
    { ID id-eNBname CRITICALITY ignore TYPE ENBname PRESENCE optional },
    { ID id-SupportedTAs CRITICALITY reject TYPE SupportedTAs PRESENCE mandatory },
    { ID id-DefaultPagingDRX CRITICALITY ignore TYPE PagingDRX PRESENCE mandatory },
    { ID id-CSG-IdList CRITICALITY reject TYPE CSG-IdList PRESENCE optional }, ...

}

-- ***********************************************************************
--
-- S1 Setup Response
--
-- ***********************************************************************

--
S1SetupResponse ::= SEQUENCE {
    protocolIEs ProtocolIE-Container  {S1SetupResponseIEs} },
    ...
}

S1SetupResponseIEs S1AP-PROTOCOL-IEs ::= {
    { ID id-MMName CRITICALITY ignore TYPE MMName PRESENCE optional }|
    { ID id-ServedGUMMEIs CRITICALITY reject TYPE ServedGUMMEIs PRESENCE mandatory }|
    { ID id-RelativeMMECapacity CRITICALITY ignore 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
-- **************************************************************

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 }|
    { ID id-CSG-IdList CRITICALITY reject TYPE CSG-IdList PRESENCE optional}|
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{ ID id-DefaultPagingDRX CRITICALITY ignore TYPE PagingDRX 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
--
-- ************************************************************

MMEConfigurationUpdate ::= SEQUENCE {
  protocolIEs ProtocolIE-Container { {MMEConfigurationUpdateIEs} },

  ETSI
MMEConfigurationUpdateIEs S1AP-PROTOCOL-IEs ::= {
   { ID id-MMEname    CRITICALITY ignore TYPE MMEname    PRESENCE optional  }|
   { ID id-ServedGUMMEIs CRITICALITY reject TYPE ServedGUMMEIs 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 Elementary Procedure
-- **************************************************************

-- Downlink S1 CDMA2000 Tunneling
-- ****************************

DownlinkS1cdma2000tunneling ::= SEQUENCE {
    protocolIEs   ProtocolIE-Container       { {DownlinkS1cdma2000tunnelingIEs} },
    ...}

DownlinkS1cdma2000tunnelingIEs SIAP-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-E-RABSubjecttoDataForwardingList    CRITICALITY ignore TYPE E-RABSubjecttoDataForwardingList  PRESENCE optional } |
    { ID id-cdma2000HOStatus    CRITICALITY ignore TYPE Cdma2000HOStatus    PRESENCE optional } |
    { ID id-cdma2000RATType    CRITICALITY reject TYPE Cdma2000RATType    PRESENCE mandatory } |
    ...}

-- ****************************

-- UPLINK S1 CDMA2000 TUNNELING ELEMENTARY PROCEDURE

-- ****************************

UplinkS1cdma2000tunneling ::= SEQUENCE {
    protocolIEs   ProtocolIE-Container       { {UplinkS1cdma2000tunnelingIEs} },
    ...}

UplinkS1cdma2000tunnelingIEs SIAP-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-cdma2000OneXRVCInfo    CRITICALITY reject TYPE Cdma2000OneXRVCInfo  PRESENCE optional } |
    { ID id-cdma2000OneXRAND    CRITICALITY reject TYPE Cdma2000OneXRAND    PRESENCE optional } |
    { ID id-cdma2000PDU      CRITICALITY reject TYPE Cdma2000PDU     PRESENCE mandatory },
    ...}

-- ****************************

-- UPLINK S1 CDMA2000 TUNNELING ELEMENTARY PROCEDURE

-- ****************************

-- UE CAPABILITY INFO INDICATION ELEMENTARY PROCEDURE

-- ****************************
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 } ,
  ... 
}

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} ,
  ... 
}

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} ,
  ... 
}
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 ELEMENTARY PROCEDURES
-- ************************************************************
-- Trace Start
-- ************************************************************
TraceStart ::= SEQUENCE {
    protocolIEs ProtocolIE-Container { {TraceStartIEs} },
    ...
}

TraceStartIEs 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-TraceActivation CRITICALITY ignore TYPE TraceActivation PRESENCE mandatory },
    ...

-- ************************************************************
-- 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-E-UTRAN-Trace-ID CRITICALITY ignore TYPE E-UTRAN-Trace-ID PRESENCE mandatory } |
    { ID id-Cause CRITICALITY ignore TYPE Cause PRESENCE mandatory },
    ...

ETSI
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-E-UTRAN-Trace-ID  CRITICALITY ignore TYPE E-UTRAN-Trace-ID  PRESENCE mandatory },
  ...
}

CellTrafficTrace ::= SEQUENCE {
  protocolIEs  ProtocolIE-Container  { { CellTrafficTraceIEs} },
  ...
}

CellTrafficTraceIEs 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-E-UTRAN-Trace-ID  CRITICALITY ignore TYPE E-UTRAN-Trace-ID  PRESENCE mandatory} |
  { ID id-EUTRAN-CGI  CRITICALITY ignore TYPE EUTRAN-CGI  PRESENCE mandatory} |
  { ID id-TraceCollectionEntityIPAddress  CRITICALITY ignore TYPE TransportLayerAddress  PRESENCE mandatory },
  ...
}
-- LOCATION ELEMENTARY PROCEDURES
-- --------------------------------------------------------------
-- 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 mandatory},
... 
}

-- 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} |
-- **************************************************************
-- OVERLOAD ELEMENTARY PROCEDURES
-- **************************************************************

OverloadStart ::= SEQUENCE {
  protocolIEs   ProtocolIE-Container { {OverloadStartIEs} },
... }

OverloadStartIEs S1AP-PROTOCOL-IES ::= {
  ... }

-- **************************************************************
-- Overload Stop
-- **************************************************************

OverloadStop ::= SEQUENCE {
  protocolIEs   ProtocolIE-Container { {OverloadStopIEs} },
... }

OverloadStopIEs S1AP-PROTOCOL-IES ::= {
  ... }

-- **************************************************************
-- WRITE-REPLACE WARNING ELEMENTARY PROCEDURE
-- **************************************************************

-- **************************************************************
-- Write-Replace Warning Request
-- **************************************************************
WriteReplaceWarningRequest ::= SEQUENCE {
  protocolIEs ProtocolIE-Container  {{WriteReplaceWarningRequestIEs} },
  ...  
}

WriteReplaceWarningRequestIEs S1AP-PROTOCOL-IEs ::= {
  { ID id-MessageIdentifier  CRITICALITY reject TYPE MessageIdentifier  PRESENCE mandatory }|
  { ID id-SerialNumber  CRITICALITY reject TYPE SerialNumber  PRESENCE mandatory }|
  { ID id-WarningAreaList  CRITICALITY ignore TYPE WarningAreaList  PRESENCE optional }|
  { ID id-RepetitionPeriod  CRITICALITY reject TYPE RepetitionPeriod  PRESENCE mandatory }|
  { ID id-NumberofBroadcastRequest  CRITICALITY reject TYPE NumberofBroadcastRequest  PRESENCE mandatory }|
  { ID id-WarningType  CRITICALITY ignore TYPE WarningType  PRESENCE optional }|
  { ID id-WarningSecurityInfo  CRITICALITY ignore TYPE WarningSecurityInfo  PRESENCE optional }|
  { ID id-DataCodingScheme  CRITICALITY ignore TYPE DataCodingScheme  PRESENCE optional }|
  { ID id-WarningMessageContents  CRITICALITY ignore TYPE WarningMessageContents  PRESENCE optional },
  ...  
}

WriteReplaceWarningResponse ::= SEQUENCE {
  protocolIEs ProtocolIE-Container  {{WriteReplaceWarningResponseIEs} },
  ...  
}

WriteReplaceWarningResponseIEs S1AP-PROTOCOL-IEs ::= {
  { ID id-MessageIdentifier  CRITICALITY reject TYPE MessageIdentifier  PRESENCE mandatory }|
  { ID id-SerialNumber  CRITICALITY reject TYPE SerialNumber  PRESENCE mandatory }|
  { ID id-BroadcastCompletedAreaList  CRITICALITY reject TYPE BroadcastCompletedAreaList  PRESENCE mandatory }|
  { ID id-CriticalityDiagnostics  CRITICALITY ignore TYPE CriticalityDiagnostics  PRESENCE optional },
  ...  
}

ENBDirectInformationTransfer ::= SEQUENCE {
  protocolIEs ProtocolIE-Container  {{ ENBDirectInformationTransferIEs }},
  ...  
}

ENBDirectInformationTransferIEs S1AP-PROTOCOL-IEs ::= {
  ...  
}
{ ID id-Inter-SystemInformationTransferTypeEDT  CRITICALITY reject  TYPE Inter-SystemInformationTransferType  PRESENCE mandatory} ,

Inter-SystemInformationTransferType ::= CHOICE {
  rIMTransfer   RIMTransfer,
  ...
}

-- ************************************************************
-- MME DIRECT INFORMATION TRANSFER ELEMENTARY PROCEDURE
-- ************************************************************

-- MME Direct Information Transfer
-- ************************************************************

MMEDirectInformationTransfer ::= SEQUENCE {
  protocolIEs   ProtocolIE-Container       {{ MMEDirectInformationTransferIEs}},
  ...
}

MMEDirectInformationTransferIEs S1AP-PROTOCOL-IES ::= {
  { ID id-Inter-SystemInformationTransferTypeMDT  CRITICALITY reject  TYPE Inter-SystemInformationTransferType  PRESENCE mandatory} ,

-- ************************************************************
-- eNB CONFIGURATION TRANSFER ELEMENTARY PROCEDURE
-- ************************************************************

-- eNB Configuration Transfer
-- ************************************************************

ENBConfigurationTransfer ::= SEQUENCE {
  protocolIEs   ProtocolIE-Container       {{ ENBConfigurationTransferIEs}},
  ...
}

ENBConfigurationTransferIEs S1AP-PROTOCOL-IES ::= {
  { ID id-SONConfigurationTransferECT  CRITICALITY ignore  TYPE SONConfigurationTransfer  PRESENCE optional} ,

-- ************************************************************
-- MME CONFIGURATION TRANSFER ELEMENTARY PROCEDURE
-- ******************************************************************************
-- MME Configuration Transfer
-- ******************************************************************************

MMEConfigurationTransfer ::= SEQUENCE {
    protocolIEs ProtocolIE-Container {{ MMEConfigurationTransferIEs}},
    ... }
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) slap (1) version1 (1) slap-IEs (2) 

DEFINITIONS AUTOMATIC TAGS ::= 
BEGIN

IMPORTS
   id-E-RABInformationListItem,
   id-E-RABItem,
   id-Bearers-SubjectToStatusTransfer-Item,
   maxNrOfCSGs,
   maxNrOfE-RABs,
   maxNrOfErrors,
   maxnoofBPLMNs,
   maxnoofPLMNsPerMME,
   maxnoofTACs,
   maxnoofEPLMNs,
   maxnoofEPLMNsPlusOne,
   maxnoofForbLACs,
   maxnoofForbTACs,
   maxnooftACs,
   maxnoofCells,
   maxnoofCellID,
   maxnoofEmergencyAreaID,
   maxnoofTAIforWarning,
   maxnoofCellinTAL,
   maxnoofCellinEAI,
   maxnoofeNBX2TLAs,
   maxnoofRATs,
   maxnoofGroupIDs,
   maxnoofMMECs

FROM S1AP-Constants
   Criticality,
   ProcedureCode,
   ProtocolIE-ID,
   TriggeringMessage
FROM S1AP-CommonDataTypes
   ProtocolExtensionContainer{},

ETSI
FROM S1AP-Containers;

-- A

AllocationAndRetentionPriority ::= SEQUENCE {
    priorityLevel            PriorityLevel,
    pre-emptionCapability    Pre-emptionCapability,
    pre-emptionVulnerability  Pre-emptionVulnerability,
    iE-Extensions            ProtocolExtensionContainer { {AllocationAndRetentionPriority-ExtIEs} } OPTIONAL,
    ...
}

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

-- B

Bearers-SubjectToStatusTransferList ::= SEQUENCE (SIZE(1.. maxNrOfE-RABs)) 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 {
    e-RAB-ID        E-RAB-ID,
    uL-COUNTvalue        COUNTvalue,
    dL-COUNTvalue        COUNTvalue,
    receiveStatusofULPDCPSDUs        ReceiveStatusofULPDCPSDUs OPTIONAL,
    iE-Extensions       ProtocolExtensionContainer { {Bearers-SubjectToStatusTransfer-ItemExtIEs} } OPTIONAL,
    ...
}

Bearers-SubjectToStatusTransfer-ItemExtIEs S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

BitRate ::= INTEGER (0..10000000000)

BPLMNs ::= SEQUENCE (SIZE(1.. maxnoofBPLMNs)) OF PLMNidentity

BroadcastCompletedAreaList ::= CHOICE {
    cellID-Broadcast       CellID-Broadcast,
    tAI-Broadcast         TAI-Broadcast,
    emergencyAreaID-Broadcast  EmergencyAreaID-Broadcast,
    ...
---

Cause ::= CHOICE {
  radioNetwork CauseRadioNetwork,
  transport CauseTransport,
  nas CauseNas,
  protocol CauseProtocol,
  misc CauseMisc,
...
}

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,
  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,
  handover-desirable-for-radio-reason,
  time-critical-handover,
resource-optimisation-handover,
reduce-load-in-serving-cell,
user-inactivity,
radio-connection-with-ue-lost,
load-balancing-tau-required,
cs-fallback-triggered,
ue-not-available-for-ps-service,
radio-resources-not-available,
failure-in-radio-interface-procedure,
invalid-qos-combination,
interrat-redirection,
interaction-with-other-procedure,
unknown-E-RAB-ID,
multiple-E-RAB-ID-instances,
enetration-and-or-integrity-protection-algorithms-not-supported,
s1-intra-system-handover-triggered,
s1-inter-system-handover-triggered,
x2-handover-triggered,
..., redirection-towards-1xRTT

} CauseTransport ::= ENUMERATED {
transport-resource-unavailable,
unspecified,
...
}

CauseNas ::= ENUMERATED {
normal-release,
authentication-failure,
detach,
unspecified,
...
}

CellIdentity ::= BIT STRING (SIZE (28))

CellID-Broadcast ::= SEQUENCE (SIZE (1..maxnoofCellID)) OF CellID-Broadcast-Item

CellID-Broadcast-Item ::= SEQUENCE {
eCGI EUTRAN-CGI,
iE-Extensions ProtocolExtensionContainer { {CellID-Broadcast-Item-ExtIEs} } OPTIONAL,
...
}

CellID-Broadcast-Item-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
...
}

Cdma2000PDU ::= OCTET STRING
Cdma2000RATType ::= ENUMERATED {
  hRPD,
  onexRTT,
  ...
}
Cdma2000SectorID ::= OCTET STRING
Cdma2000HOStatus ::= ENUMERATED {
  hOSuccess,
  hOFailure,
  ...
}
Cdma2000HORequiredIndication ::= ENUMERATED {
  true,
  ...
}
Cdma2000OneXSRVCCInfo ::= SEQUENCE {
  cdma2000OneXMEID Cdma2000OneXMEID,
  cdma2000OneXMSI Cdma2000OneXMSI,
  cdma2000OneXPilot Cdma2000OneXPilot,
  iE-Extensions ProtocolExtensionContainer {{Cdma2000OneXSRVCCInfo-ExtIEs}} OPTIONAL,
  ...
}
Cdma2000OneXSRVCCInfo-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...
}
Cdma2000OneXMEID ::= OCTET STRING
Cdma2000OneXMSI ::= OCTET STRING
Cdma2000OneXPilot ::= OCTET STRING
Cdma2000OneXRAND ::= OCTET STRING
Cell-Size ::= ENUMERATED {verysmall, small, medium, large, ...}
CellType ::= SEQUENCE {
  cell-Size Cell-Size,
  iE-Extensions ProtocolExtensionContainer {{CellType-ExtIEs}} OPTIONAL,
  ...
}
CellType-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...
}
CGI ::= SEQUENCE {
  plMNIdentity PLMNIdentity,
IAC    LAC,
cI    CI,
rAC    RAC   OPTIONAL,
iE-Extensions ProtocolExtensionContainer { {CGI-ExtIIES} } OPTIONAL,
...

CGI-ExtIIES S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

CI ::= OCTET STRING {SIZE (2)}

CNDomain ::= ENUMERATED {
    ps,
    cs
}

CSFallbackIndicator ::= ENUMERATED {
    cs-fallback-required,
    ...
    cs-fallback-high-priority
}

CSG-Id ::= BIT STRING {SIZE (27)}

CSG-IdList ::= SEQUENCE {SIZE (1..maxNrOfCSGs)} OF CSG-IdList-Item

CSG-IdList-Item ::= SEQUENCE {
    cSG-Id   CSG-Id,
    iE-Extensions ProtocolExtensionContainer { {CSG-IdList-Item-ExtIIES} } OPTIONAL,
    ...
}

CSG-IdList-Item-ExtIIES S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

COUNTvalue ::= SEQUENCE {
    pDCP-SN   PDCP-SN,
    hFN    HFN,
    iE-Extensions ProtocolExtensionContainer { {COUNTvalue-ExtIIES} } OPTIONAL,
    ...
}

COUNTvalue-ExtIIES S1AP-PROTOCOL-EXTENSION ::= {
    ...
}

CriticalityDiagnostics ::= SEQUENCE {
    procedureCode     ProcedureCode     OPTIONAL,
    triggeringMessage    TriggeringMessage    OPTIONAL,
    procedureCriticality   Criticality      OPTIONAL,
    iEsCriticalityDiagnostics  CriticalityDiagnostics-IE-List  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,
  iE-Extensions ProtocolExtensionContainer {{CriticalityDiagnostics-IE-Item-ExtIEs}} OPTIONAL,
  ...  
}

CriticalityDiagnostics-IE-Item-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...  
}

-- D
DataCodingScheme ::= BIT STRING (SIZE (8))

DL-Forwarding ::= ENUMERATED {
  dL-Forwarding-proposed,
  ...  
}

Direct-Forwarding-Path- Availability ::= ENUMERATED {
  directPathAvailable,
  ...  
}

-- E
EUTRAN-CellIdentity ::= SEQUENCE (SIZE (1..maxnoofCellID)) OF EUTRAN-CGI

EmergencyAreaIDList ::= SEQUENCE (SIZE (1..maxnoofEmergencyAreaID)) OF EmergencyAreaID

EmergencyAreaID ::= OCTET STRING (SIZE (3))

EmergencyAreaID-Broadcast ::= SEQUENCE (SIZE (1..maxnoofEmergencyAreaID)) OF EmergencyAreaID-Broadcast-Item

EmergencyAreaID-Broadcast-Item ::= SEQUENCE {
  emergencyAreaID EmergencyAreaID,
  completedCellinEAI CompletedCellinEAI,
  iE-Extensions ProtocolExtensionContainer {{EmergencyAreaID-Broadcast-Item-ExtIEs}} OPTIONAL,
  ...  
}
EmergencyAreaID-Broadcast-Item-ExtIEs S1AP-PROTOCOL-EXTENSION ::= { ... }

CompletedCellinEAI ::= SEQUENCE (SIZE(1..maxnoofCellinEAI)) OF CompletedCellinEAI-Item

CompletedCellinEAI-Item ::= SEQUENCE {
  eCGI               EUTRAN-CGI,
  iE-Extensions     ProtocolExtensionContainer { {CompletedCellinEAI-Item-ExtIEs} } OPTIONAL,
  ... }

CompletedCellinEAI-Item-ExtIEs S1AP-PROTOCOL-EXTENSION ::= { ... }

ENB-ID ::= CHOICE {
  macroENB-ID     BIT STRING (SIZE(20)),
  homeENB-ID      BIT STRING (SIZE(28)),
  ... }

GERAN-Cell-ID ::= SEQUENCE {
  lAI              LAI,
  rAC              RAC,
  cI               CI,
  iE-Extensions     ProtocolExtensionContainer { { GERAN-Cell-ID-ExtIEs} } OPTIONAL,
  ... }

GERAN-Cell-ID-ExtIEs S1AP-PROTOCOL-EXTENSION ::= { ... }

Global-ENB-ID ::= SEQUENCE {
  pLMNIdentity    PLMNidentity,
  eNB-ID          ENB-ID,
  iE-Extensions   ProtocolExtensionContainer { {GlobalENB-ID-ExtIEs} } OPTIONAL,
  ... }

GlobalENB-ID-ExtIEs S1AP-PROTOCOL-EXTENSION ::= { ... }

ENB-StatusTransfer-TransparentContainer ::= SEQUENCE {
  bearers-SubjectToStatusTransferList  Bearers-SubjectToStatusTransferList,
  iE-Extensions     ProtocolExtensionContainer { {ENB-StatusTransfer-TransparentContainer-ExtIEs} } OPTIONAL,
  ... }

ENB-StatusTransfer-TransparentContainer-ExtIEs S1AP-PROTOCOL-EXTENSION ::= { ... }
ENB-UE-S1AP-ID ::= INTEGER (0..16777215)

ENBname ::= PrintableString (SIZE (1..150, ...))

ENBX2TLAs ::= SEQUENCE (SIZE(1..maxnoofENBX2TLAs)) OF TransportLayerAddress

EncryptionAlgorithms ::= BIT STRING (SIZE (16, ...))

EPLMNs ::= SEQUENCE (SIZE(1..maxnoofEPLMNs)) OF PLMNidentity

EventType ::= ENUMERATED {
  direct,
  change-of-serve-cell,
  stop-change-of-serve-cell,
  ...
}

E-RAB-ID ::= INTEGER (0..15, ...)

E-RABInformationList ::= SEQUENCE (SIZE (1..maxNrOfE-RABs)) OF ProtocolIE-SingleContainer { { E-RABInformationListIEs } }

E-RABInformationListIEs S1AP-PROTOCOL-IES ::= {
  { ID id-E-RABInformationListItem CRITICALITY ignore TYPE E-RABInformationListItem PRESENCE mandatory },
  ...
}

E-RABInformationListItem ::= SEQUENCE {
  e-RAB-ID E-RAB-ID,
  dl-Forwarding DL-Forwarding OPTIONAL,
  iE-Extensions ProtocolExtensionContainer { {E-RABInformationListItem-ExtIEs} } OPTIONAL,
  ...
}

E-RABInformationListItem-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...
}

E-RABList ::= SEQUENCE (SIZE(1..maxNrOfE-RABs)) OF ProtocolIE-SingleContainer { {E-RABItemIEs} }

E-RABItemIEs S1AP-PROTOCOL-IES ::= {
  { ID id-E-RABItem CRITICALITY ignore TYPE E-RABItem PRESENCE mandatory },
  ...
}

E-RABItem ::= SEQUENCE {
  e-RAB-ID E-RAB-ID,
  cause Cause,
  iE-Extensions ProtocolExtensionContainer { {E-RABItem-ExtIEs} } OPTIONAL,
  ...
}

E-RABItem-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...
}
E-RABLevelQoSParameters ::= SEQUENCE {
  qCI QCI,
  allocationRetentionPriority AllocationAndRetentionPriority,
  gbrQosInformation GBR-QosInformation OPTIONAL,
  iE-Extensions ProtocolExtensionContainer { {E-RABQoSParameters-ExtIEs} } OPTIONAL,
  ...
}
E-RABQoSParameters-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...
}
EUTRAN-CGI ::= SEQUENCE {
  pLMNidentity PLMNIdentity,
  cell-ID CellIdentity,
  iE-Extensions ProtocolExtensionContainer { {EUTRAN-CGI-ExtIEs} } OPTIONAL,
  ...
}
EUTRAN-CGI-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...
}
ExtendedRNC-ID ::= INTEGER (4096..65535)
-- F
ForbiddenInterRATs ::= ENUMERATED {
  all, geran, utran, cdma2000, ...
}
ForbiddenTAs ::= SEQUENCE (SIZE(1.. maxnoofEPLMNsPlusOne)) OF ForbiddenTAs-Item
ForbiddenTAs-Item ::= SEQUENCE {
  pLMN-Identity PLMNIdentity,
  forbiddenTACs ForbiddenTACs,
  iE-Extensions ProtocolExtensionContainer { {ForbiddenTAs-Item-ExtIEs} } OPTIONAL,
  ...
}
ForbiddenTAs-Item-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...
}
ForbiddenTACs ::= SEQUENCE (SIZE(1..maxnoofForbTACs)) OF TAC

ForbiddenLAs ::= SEQUENCE (SIZE(1..maxnoofEPLMNsPlusOne)) OF ForbiddenLAs-Item

ForbiddenLAs-Item ::= SEQUENCE {
  pLMN-Identity  PLMNidentity,
  forbiddenLACs  ForbiddenLACs,
  iE-Extensions  ProtocolExtensionContainer { {ForbiddenLAs-Item-ExtIEs} } OPTIONAL,
  ...
}

ForbiddenLAs-Item-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...
}

ForbiddenLACs ::= SEQUENCE (SIZE(1..maxnoofForbLACs)) OF LAC

-- G

GBR-QosInformation ::= SEQUENCE {
  e-RAB-MaximumBitrateDL   BitRate,
  e-RAB-MaximumBitrateUL   BitRate,
  e-RAB-GuaranteedBitrateDL BitRate,
  e-RAB-GuaranteedBitrateUL BitRate,
  iE-Extensions  ProtocolExtensionContainer { { GBR-QosInformation-ExtIEs} } OPTIONAL,
  ...
}

GBR-QosInformation-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...
}

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 OPTIONAL,
forbiddenInterRATs OPTIONAL,
iE-Extensions ProtocolExtensionContainer { {HandoverRestrictionList-ExtIEs} } OPTIONAL,
...
}

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

HandoverType ::= ENUMERATED {
  intralte,
  lteutran,
  ltegeran,
  utrantolte,
  gerantolte,
  ...
}

HFN ::= INTEGER (0..1048575)
-- I
IMSI ::= OCTET STRING (SIZE (3..8))

IntegrityProtectionAlgorithms ::= BIT STRING (SIZE (16,...})

InterfacesToTrace ::= BIT STRING (SIZE (8))
-- 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 ::= {
  ...
}

LastVisitedCell-Item ::= CHOICE {
  e-UTRAN-Cell LastVisitedEUTRANCellInformation,
  uTRAN-Cell LastVisitedUTRANCellInformation,
  gERAN-Cell LastVisitedGERANCellInformation,
  ...

  ETSI
} LastVisitedEUTRANCellInformation ::= SEQUENCE {
  global-Cell-ID EUTRAN-CGI,
  cellType CellType,
  time-UE-StayedInCell Time-UE-StayedInCell,
  iE-Extensions ProtocolExtensionContainer { { LastVisitedEUTRANCellInformation-ExtIEs} } OPTIONAL,
  ...
} LastVisitedEUTRANCellInformation-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...
} LastVisitedUTRANCellInformation ::= OCTET STRING
LastVisitedGERANCellInformation ::= CHOICE {
  undefined NULL,
  ...
}
L3-Information ::= OCTET STRING

-- M
MessageIdentifier ::= BIT STRING (SIZE (16))
MMEname ::= PrintableString (SIZE (1..150,...))
MME-Group-ID ::= OCTET STRING (SIZE (2))
MME-Code ::= OCTET STRING (SIZE (1))
MME-UE-S1AP-ID ::= OCTET STRING (SIZE (4))
M-TMSI ::= OCTET STRING
MSClassmark2 ::= OCTET STRING
MSClassmark3 ::= OCTET STRING

-- N
NAS-PDU ::= OCTET STRING
NASSecurityParametersfromE-UTRAN ::= OCTET STRING
NASSecurityParameterstoE-UTRAN ::= OCTET STRING
NumberofBroadcastRequest ::= INTEGER (0..65535)
NumberofBroadcast ::= INTEGER (0..65535)

-- O
OldBSS-ToNewBSS-Information ::= OCTET STRING
OverloadAction ::= ENUMERATED {
reject-non-emergency-mo-dt,
reject-all-rrc-cr-signalling,
permit-emergency-sessions-only,

...}

OverloadResponse ::= CHOICE {
  overloadAction OverloadAction,
...}

-- P

PagingDRX ::= ENUMERATED {
  v32,
  v64,
  v128,
  v256,
...}

PDCP-SN ::= INTEGER (0..4095)

PLMNIdentity ::= TBCD-STRING

Pre-emptionCapability ::= ENUMERATED {
  shall-not-trigger-pre-emption,
  may-trigger-pre-emption
}

Pre-emptionVulnerability ::= ENUMERATED {
  not-pre-emptable,
  pre-emptable
}

PriorityLevel ::= INTEGER { spare (0), highest (1), lowest (14), no-priority (15) } (0..15)

-- Q

QCI ::= INTEGER (0..255)

-- R

ReceiveStatusofULPDCPSDUs ::= BIT STRING (SIZE(4096))

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 ::= {
...
}

RIMTransfer ::= SEQUENCE {
  rIMInformation      RIMInformation,
  rIMRoutingAddress    RIMRoutingAddress OPTIONAL,
  iE-Extensions        ProtocolExtensionContainer { { RIMTransfer-ExtIEs} } OPTIONAL,
  ...
}

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

RIMInformation ::= OCTET STRING

RIMRoutingAddress ::= CHOICE {
  gERAN-Cell-ID   GERAN-Cell-ID,
  ...
}

ReportArea ::= ENUMERATED {
  ecgi,
  ...
}

RepetitionPeriod ::= INTEGER (0..4096)

RNC-ID ::= INTEGER (0..4095)

RRC-Container ::= OCTET STRING

RRC-Establishment-Cause ::= ENUMERATED {
  emergency,
  highPriorityAccess,
  mt-Access,
  mo-Signalling,
  mo-Data,
  ...
}
SecurityKey ::= BIT STRING (SIZE(256))

SecurityContext ::= SEQUENCE {
  nextHopChainingCount INTEGER (0..7),
  nextHopParameter SecurityKey,
  iE-Extensions ProtocolExtensionContainer {{ SecurityContext-ExtIEs} } OPTIONAL,
  ...
}

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

SerialNumber ::= BIT STRING (SIZE (16))

SONInformation ::= CHOICE{
  sONInformationRequest SONInformationRequest,
  sONInformationReply SONInformationReply,
  ...
}

SONInformationRequest ::= ENUMERATED {
  x2TNL-Configuration-Info,
  ...
}

SONInformationReply ::= SEQUENCE {
  x2TNLConfigurationInfo X2TNLConfigurationInfo OPTIONAL,
  iE-Extensions ProtocolExtensionContainer {{SONInformationReply-ExtIEs} } OPTIONAL,
  ...
}

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

SONConfigurationTransfer ::= SEQUENCE {
  targeteNB-ID TargeteNB-ID,
  sourceeNB-ID SourceeNB-ID,
  SONInformation SONInformation,
  iE-Extensions ProtocolExtensionContainer {{ SONConfigurationTransfer-ExtIEs} } OPTIONAL,
  ...
}

SONConfigurationTransfer-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...
}
Source-ToTarget-TransparentContainer ::= OCTET STRING

SourceBSS-ToTargetBSS-TransparentContainer ::= OCTET STRING

SourceeNB-ID ::= SEQUENCE {
  global-ENB-ID Global-ENB-ID,
  selected-TAI TAI,
  iE-Extensions ProtocolExtensionContainer { {SourceeNB-ID-ExtIEs} } OPTIONAL
}

SourceeNB-ID-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...,
}

SRVCCOperationPossible ::= ENUMERATED {
  possible,
  ...,
}

SRVCCCHOIndication ::= ENUMERATED {
  pSandCS,
  cSonly,
  ...,
}

SourceeNB-ToTargeteNB-TransparentContainer ::= SEQUENCE {
  rRC-Container RRC-Container,
  e-RABInformationList E-RABInformationList OPTIONAL,
  targetCell-ID EUTRAN-CGI,
  subscriberProfileIDforRFP SubscriberProfileIDforRFP OPTIONAL,
  uE-HistoryInformation UE-HistoryInformation,
  iE-Extensions ProtocolExtensionContainer { {SourceeNB-ToTargeteNB-TransparentContainer-ExtIEs} } OPTIONAL,
  ...,
}

SourceeNB-ToTargeteNB-TransparentContainer-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...,
}

SourceRNC-ToTargetRNC-TransparentContainer ::= OCTET STRING

ServedGUMMEIs ::= SEQUENCE (SIZE (1..maxnoofRATs)) OF ServedGUMMEIsItem

ServedGUMMEIsItem ::= SEQUENCE {
  servedPLMNs ServedPLMNs,
  servedGroupIDs ServedGroupIDs,
  servedMMECs ServedMMECs,
  iE-Extensions ProtocolExtensionContainer { {ServedGUMMEIsItem-ExtIEs} } OPTIONAL,
  ...,
}
ServedGUMMEIsItem-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...}

ServedGroupIDs ::= SEQUENCE (SIZE(1.. maxnoofGroupIDs)) OF MME-Group-ID
ServedMMECs ::= SEQUENCE (SIZE(1.. maxnoofMMECs)) OF MME-Code
ServedPLMNs ::= SEQUENCE (SIZE(1.. maxnoofPLMNPerMME)) OF PLMNidentity
SubscriberProfileIDforRFP ::= INTEGER (1..256)
SupportedTAs ::= SEQUENCE (SIZE(1.. maxnoofTACs)) OF SupportedTAs-Item

SupportedTAs-Item ::= SEQUENCE {
  tAC     TAC,
  broadcastPLMNs  BPLMNs,
  iE-Extensions  ProtocolExtensionContainer { {SupportedTAs-Item-ExtIEs} } OPTIONAL,
  ...
}

SupportedTAs-Item-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...}

S-TMSI ::= SEQUENCE {
  mMEC MME-Code,
  m-TMSI M-TMSI,
  iE-Extensions  ProtocolExtensionContainer { {S-TMSI-ExtIEs} } OPTIONAL,
  ...
}

S-TMSI-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...}

-- T

TAC ::= OCTET STRING (SIZE (2))

TAIListforWarning ::= SEQUENCE (SIZE(1..maxnoofTAIforWarning)) OF TAI

TAI ::= SEQUENCE {
  pLMNidentity   PLMNidentity,
  tAC     TAC,
  iE-Extensions  ProtocolExtensionContainer { {TAI-ExtIEs} } OPTIONAL,
  ...
}

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

-- T

TAI-Broadcast ::= SEQUENCE (SIZE(1..maxnoofTAIforWarning)) OF TAI-Broadcast-Item
TAI-Broadcast-Item ::= SEQUENCE {
  tAI,  
  completedCellinTAI,  
  ProtocolExtensionContainer { {TAI-Broadcast-Item-ExtIEs} } OPTIONAL,  
  ...  
}

TAI-Broadcast-Item-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...  
}

CompletedCellinTAI ::= SEQUENCE {  
  TAI,  
  CompletedCellinTAI-Item,  
  ProtocolExtensionContainer { {CompletedCellinTAI-Item-ExtIEs} } OPTIONAL,  
  ...  
}

CompletedCellinTAI-Item ::= SEQUENCE{
  CGI,  
  ProtocolExtensionContainer { {CompletedCellinTAI-Item-ExtIEs} } OPTIONAL,  
  ...  
}

CompletedCellinTAI-Item-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...  
}

TBCD-STRING ::= OCTET STRING (SIZE (3))

TargetID ::= CHOICE {
  targeteNB-ID,  
  targetRNC-ID,  
  CGI  
}

TargeteNB-ID ::= SEQUENCE {
  global-ENB-ID,  
  selected-TAI,  
  ProtocolExtensionContainer { {TargeteNB-ID-ExtIEs} } OPTIONAL,  
  ...  
}

TargeteNB-ID-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...  
}

TargetRNC-ID ::= SEQUENCE {
  LAI,  
  RAC  
}

TargetRNC-ID-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...  
}
TargetRNC-ID-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {

"..."
}

TargeteNB-ToSourceeNB-TransparentContainer ::= SEQUENCE {
rRC-Container RRC-Container,
iE-Extensions ProtocolExtensionContainer {{TargeteNB-ToSourceeNB-TransparentContainer-ExtIEs} } OPTIONAL,
"..."
}

TargeteNB-ToSourceeNB-TransparentContainer-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {

"..."
}

Target-Source-TransparentContainer ::= OCTET STRING

TargetRNC-ToSourceRNC-TransparentContainer ::= OCTET STRING

TargetBSS-ToSourceBSS-TransparentContainer ::= OCTET STRING

TimeToWait ::= ENUMERATED {v1s, v2s, v5s, v10s, v20s, v60s, ...}

Time-UE-StayedInCell ::= INTEGER (0..4095)

TransportLayerAddress ::= BIT STRING (SIZE(1..160, ...))

TraceActivation ::= SEQUENCE {
e-UTRAN-Trace-ID E-UTRAN-Trace-ID,
interfacesToTrace InterfacesToTrace,
traceDepth TraceDepth,
traceCollectionEntityIPAddress TransportLayerAddress,
iE-Extensions ProtocolExtensionContainer {{TraceActivation-ExtIEs} } OPTIONAL,
"..."
}

TraceActivation-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {

"..."
}

TraceDepth ::= ENUMERATED {
minimum,
medium,
maximum,
minimumWithoutVendorSpecificExtension,
mediumWithoutVendorSpecificExtension,
maximumWithoutVendorSpecificExtension,
"..."
}

E-UTRAN-Trace-ID ::= OCTET STRING (SIZE (8))

TypeError ::= ENUMERATED {
not-understood,
missing,
"..."
UEAggregateMaximumBitrate ::= SEQUENCE {
  uEaggregateMaximumBitRateDL    BitRate,
  uEaggregateMaximumBitRateUL    BitRate,
  iE-Extensions ProtocolExtensionContainer { {UEAggregate-MaximumBitrates-ExtIEs} } OPTIONAL,
  ...
}

UEAggregate-MaximumBitrates-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...
}

UE-S1AP-IDs ::= CHOICE{
  uE-S1AP-ID-pair     UE-S1AP-ID-pair,
  mME-UE-S1AP-ID     MME-UE-S1AP-ID,
  ...
}

UE-S1AP-ID-pair ::= SEQUENCE{
  mME-UE-S1AP-ID     MME-UE-S1AP-ID,
  eNB-UE-S1AP-ID     ENB-UE-S1AP-ID,
  iE-Extensions ProtocolExtensionContainer { {UE-S1AP-ID-pair-ExtIEs} } OPTIONAL,
  ...
}

UE-S1AP-ID-pair-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ...
}

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 ::= BIT STRING (SIZE (10))

UE-HistoryInformation ::= SEQUENCE (SIZE(1..maxnoofCells)) OF LastVisitedCell-Item

UE PagingID ::= CHOICE {
  s-TMSI  S-TMSI,
  IMSI     IMSI,
  ...
}
UERadioCapability ::= OCTET STRING

UESecurityCapabilities ::= SEQUENCE {
  encryptionAlgorithms    EncryptionAlgorithms,
  integrityProtectionAlgorithms  IntegrityProtectionAlgorithms,
  ... ProtocolExtensionContainer { { UESecurityCapabilities-ExtIEs} } OPTIONAL,
}

UESecurityCapabilities-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ... ProtocolExtensionContainer { { UESecurityCapabilities-ExtIEs} } OPTIONAL,
}

-- V
-- W

WarningAreaList ::= CHOICE {
  cellIDList ECGIList,
  trackingAreaListforWarning TAIListforWarning,
  emergencyAreaIDList EmergencyAreaIDList,
  ... ProtocolExtensionContainer { { WarningAreaList-ExtIEs} } OPTIONAL,
}

WarningType ::= OCTET STRING (SIZE (2))

WarningSecurityInfo ::= OCTET STRING (SIZE (50))

WarningMessageContents ::= OCTET STRING (SIZE (1..9600))

-- X

X2TNLConfigurationInfo ::= SEQUENCE {
  eNBX2TransportLayerAddresses ENBX2TLAs,
  ... ProtocolExtensionContainer { { X2TNLConfigurationInfo-ExtIEs} } OPTIONAL,
}

X2TNLConfigurationInfo-ExtIEs S1AP-PROTOCOL-EXTENSION ::= {
  ... ProtocolExtensionContainer { { X2TNLConfigurationInfo-ExtIEs} } OPTIONAL,
}

-- 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
IMPORTS
  ProcedureCode,
  ProtocolIE-ID
FROM S1AP-CommonDataTypes;

id-HandoverPreparation     ProcedureCode ::= 0
id-HandoverResourceAllocation   ProcedureCode ::= 1
id-HandoverNotification     ProcedureCode ::= 2
id-PathSwitchRequest       ProcedureCode ::= 3
id-HandoverCancel         ProcedureCode ::= 4
id-E-RABSetup              ProcedureCode ::= 5
id-E-RABModify             ProcedureCode ::= 6
id-E-RABRelease            ProcedureCode ::= 7
id-E-RABReleaseIndication 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
id-OverloadStart           ProcedureCode ::= 34
id-OverloadStop ProcedureCode ::= 35
id-WriteReplaceWarning ProcedureCode ::= 36
id-eNBDirectInformationTransfer ProcedureCode ::= 37
id-MMEDirectInformationTransfer ProcedureCode ::= 38
id-PrivateMessage ProcedureCode ::= 39
id-eNBConfigurationTransfer ProcedureCode ::= 40
id-MMEConfigurationTransfer ProcedureCode ::= 41
id-CellTrafficTrace ProcedureCode ::= 42

-- ************************************************************
-- Extension constants
-- ************************************************************
maxPrivateIEs INTEGER ::= 65535
maxProtocolExtensions INTEGER ::= 65535
maxProtocolIEs INTEGER ::= 65535

-- ************************************************************
-- Lists
-- ************************************************************
maxNrOfCSGs INTEGER ::= 256
maxNrOfE-RABs INTEGER ::= 256
maxnoofTAIs INTEGER ::= 256
maxnoofTACs INTEGER ::= 256
maxNrOfErrors INTEGER ::= 256
maxnoofBPLMNs INTEGER ::= 6
maxnoofPLMNsPerMME INTEGER ::= 32
maxnoofBPLMNs INTEGER ::= 15
maxnoofBPLMNsPlusOne INTEGER ::= 16
maxnoofForbLACs INTEGER ::= 4096
maxnoofForbTACs INTEGER ::= 4096
maxNrOfIndividualS1ConnectionsToReset INTEGER ::= 256
maxnoofCells INTEGER ::= 16
maxnoofTAIforWarning INTEGER ::= 65535
maxnoofCellID INTEGER ::= 65535
maxnoofEmergencyAreaID INTEGER ::= 65535
maxnoofCellinTAI INTEGER ::= 65535
maxnoofCellinEAI INTEGER ::= 65535
maxnoofNBX2TLAs INTEGER ::= 2
maxnoofRATs INTEGER ::= 8
maxnoofGroupIDs INTEGER ::= 65535
maxnoofMMECs INTEGER ::= 256

-- **************************************************************
-- IEs
-- **************************************************************
--- **MESSAGES**

<table>
<thead>
<tr>
<th>ProtocolIE-ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>id-MME-UE-S1AP-ID</td>
</tr>
<tr>
<td>1</td>
<td>id-HandoverType</td>
</tr>
<tr>
<td>2</td>
<td>id-Cause</td>
</tr>
<tr>
<td>3</td>
<td>id-SourceID</td>
</tr>
<tr>
<td>4</td>
<td>id-TargetID</td>
</tr>
<tr>
<td>8</td>
<td>id-eNB-UE-S1AP-ID</td>
</tr>
<tr>
<td>12</td>
<td>id-E-RABSubjecttoDataForwardingList</td>
</tr>
<tr>
<td>13</td>
<td>id-E-RABtoReleaseListHOCmd</td>
</tr>
<tr>
<td>14</td>
<td>id-E-RABDataForwardingItem</td>
</tr>
<tr>
<td>15</td>
<td>id-E-RABReleaseItemBearerRelComp</td>
</tr>
<tr>
<td>16</td>
<td>id-E-RABToBeSetupListBearerSUReq</td>
</tr>
<tr>
<td>17</td>
<td>id-E-RABToBeSetupItemListBearerSUReq</td>
</tr>
<tr>
<td>18</td>
<td>id-E-RABAdmittedList</td>
</tr>
<tr>
<td>19</td>
<td>id-E-RABFailedToSetupItemListHOReqAck</td>
</tr>
<tr>
<td>20</td>
<td>id-E-RABAdmittedItem</td>
</tr>
<tr>
<td>21</td>
<td>id-E-RABFailedToSetupItemListHOReqAck</td>
</tr>
<tr>
<td>22</td>
<td>id-E-RABToBeSwitchedDLLList</td>
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<tr>
<td>23</td>
<td>id-E-RABToBeSwitchedDLLItem</td>
</tr>
<tr>
<td>24</td>
<td>id-E-RABToBeSetupListCtxtSUReq</td>
</tr>
<tr>
<td>25</td>
<td>id-TraceActivation</td>
</tr>
<tr>
<td>26</td>
<td>id-NAS-PDU</td>
</tr>
<tr>
<td>27</td>
<td>id-E-RABToBeSetupItemListHOReq</td>
</tr>
<tr>
<td>28</td>
<td>id-E-RABSetupListBearerSURes</td>
</tr>
<tr>
<td>29</td>
<td>id-E-RABFailedToSetupListBearerSURes</td>
</tr>
<tr>
<td>30</td>
<td>id-E-RABToBeModifiedListBearerModReq</td>
</tr>
<tr>
<td>31</td>
<td>id-E-RABModifyListBearerModRes</td>
</tr>
<tr>
<td>32</td>
<td>id-E-RABFailedToBeModifiedItemBearerModReq</td>
</tr>
<tr>
<td>33</td>
<td>id-E-RABReleaseItemList</td>
</tr>
<tr>
<td>34</td>
<td>id-E-RABFailedToReleaseList</td>
</tr>
<tr>
<td>35</td>
<td>id-E-RABItem</td>
</tr>
<tr>
<td>36</td>
<td>id-E-RABToBeModifiedItemBearerModReq</td>
</tr>
<tr>
<td>37</td>
<td>id-E-RABModifyItemBearerModRes</td>
</tr>
<tr>
<td>38</td>
<td>id-E-RABReleaseItem</td>
</tr>
<tr>
<td>39</td>
<td>id-E-RABSetupItemListBearerSURes</td>
</tr>
<tr>
<td>40</td>
<td>id-TraceActivation</td>
</tr>
<tr>
<td>41</td>
<td>id-SecurityContext</td>
</tr>
<tr>
<td>43</td>
<td>id-UEPagingID</td>
</tr>
<tr>
<td>44</td>
<td>id-pagingDRX</td>
</tr>
<tr>
<td>46</td>
<td>id-TAIList</td>
</tr>
<tr>
<td>47</td>
<td>id-TAIItem</td>
</tr>
<tr>
<td>48</td>
<td>id-E-RABFailedToSetupListCtxtSURes</td>
</tr>
<tr>
<td>49</td>
<td>id-E-RABReleaseItemHOCmd</td>
</tr>
<tr>
<td>50</td>
<td>id-E-RABSetupItemListCtxtSURes</td>
</tr>
<tr>
<td>51</td>
<td>id-E-RABReleaseListCtxtSURes</td>
</tr>
<tr>
<td>52</td>
<td>id-E-RABToBeSetupItemListCtxtSUReq</td>
</tr>
<tr>
<td>53</td>
<td>id-E-RABToBeSetupListHOReq</td>
</tr>
<tr>
<td>54</td>
<td>id-GERANtoLTEHOInformationRes</td>
</tr>
<tr>
<td>55</td>
<td>id-UTRANtoLTEHOInformationRes</td>
</tr>
<tr>
<td>56</td>
<td>id-CriticalityDiagnostics</td>
</tr>
<tr>
<td>57</td>
<td>id-Global-ENB-ID</td>
</tr>
<tr>
<td>58</td>
<td>id-eNBname</td>
</tr>
<tr>
<td>59</td>
<td>id-MMEname</td>
</tr>
</tbody>
</table>
id-ServedPLMNs ProtocolIE-ID ::= 63
id-SupportedTAs ProtocolIE-ID ::= 64
id-TimeToWait ProtocolIE-ID ::= 65
id-uEaggregateMaximumBitrate ProtocolIE-ID ::= 66
id-TAI ProtocolIE-ID ::= 67
id-E-RABReleaseListBearerRelComp ProtocolIE-ID ::= 69
id-cdma2000PDU ProtocolIE-ID ::= 70
id-cdma2000RAND ProtocolIE-ID ::= 71
id-cdma2000SectorID ProtocolIE-ID ::= 72
id-SecurityKey ProtocolIE-ID ::= 73
id-UERadioCapability ProtocolIE-ID ::= 74
id-GUMMEI-ID ProtocolIE-ID ::= 75
id-E-RABInformationListItem ProtocolIE-ID ::= 78
id-Direct-Forwarding-Path-Availability ProtocolIE-ID ::= 79
id-UEIdentityIndexValue ProtocolIE-ID ::= 80
id-cdma2000HOStatus ProtocolIE-ID ::= 83
id-cdma2000HORelatedHO ProtocolIE-ID ::= 84
id-E-UTRAN-Trace-ID ProtocolIE-ID ::= 86
id-RelativeMMRCapacity ProtocolIE-ID ::= 87
id-SourceMME-UB-S1AP-ID ProtocolIE-ID ::= 88
id-BearerStatusToSubjectToStatusTransfer-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-E-RABToBeSwitchedULItem ProtocolIE-ID ::= 94
id-E-RABToBeSwitchedULList 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 ProtocolIE-ID ::= 100
id-OverloadResponse ProtocolIE-ID ::= 101
id-cdma2000OneXSrvCCInfo ProtocolIE-ID ::= 102
id-E-RABFailedToBeReleasedList ProtocolIE-ID ::= 103
id-Source-ToTarget-TransparentContainer ProtocolIE-ID ::= 104
id-ServedGUMMEIs ProtocolIE-ID ::= 105
id-SubscriberProfileIDforRFP ProtocolIE-ID ::= 106
id-UESecurityCapabilities ProtocolIE-ID ::= 107
id-CSFallbackIndicator ProtocolIE-ID ::= 108
id-CNDomain ProtocolIE-ID ::= 109
id-S-RABReleasedList ProtocolIE-ID ::= 110
id-MessageIdentifier ProtocolIE-ID ::= 111
id-SerialNumber ProtocolIE-ID ::= 112
id-WarningAreaList ProtocolIE-ID ::= 113
id-RepetitionPeriod ProtocolIE-ID ::= 114
id-NumberofBroadcastRequest ProtocolIE-ID ::= 115
id-WarningType ProtocolIE-ID ::= 116
id-WarningSecurityInfo ProtocolIE-ID ::= 117
id-DataCodingScheme ProtocolIE-ID ::= 118
id-WarningMessageContents ProtocolIE-ID ::= 119
id-BroadcastCompletedAreaList ProtocolIE-ID ::= 120
id-Inter-SystemInformationTransferTypeEDT ProtocolIE-ID ::= 121
id-Inter-SystemInformationTransferTypeMDT ProtocolIE-ID ::= 122
id-Target-ToSource-TransparentContainer ProtocolIE-ID ::= 123
id-SRVCCOperationPossible ProtocolIE-ID ::= 124
id-SRVCCOIndication ProtocolIE-ID ::= 125
id-NAS-DownlinkCount ProtocolIE-ID ::= 126
id-CSG-Id ProtocolIE-ID ::= 127
id-CSG-IdList ProtocolIE-ID ::= 128
id-SCONfigurationTransferECT ProtocolIE-ID ::= 129
id-SCONfigurationTransferMCT ProtocolIE-ID ::= 130
id-TraceCollectionEntityIPAddress ProtocolIE-ID ::= 131
id-MSClassmark2 ProtocolIE-ID ::= 132
id-MSClassmark3 ProtocolIE-ID ::= 133
id-RAC-Establishment-Cause ProtocolIE-ID ::= 134
id-NASSecurityParametersfromE-UTRAN ProtocolIE-ID ::= 135
id-NASSecurityParameterstoE-UTRAN ProtocolIE-ID ::= 136
id-DefaultPagingDRX ProtocolIE-ID ::= 137
id-Source-ToTarget-TransparentContainer-Secondary ProtocolIE-ID ::= 138
id-Target-ToSource-TransparentContainer-Secondary ProtocolIE-ID ::= 139

9.3.7 Container Definitions

-- *******************************************************
-- -- Container definitions
-- *******************************************************

S1AP-Containers { 
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0) 
eps-Access (20) modules (3) slap (1) version1 (1) slap-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;
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 Private IEs

S1AP-PRIVATE-IES ::= CLASS {
  &id    PrivateIE-ID,
  &criticality   Criticality,
  &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),
  firstValue S1AP-PROTOCOL-IES-PAIR.&FirstValue (IEsSetParam),
  secondCriticality S1AP-PROTOCOL-IES-PAIR.&secondCriticality (IEsSetParam),
  secondValue S1AP-PROTOCOL-IES-PAIR.&SecondValue (IEsSetParam)
}

-- ***************************************************
-- 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 {IEsSetParam}

ProtocolExtensionField {S1AP-PROTOCOL-EXTENSION : ExtensionSetParam} ::= SEQUENCE {
  id S1AP-PROTOCOL-EXTENSION.&id (ExtensionSetParam),
  criticality S1AP-PROTOCOL-EXTENSION.&criticality (ExtensionSetParam),
  extensionValue S1AP-PROTOCOL-EXTENSION.&Extension (ExtensionSetParam)
}

-- ***************************************************
-- 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),
  value S1AP-PRIVATE-IES.&Value (IEsSetParam)
}
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

TS1\textsubscript{RELOCprep}

- Specifies the maximum time for the Handover Preparation procedure in the source eNB.

TS1\textsubscript{RELOCOverall}

- Specifies the maximum time for the protection of the overall handover procedure in the source eNB.

TX2\textsubscript{RELOCOverall}

- it is specified in reference [22].
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:

![Diagram of 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", 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 that does not have a message to report unsuccessful outcome is missing one or more IEs/IE groups with specified criticality "Ignore IE and Notify Sender", 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 "Ignore IE and Notify Sender", the receiving node shall consider the procedure as unsuccessfully terminated and initiate local error handling.

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 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.

**Class 1:**

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.

**Class 2:**

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.

- If an AP ID error is detected, the error handling as described in subclause 10.6 shall be applied.
10.6 Handling of AP ID

NOTE: The "first message", the "first returned message" and the "last message" as used below correspond to messages 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 has 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 unless otherwise allowed by the specification. The "last message" is a message sent by a node in order to complete the termination of a given UE-associated logical connection, such that no other messages for the same connection are expected in either direction.

If a node receives a first message that includes a remote AP ID which is erroneous e.g. an AP ID which has been stored previously for another UE-associated logical connection for the same peer node, the receiving 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. 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 first returned message that includes a remote AP ID which has been stored previously for another UE-associated logical connection for the same peer node, or that includes an AP ID pair which is inconsistent (e.g. the local AP ID is unknown or already allocated to another UE-associated logical connection), the receiving node shall initiate an Error Indication procedure with inclusion of the received AP IDs from the peer node and an appropriate cause value. Both nodes shall initiate a local release of any established UE-associated logical connection (for the same S1 interface) having these AP IDs as local or remote identifier.

If a node receives a message (other than the first or first returned messages) that includes AP ID(s) identifying a logical connection which is unknown to the node (for the same S1 interface):

- if this message is not the last message for this UE-associated logical connection, the node shall initiate an Error Indication procedure with inclusion of the received AP ID(s) from the peer node and an appropriate cause value. Both nodes shall initiate a local release of any established UE-associated logical connection (for the same S1 interface) having the erroneous AP ID(s) as local or remote identifier.

- if this message is the last message for this UE-associated logical connection, the receiving node shall initiate a local release of any established UE-associated logical connection (for the same S1 interface) that have either the local or remote AP ID(s) as identifiers.
Annex A (informative):  
S1AP Transparent containers content

Transparent containers are used in order to transfer information from one RAN node to the another RAN node. Depending on the particular scenario the behaviour of both involved RAN nodes may be either specified according to the same radio system or according to different radio systems. During an inter-system handover the source RAN node has to adapt to the target RAN node and its requirements. Therefore the container content is encoded according to the rules which are specified for the target radio system. In section 8.4.1.2, it is described how the container shall be encoded with respect to the scenario in which it is used.

The table below is showing all possible scenarios and definitions according to which the content of the transparent container shall be encoded. Additionally the reference to the specification defining particular IE is given.

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NOTE: In case of SRVCC operation to GERAN with DTM support two transparent containers shall be included in HANDOVER REQUIRED message and HANDOVER COMMAND message. In the table the content of the containers is showing how both transparent containers shall be encoded.
## Annex B (informative):
### Change history

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- **March 2009**: Minor corrections before freezing of ASN.1

| 44    | RP-090637| 0504   | Editorial Updates | 8.6.0 |
| 44    | RP-090637| 0512   | Correction of RAN#43 CR implementation | 8.6.0 |
| RP-090637 | 0510 | Explicitly allow TRACE START to be the first VE-associated message received at the eNB | 8.6.0 |
| RP-090637 | 0507 | 1 Clarification of UE Capability Info Indication | 8.6.0 |
| RP-090637 | 0500 | 1 Mandatory UE History Information IE in HANDOVER REQUIRED For Inter-RAT HO from E-UTRAN to UMTS | 8.6.0 |
| RP-090637 | 0482 | 1 Clarify eNB may send Release msg rather than RRC Reject msg on receiving OVERLOAD Start msg | 8.6.0 |
| RP-090637 | 0480 | 1 Clarify reporting of duplicate E-RABs in E-RAB RESPONSE | 8.6.0 |
| RP-090637 | 0468 | Correction of security parameters | 8.6.0 |
| RP-090637 | 0463 | 1 Emergency call Indicator during CS Fallback | 8.6.0 |
| RP-090637 | 0438 | 2 Correction on Path Switch Request procedure | 8.6.0 |
| RP-090644 | 0443 | 2 Removing "outcome" element from the Triggering Message IE | 8.6.0 |
| RP-090644 | 0448 | 1 Missing S1AP functions | 8.6.0 |
| RP-090644 | 0451 | 1 Correction of abnormal conditions in UE Context Release | 8.6.0 |
| RP-090644 | 0452 | 1 Clarification of E-UTRAN Trace ID in Cell Traffic Trace message | 8.6.0 |
| RP-090644 | 0453 | Removal of duplication description of MME UE S1AP ID and eNB UE S1AP ID | 8.6.0 |
| RP-090644 | 0455 | 1 Abnormal condition for Handover Cancellation | 8.6.0 |
| RP-090640 | 0458 | 3 NNSF for HeNB GW deployment scenario | 8.6.0 |
| RP-090640 | 0503 | 1 Transparent Container Coding | 8.6.0 |
| RP-090640 | 0471 | 2 Some Editorial Corrections on ASN.1 | 8.6.0 |
| RP-090640 | 0492 | Operational use of updated configuration data | 8.6.0 |
| RP-090640 | 0484 | Rephrasing of abnormal conditions for S1 setup | 8.6.0 |
| RP-090640 | 0494 | Redirection to 1xRTT system | 8.6.0 |
| RP-090628 | 0464 | 2 NAS PDU in E-RAB Release Command | 8.6.0 |
| RP-090636 | 0491 | Alignment of eNB configuration update procedure | 8.6.0 |
| RP-090636 | 0476 | 2 Add that a non-GBR must be received and admitted on S1-HO | 8.6.0 |
| RP-090636 | 0461 | 1 Clarification of Security Context to be used in HANDOVER REQUEST message | 8.6.0 |
| RP-090636 | 0459 | Correction the text about the Handover Resource Allocation procedure | 8.6.0 |
| RP-090636 | 0502 | Clarification for RAT list in S1 Setup Response and MME configuration Update | 8.6.0 |
| RP-090636 | 0501 | 1 Clarification of range bound for maximal number of PLMNs per MME and GUMMEIs | 8.6.0 |

June 2009 Correction of an ASN.1 implementation error of CR0463r1 in RP-090637 (R3-091456) 8.6.1
## History

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