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*Technical Specification*

**LTE;**
**Evolved Universal Terrestrial Radio Access Network (E-UTRAN);**
**X2 Application Protocol (X2AP)**
**(3GPP TS 36.423 version 8.3.0 Release 8)**


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# Contents

# Foreword

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

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# 1 Scope

The present document specifies the radio network layer signalling procedures of the control plane between eNBs in E-UTRAN. X2AP supports the functions of X2 interface by signalling procedures defined in this document. X2AP is developed in accordance to the general principles stated in [2] and [3].

# 2 References

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

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

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

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

[3] 3GPP TS 36.420: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN);X2 General Aspects and Principles".

[4] 3GPP TS 36.413: " Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP)".

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

[6] 3GPP TS 32.422: "Telecommunication Management; Subscriber and Equipment Trace; Trace Control and Configuration Management".

[7] 3GPP TS 32.421: "Telecommunication Management; Subscriber and Equipment Trace; Trace concepts and requirements".

[8] 3GPP TS 36.424: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 data transport".

[9] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRAN); Radio Resource Control (RRC) Protocol Specification".

[10] 3GPP TS 36.211: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical Channels and Modulation".

[11] 3GPP TS 36.213: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer procedures ".

[12] 3GPP TS 23.401: "General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access".

[13] 3GPP TS 23.203: "Policy and charging control architecture".

[14] 3GPP TS 24.301: "Non-Access-Stratum (NAS) protocol for Evolved Packet System; Stage 3".

[15] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA), Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; stage 2".

[16] 3GPP TS 36.104: " Base Station (BS) radio transmission and reception ".

[17] 3GPP TS 24.008: "Mobile Radio Interface Layer 3 Specification; Core Network Protocols; Stage 3".

# 3 Definitions, symbols and abbreviations

## 3.1 Definitions

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

**Elementary Procedure:** X2AP protocol consists of Elementary Procedures (EPs). An X2AP Elementary Procedure is a unit of interaction between two eNBs. An EP consists of an initiating message and possibly a response message. Two kinds of EPs are used:

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

## 3.2 Symbols

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

<symbol> <Explanation>

## 3.3 Abbreviations

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

| | |
|---|---|
| DL | Downlink |
| EARFCN | E-UTRA Absolute Radio Frequency Channel Number |
| eNB | E-UTRAN NodeB |
| EP | Elementary Procedure |
| EPC | Evolved Packet Core |
| E-UTRAN | Evolved UTRAN |
| GUMMEI | Globally Unique MME Identifier |
| HFN | Hyper Frame Number |
| IE | Information Element |
| MME | Mobility Management Entity |
| PDCP | Packet Data Convergence Protocol |
| PLMN | Public Land Mobile Network |
| S-GW | Serving Gateway |
| SN | Sequence Number |
| TAC | Tracking Area Code |
| UE | User Equipment |
| UL | Uplink |

# 4 General

## 4.1 Procedure specification principles

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

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

- The procedure text discriminates between:

  1) Functionality which "shall" be executed

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

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

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

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

## 4.2 Forwards and backwards compatibility

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

## 4.3 Specification notations

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

| | |
|---|---|
| Procedure | When referring to an elementary procedure in the specification the Procedure Name is written with the first letters in each word in upper case characters followed by the word "procedure", e.g. Handover Preparation procedure. |
| Message | When referring to a message in the specification the MESSAGE NAME is written with all letters in upper case characters followed by the word "message", e.g. HANDOVER REQUEST 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. *SAE Bearer ID* 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 X2AP services

The present clause describes the services an eNB offers to its neighbours.

## 5.1 X2AP procedure modules

The X2 interface X2AP procedures are divided into two modules as follows:

1. X2AP Basic Mobility Procedures;
2. X2AP Global Procedures;

The X2AP Basic Mobility Procedures module contains procedures used to handle the mobility within E-UTRAN.

The Global Procedures module contains procedures that are not related to a specific UE. The procedures in this module are in contrast to the above module involving two peer eNBs.

## 5.2 Parallel transactions

Unless explicitly indicated in the procedure specification, at any instance in time one protocol peer shall have a maximum of one ongoing X2AP procedure related to a certain UE.

# 6 Services expected from signalling transport

Editors Note: More clarification to be added here when definition clearer in 36.401.

The signalling connection shall provide in sequence delivery of X2AP messages. X2AP shall be notified if the signalling connection breaks.

# 7 Functions of X2AP

The X2AP protocol provides the following functions:

- Mobility Management. This function allows the eNB to move the responsibility of a certain UE to another eNB. Forwarding of user plane data, Status Transfer and UE Context Release function are parts of the mobility management.
- Load Management. This function is used by eNBs to indicate resource status, overload and traffic load to each other.
- Reporting of General Error Situations. This function allows reporting of general error situations, for which function specific error messages have not been defined.
- Resetting the X2. This function is used to completely reset the X2 interface.
- Setting up the X2. This function is used to exchange necessary data for the eNB for setup the X2 interface.
- eNB Configuration Update. This function allows updating of application level data needed for two eNBs to interoperate correctly over the X2 interface.

The mapping between the above functions and X2 EPs is shown in the table below.

**Table 7-1: Mapping between X2AP functions and X2AP EPs**

| Function | Elementary Procedure(s) |
|---|---|
| Mobility Management | a) Handover Preparation<br>b) SN Status Transfer<br>c) UE Context Release<br>d) Handover Cancel |
| Load Management | a) Load Indication<br>b) Resource Status Update Initiation<br>c) Resource Status Reporting |
| Reporting of General Error Situations | Error Indication |
| Resetting the X2 | Reset |
| Setting up the X2 | X2 Setup |
| eNB Configuration Update | eNB Configuration Update |

# 8 X2AP procedures

## 8.1 Elementary procedures

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

**Table 8.1-1: Class 1 Elementary Procedures**

| Elementary Procedure | Initiating Message | Successful Outcome | Unsuccessful Outcome |
|---|---|---|---|
| | | Response message | Response message |
| Handover Preparation | HANDOVER REQUEST | HANDOVER REQUEST ACKNOWLEDGE | HANDOVER PREPARATION FAILURE |
| Reset | RESET REQUEST | RESET RESPONSE | |
| X2 Setup | X2 SETUP REQUEST | X2 SETUP RESPONSE | X2 SETUP FAILURE |
| eNB Configuration Update | ENB CONFIGURATION UPDATE | ENB CONFIGURATION UPDATE ACKNOWLEDGE | ENB CONFIGURATION UPDATE FAILURE |
| Resource Status Reporting Initiation | RESOURCE STATUS REQUEST | RESOURCE STATUS RESPONSE | RESOURCE STATUS FAILURE |

**Table 8.1-2: Class 2 Elementary Procedures**

| Elementary Procedure | Initiating Message |
|---|---|
| Load Indication | LOAD INFORMATION |
| Handover Cancel | HANDOVER CANCEL |
| SN Status Transfer | SN STATUS TRANSFER |
| UE Context Release | UE CONTEXT RELEASE |
| Resource Status Reporting | RESOURCE STATUS UPDATE |
| Error Indication | ERROR INDICATION |

# 8.2 Basic mobility procedures

## 8.2.1 Handover Preparation

### 8.2.1.1 General

This procedure is used to establish necessary resources in an eNB for an incoming handover.

### 8.2.1.2 Successful Operation

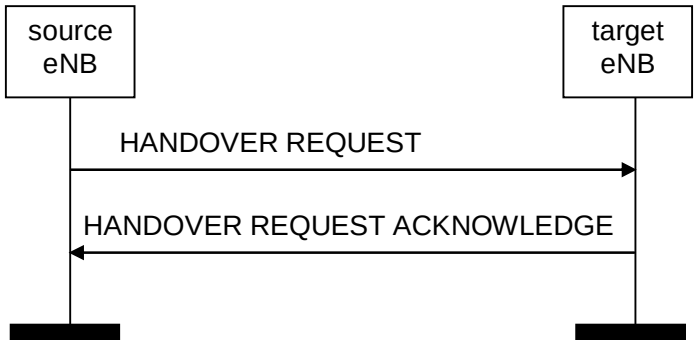


**Figure 8.2.1.2-1: Handover Preparation, successful operation**

The source eNB initiates the procedure by sending the HANDOVER REQUEST message to the target eNB. When the source eNB sends the HANDOVER REQUEST message, it shall start the timer $T_{RELOCprep}$

If at least one of the requested SAE bearers is admitted to the cell, the target eNB shall reserve necessary resources, and send the HANDOVER REQUEST ACKNOWLEDGE message back to the source eNB. The target eNB shall include the SAE Bearers for which resources have been prepared at the target cell in the *SAE Bearers Admitted List* IE. The target eNB shall include the SAE bearers that have not been admitted in the *SAE Bearers Not Admitted List* IE with an appropriate cause value.

For each bearer for which the source eNB proposes to do forwarding of downlink data, the source eNB shall include the *DLForwarding* IE within the *SAE Bearer Info* IE of the HANDOVER REQUEST message. For each bearer that it has decided to admit, the target eNB may include the *DL GTP Tunnel Endpoint* IE within the *SAE Bearer Info* IE of the HANDOVER REQUEST ACKNOWLEDGE message to indicate that it accepts the proposed forwarding of downlink data for this bearer. This GTP tunnel endpoint may be different from the corresponding *GTP TEID* IE in the *SAE Bearer To Be Switched in Downlink List* of the PATH SWITCH REQUEST message (see [4]) depending on implementation choice.

For each bearer in the *SAE Bearers Admitted List* IE, the target eNB may include the *UL GTP Tunnel Endpoint* IE if it requests data forwarding of uplink packets to be performed for that bearer.

Upon reception of the HANDOVER REQUEST ACKNOWLEDGE message the source eNB shall stop the timer $T_{RELOCprep}$, start the timer $TX2_{RELOCOverall}$ and terminate the Handover Preparation procedure. The source eNB is then defined to have a Prepared Handover for that X2 UE-associated signalling.

If the *Trace Activation* IE is included in the HANDOVER REQUEST message then the target eNB should initiate the requested trace function as described in [6].

If the *Handover Restriction List* IE is

- contained in the HANDOVER REQUEST message, the target eNB shall store this information and the target eNB should use the information in *Handover Restriction List* IE to determine a target cell for subsequent handover attempts.

- not contained in the HANDOVER REQUEST message, the target eNB shall consider that no access restriction applies to the UE.

If the *Location Reporting Information* IE is included in the HANDOVER REQUEST message then the eNB shall initiate the requested location reporting procedure as defined in [4].

The HANDOVER REQUEST message shall contain the *Subscriber Profile ID for RAT/Frequency priority* IE, if available.

If the *Subscriber Profile ID for RAT/Frequency priority* IE is

- contained in the HANDOVER REQUEST message, the target eNB shall store this information and the target eNB should use the information as defined in [15].

Editor"s Note: The reporting of Cell ID with regard to cell change caused by X2 handover is FFS.

#### 8.2.1.2.1 UE History Information

Configuration may be used to instruct an eNB about collection of UE historical information.

When configured to collect UE historical information, the eNB shall:

- Collect information about the UE for as long as the UE stays in one of its cells, and store the collected information to be used for future handover preparations.
- At handover preparation, add the stored information to the *Last Visited Cell List* IE and include the *UE History Information* IE in the HANDOVER REQUEST message.
- At reception of the HANDOVER REQUEST message in where the *UE History Information* IE is included, collect the same type of information as that included in the *UE History Information* IE and act according to the bullets above.

### 8.2.1.3 Unsuccessful Operation

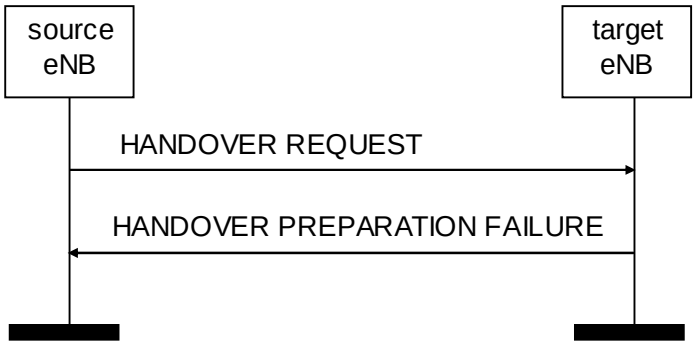


**Figure 8.2.1.3-1: Handover Preparation, unsuccessful operation**

If the target eNB is not able to accept any of the SAE bearers or a failure occurs during the Handover Preparation, the target eNB shall send the HANDOVER PREPARATION FAILURE message to the source eNB. The message shall contain the *Cause* IE with an appropriate value.

**Interactions with Handover Cancel procedure:**

If there is no response from the target eNB to the HANDOVER REQUEST message before timer $T_{RELOCprep}$ expires in the source eNB, the source eNB should cancel the Handover Preparation procedure towards the target eNB by initiating the Handover Cancel procedure with the appropriate value for the *Cause* IE, e.g. "$T_{RELOCprep}$ expiry".

### 8.2.1.4 Abnormal Conditions

If the target eNB receives a HANDOVER REQUEST message containing several *SAE Bearer ID* IEs (in the *SAE Bearers To Be Setup List* IE) set to the same value, the target eNB shall not admit the corresponding SAE bearers.

If the target eNB receives a HANDOVER REQUEST message containing a *SAE Bearer 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 target eNB shall not admit the corresponding SAE bearer.

## 8.2.2 SN Status Transfer

### 8.2.2.1 General

The purpose of the SN 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 during an X2 handover for each respective SAE bearer for which PDCP SN and HFN status preservation applies.

### 8.2.2.2 Successful Operation

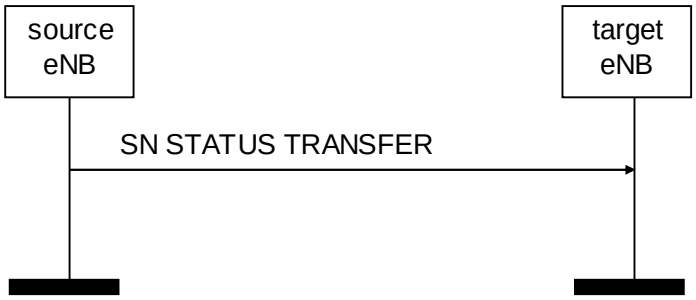


**Figure 8.2.2.2-1: SN Status Transfer, successful operation**

The source eNB initiates the procedure by stop assigning PDCP SNs to downlink SDUs and stop delivering UL SDUs towards the EPC and sending the SN STATUS TRANSFER message to the target eNB at the time point when it considers the transmitter/receiver status to be frozen.

At that point of time, the source eNB shall either:

- discard the uplink packets received out of sequence for a bearer and includes the bearer in the *SAE Bearers Subject to Status Transfer List* IE to indicate that PDCP SN status preservation applies for the bearer,
- forward the uplink packets received out of sequence for a bearer and, if status preservation applies for the bearer, includes the bearer in the *SAE Bearers Subject to Status Transfer List* IE to indicate that PDCP SN status preservation applies for the bearer,
- send the uplink packets received out of sequence to the EPC for each bearer for which the PDCP SN status preservation doesn"t apply.

The source eNB may also include in the SN 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.

For each bearer for which the *UL COUNT Value* IE is received in the SN 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.

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

If the *DL COUNT Value* IE is received in the SN STATUS TRANSFER message for one bearer, the target eNB shall use it to mark with the value contained in the *PDCP-SN* IE of this IE the first downlink packet for which there is no PDCP SN yet assigned.

### 8.2.2.2 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.

## 8.2.3 UE Context Release

### 8.2.3.1 General

The UE Context Release procedure is initiated by the target eNB to signal to the source eNB that control plane resources for the handed over UE context can be released.

### 8.2.3.2 Successful Operation


**Figure 8.2.3.2-1: UE Context Release, successful operation**

The UE Context Release procedure is initiated by the target eNB. By sending UE CONTEXT RELEASE the target eNB informs success of Handover to source eNB and triggers the release of resources.

Upon reception of the UE CONTEXT RELEASE message, the source eNB can release radio and control plane related resources associated to the UE context. For bearers for which data forwarding has been performed, the source eNB should continue forwarding of U-plane data as long as packets are received at the source eNB from the EPC or the source eNB buffer has not been emptied (an implementation dependent mechanism decides that data forwarding can be stopped).

### 8.2.3.3 Unsuccessful Operation

Not applicable.

### 8.2.3.4 Abnormal Conditions

If the UE Context Release procedure is not initiated towards the source eNB from any prepared eNB before the expiry of the timer $TX2_{RELOCoverall}$, the source eNB shall release all resources associated to the UE context and request the MME to release the UE context.

If the UE returns to source eNB before the reception of the UE CONTEXT RELEASE message or the expiry of the timer $TX2_{RELOCoverall}$, the source eNB shall stop the $TX2_{RELOCoverall}$ and continue.

## 8.2.4 Handover Cancel

### 8.2.4.1 General

The Handover Cancel procedure is used to cancel an already prepared handover.

#### 8.2.4.2 Successful Operation


**Figure 8.2.4.2-1: Handover Cancel, successful operation**

The source eNB initiates the procedure by sending the HANDOVER CANCEL message to the target eNB. The source eNB shall indicate the reason for cancelling the handover by means of an appropriate cause value.

At the reception of the HANDOVER CANCEL message, the target eNB shall remove any reference to, and release any resources previously reserved to the concerned UE context.

#### 8.2.4.3 Unsuccessful Operation

Not applicable.

#### 8.2.4.4 Abnormal Conditions

Should the HANDOVER CANCEL message refer to a context that does not exist, the target eNB shall ignore the message.8.3 Global Procedures

### 8.3.1 Load Indication

#### 8.3.1.1 General

The purpose of the Load Indication procedure is to transfer load and interference co-ordination information between intra-frequency neighboring eNBs.

The procedure uses non UE associated signalling.

#### 8.3.1.2 Successful Operation

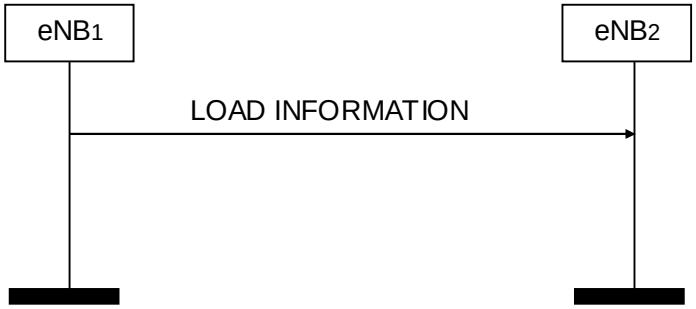


**Figure 8.3.1.2-1: Load Indication, successful operation**

An eNB initiates the procedure by sending LOAD INFORMATION message to intra-frequency neighbouring eNBs.

If the *UL Interference Overload Indication* IE is received in the LOAD INFORMATION message, it indicates the interference level experienced by the sending eNB on some resource blocks. The receiving eNB may take such information into account when setting its scheduling policy and shall consider the received *UL Interference Overload Indication* IE value valid until reception of a new LOAD INFORMATION message carrying an update of the same IE.

If the *UL High Interference Indication* IE is received in the LOAD INFORMATION message, it indicates, per PRB, the occurrence of high interference sensitivity, as seen from the sending eNB. The receiving eNB should try to avoid scheduling cell edge UEs in its cells for the concerned PRBs. The *Target Cell ID* IE received within the *UL High Interference Information* IE group in the LOAD INFORMATION message indicates the cell for which the corresponding UL High Interference Indication is meant. The receiving eNB shall consider the value of the *UL High Interference Information* IE group valid until reception of a new LOAD INFORMATION message carrying an update.

If the *Relative Narrowband Tx Power (RNTP)* IE is received in the LOAD INFORMATION message, it indicates, per PRB, whether downlink transmission power is lower than the value indicated by the *RNTP Threshold* IE. The receiving eNB may take such information into account when setting its scheduling policy and shall consider the received *Relative Narrowband Tx Power (RNTP)* IE value valid until reception of a new LOAD INFORMATION message carrying an update.

#### 8.3.1.3 Unsuccessful Operation

Not applicable.

#### 8.3.1.4 Abnormal Conditions

Void.

### 8.3.2 Error Indication

Editor Note: Used by peer node to report detected errors in a received message.

#### 8.3.2.1 General

The Error Indication procedure is initiated by an eNB 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.

#### 8.3.2.2 Successful Operation


**Figure 8.3.2.2-1: Error Indication, successful operation.**

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

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 UE associated signalling the *Old eNB UE X2AP ID* IE and *New eNB UE X2AP ID* IE shall be included in the ERROR INDICATION message. If one or both of *Old eNB UE X2AP ID* IE and *New eNB UE X2AP ID* IE are not correct, the cause shall be set to appropriate value e.g. " unknown Old eNB UE X2AP ID", "unknown New eNB UE X2AP ID" or "unknown pair of UE X2AP ID".

#### 8.3.2.3 Unsuccessful Operation

Not applicable.

#### 8.3.2.4 Abnormal Conditions

Not applicable.

### 8.3.3 X2 Setup

#### 8.3.3.1 General

The purpose of the X2 Setup procedure is to exchange application level data needed for two eNBs to interoperate correctly over the X2 interface.

The procedure uses non UE associated signalling.

#### 8.3.3.2 Successful Operation

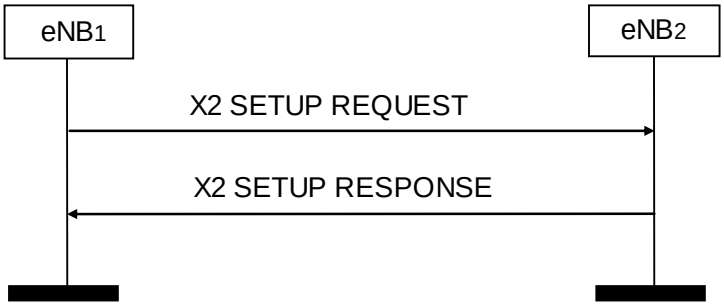


**Figure 8.3.3.2-1: X2 Setup, successful operation**

An eNB initiates the procedure by sending an X2 SETUP REQUEST message to a candidate eNB. Candidate eNB replies with an X2 SETUP RESPONSE message. The initiating eNB transfers a list of served cells to the candidate eNB. Candidate eNB replies with a list of its served cells.

#### 8.3.3.3 Unsuccessful Operation

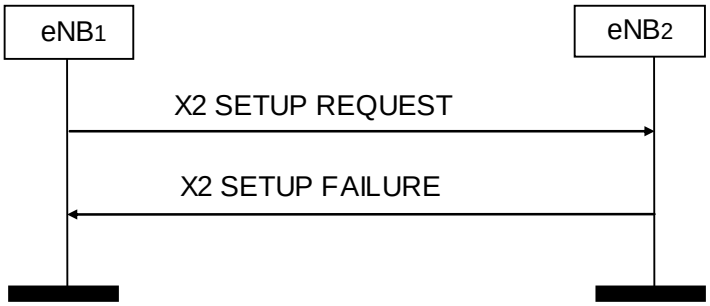


**Figure 8.3.3.3-1: X2 Setup, unsuccessful operation**

If the candidate eNB can not accept the setup it shall respond with an X2 SETUP FAILURE message with appropriate cause value.

If the X2 SETUP FAILURE messages include the *Time To Wait* IE the eNB shall wait at least for the indicated time before reinitiating the X2 setup towards the same eNB.

#### 8.3.3.4 Abnormal Conditions

If the X2 SETUP REQUEST message is not the first message received for a specific TNL association then this shall be treated as a logical error.

## 8.3.4 Reset

### 8.3.4.1 General

The purpose of the Reset procedure is to align the resources in eNB1 and eNB2 in the event of an abnormal failure. The procedure resets the whole X2 interface.

The procedure uses non UE associated signalling.

### 8.3.4.2 Successful Operation

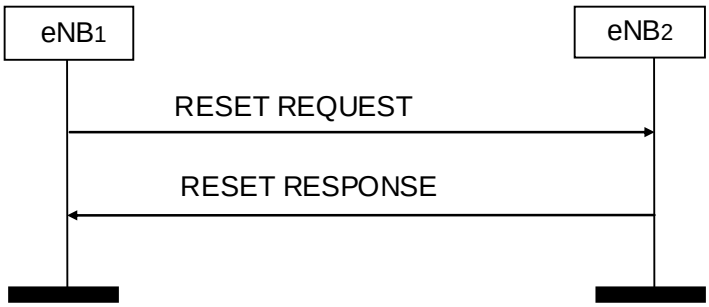


**Figure 8.3.4.2-1: Reset, successful operation**

The procedure is initiated with a RESET REQUEST message sent from the $eNB_1$ to the $eNB_2$. Upon receipt of this message, $eNB_2$ shall abort any other ongoing procedures over X2 between $eNB_1$ and $eNB_2$. The $eNB_2$ shall delete all the context information related to the $eNB_1$ including the X2AP ID for the contexts. After completion of release of the resources, the $eNB_2$ shall respond with a RESET RESPONSE message.

### 8.3.4.3 Unsuccessful Operation

Void.

### 8.3.4.4 Abnormal Conditions

If the RESET REQUEST message is received, any other ongoing procedure (except another Reset procedure) on the same X2 interface shall be aborted.

If Reset procedure is ongoing and eNB receives a RESET REQUEST message from the peer entity on the same X2 interface, the eNB shall respond with RESET RESPONSE message as described in 8.3.4.2.

## 8.3.5 eNB Configuration Update

### 8.3.5.1 General

The purpose of the eNB Configuration Update procedure is to update application level data needed for two eNBs to interoperate correctly over the X2 interface.

### 8.3.5.2 Successful Operation

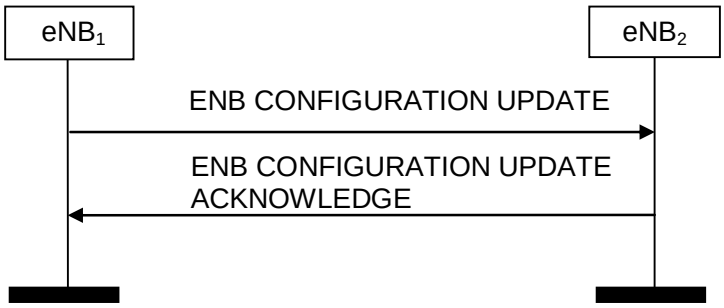


**Figure 8.3.5.2-1: eNB Configuration Update, successful operation**

An eNB1 initiates the procedure by sending an ENB CONFIGURATION UPDATE message to a peer eNB2.

Upon reception of an ENB CONFIGURATION UPDATE message, eNB2 shall update the information for eNB1 as follows:

**Update of Served Cell Information:**

- If *Served Cells To Add* IE is contained in the ENB CONFIGURATION UPDATE message, eNB2 shall add cell information according to the information in the *Served Cell Information* IE.
- If *Served Cells To Modify* IE is contained in the ENB CONFIGURATION UPDATE message, eNB2 shall modify information of cell indicated by *Old ECGI* IE according to the information in the *Served Cell Information* IE.
- If *Served Cells To Delete* IE is contained in the ENB CONFIGURATION UPDATE message, eNB2 shall delete information of cell indicated by *Old ECGI* IE.

**Update of GU Group ID List:**

- If *GU Group Id To Add List* IE is contained in the ENB CONFIGURATION UPDATE message, eNB2 shall add the GU Group Id to its GU Group Id List.
- If *GU Group Id To Delete List* IE is contained in the ENB CONFIGURATION UPDATE message, eNB2 shall remove the GU Group Id from its GU Group Id List.

After successful update of requested information, eNB2 shall reply with the ENB CONFIGURATION UPDATE ACKNOWLEDGE message to inform the initiating eNB1 that the requested update of application data was performed successfully. In case the peer eNB2 receives an ENB CONFIGURATION UPDATE without any IE except for *Message Type* IE it should reply with ENB CONFIGURATION UPDATE ACKNOWLEDGE message without performing any updates to the existing configuration.

### 8.3.5.3 Unsuccessful Operation

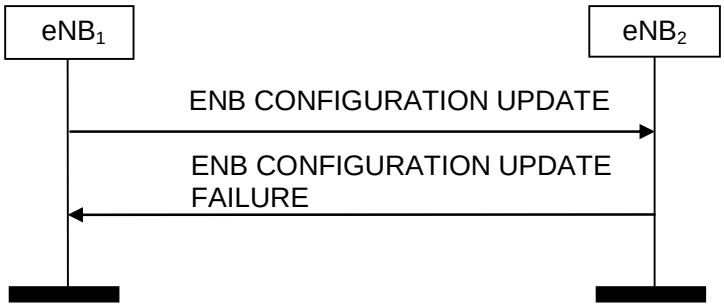


**Figure 8.3.5.3-1: eNBConfiguration Update, unsuccessful operation**

If the eNB 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 message 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 eNB. Both nodes shall continue to operate the X2 with the existing configuration data.

## 8.3.6 Resource Status Reporting Initiation

### 8.3.6.1 General

This procedure is used by an eNB to request the reporting of load measurements to another eNB.

### 8.3.6.2 Successful Operation

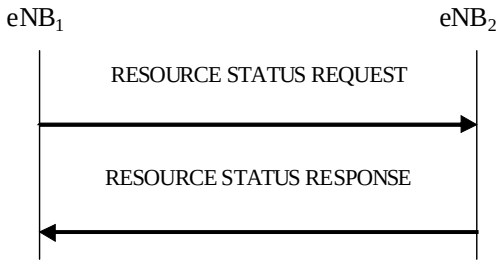


**Figure 8.3.6.2-1: Resource Status Initiation, successful operation**

The procedure is initiated with a RESOURCE STATUS REQUEST message sent from eNB1 to eNB2. Upon receipt, eNB2 shall initiate the requested measurement according to the parameters given in the request in case the *Registration Request* IE set to "start" and shall terminate the reporting in case the *Registration Request* IE set to " stop".

If the *Reporting Periodicity* IE is included in the RESOURCE STATUS REQUEST message, eNB2 shall use its value as the time interval between two subsequent measurement reports. If this value is not specified, eNB2 shall apply a default value or shall fail the procedure.

If the *Cell Id List* IE is included in the RESOURCE STATUS REQUEST message, eNB2 shall perform and report measurements only for the cells included in the list. If this value is not specified, eNB2 shall report all the cells it controls.

**Response message**
If eNB2 was able to initiate the measurements as requested by eNB1, it shall respond with the RESOURCE STATUS RESPONSE message.

### 8.3.6.3 Unsuccessful Operation

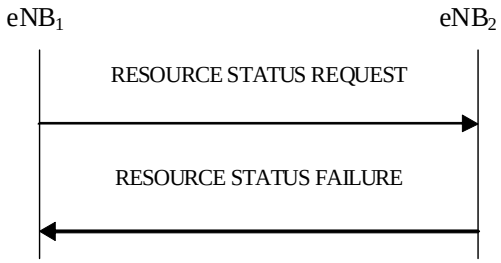


**Figure 8.3.6.3-1: Resource Status Initiation, unsuccessful operation**

If the requested measurement cannot be initiated, eNB2 shall send a RESOURCE STATUS FAILURE message. The *Cause* IE shall be set to an appropriate value.

### 8.3.6.4 Abnormal Conditions

Void

### 8.3.7 Resource Status Reporting

#### 8.3.7.1 General

This procedure is initiated by eNB2 to report the result of measurements requested by eNB1 using the Resource Status Reporting Initiation.

#### 8.3.7.2 Successful Operation


**Figure 8.3.7.2-1: Resource Status Reporting, successful operation**

**Report Contents**

The eNB2 shall report the results of the measurements in RESOURCE STATUS UPDATE message for each requested cell.

Editor Note: The report contents are FFS.

# 9 Elements for X2AP Communication

## 9.0 General

Subclauses 9.1 and 9.2 describe the structure of the messages and information elements required for the X2AP protocol in tabular format. Subclause 9.3 provides the corresponding ASN.1 definition.

The following attributes are used for the tabular description of the messages and information elements: Presence, Range Criticality and Assigned Criticality. Their definition and use can be found in [4].

## 9.1 Message Functional Definition and Content

Editors Note: Details on the Connection Management Identifiers is FFS. When general principles and consistency with S1AP has been decided all X2AP procedures will need to be revised.

### 9.1.1 Messages for Basic Mobility Procedures

#### 9.1.1.1 HANDOVER REQUEST

This message is sent by the source eNB to the target eNB to request the preparation of resources for a handover.

Direction: source eNB → target eNB.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Message Type | M | | 9.2.15 | | YES | reject |
| Old eNB UE X2AP ID | M | | eNB UE X2AP ID 9.2.26 | Allocated at the source eNB | YES | reject |
| Cause | M | | 9.2.8 | | YES | ignore |
| Target Cell ID | M | | ECGI 9.2.16 | | YES | reject |
| GUMMEI | M | | 9.2.18 | | YES | reject |
| **UE Context Information** | | 1 | | | YES | reject |
| > MME UE S1AP ID | M | | INTEGER (0..$2^{32}$-1) | MME UE S1AP ID allocated at the MME | – | – |
| > Aggregate Maximum Bit Rate | O | | 9.2.14 | | – | – |
| > Subscriber Profile ID for RAT/Frequency priority | O | | 9.2.27 | | – | – |
| **>SAE Bearers To Be Setup List** | | 1 | | | – | – |
| **>>SAE Bearer Info** | | *1 to <maxnoof Bearers>* | | | EACH | ignore |
| >>> SAE Bearer ID | M | | 9.2.25 | | – | – |
| >>> SAE Bearer Level QoS Parameters | M | | 9.2.11 | Inlcudes necessary QoS parameters | – | – |
| >>> DL Forwarding | O | | 9.2.7 | | – | – |
| >>> UL GTP Tunnel Endpoint | M | | GTP Tunnel Endpoint 9.2.1 | SGW tunnel endpoint. For delivery of UL PDUs | – | – |
| > RRC Context | M | | OCTET STRING | to transfer UE RAN context, see subclause 10.2.3 in [9]. | – | – |
| >Handover Restriction List | O | | 9.2.5 | | – | – |
| >Location Reporting Information | O | | 9.2.23 | Includes the necessary parameters for location reporting | – | – |
| UE History Information | O | | 9.2.3 | | YES | ignore |
| Trace Activation | O | | 9.2.2 | | YES | ignore |

Editors Note: The details of required IEs to transfer security information, roaming restriction information, potentially some user plane related context, etc., are left FFS.

| Range bound | Explanation |
|---|---|
| maxnoofSAEbearers | Maximum no. of SAE bearers. Value is 256 |

### 9.1.1.2 HANDOVER REQUEST ACKNOWLEDGE

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

Direction: target eNB → source eNB.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Message Type | M | | 9.2.15 | | YES | reject |
| Old eNB UE X2AP ID | M | | eNB UE X2AP ID 9.2.26 | Allocated at the source eNB | YES | reject |
| New eNB UE X2AP ID | M | | eNB UE X2AP ID 9.2.26 | Allocated at the target eNB | YES | reject |
| **SAE Bearers Admitted List** | | 0..1 | | | YES | ignore |
| **> SAE Bearer Info** | | *1 to <maxnoof Bearers>* | | | EACH | ignore |
| >> SAE Bearer ID | M | | 9.2.25 | | – | – |
| >> UL GTP Tunnel Endpoint | O | | GTP Tunnel Endpoint 9.2.1 | Target eNB tunnel endpoint. For delivery of UL PDUs | – | – |
| >> DL GTP Tunnel Endpoint | O | | GTP Tunnel Endpoint 9.2.1 | Target eNB tunnel endpoint. For delivery of DL PDUs | – | – |
| **SAE Bearers Not Admitted List** | | *0..1* | | | YES | ignore |
| **> SAE Bearer Info** | | *1 to <maxnoof Bearers>* | | | EACH | ignore |
| >> SAE Bearer ID | M | | 9.2.25 | | – | – |
| >> Cause | M | | 9.2.8 | | – | – |
| Target eB To Source eB Transparent Container | M | | OCTET STRING | It includes HO info for the UE, see subclause 10.2.2 in [9]. | YES | ignore |
| Criticality Diagnostics | O | | 9.2.9 | | YES | ignore |

| Range bound | Explanation |
|---|---|
| maxnoofBearers | Maximum no. of SAE bearers. Value is 256 |

### 9.1.1.3 HANDOVER PREPARATION FAILURE

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

Direction: target eNB → source eNB.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Message Type | M | | 9.2.15 | | YES | reject |
| Old eNB UE X2AP ID | M | | eNB UE X2AP ID 9.2.26 | Allocated at the source eNB | YES | reject |
| Cause | M | | 9.2.8 | | YES | ignore |
| Criticality Diagnostics | O | | 9.2.9 | | YES | ignore |

### 9.1.1.4 SN STATUS TRANSFER

This message is sent by the source eNB to the target eNB to transfer the uplink/downlink PDCP-SN status during a handover.

Direction: source eNB → target eNB.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Message Type | M | | 9.2.15 | | YES | ignore |
| Old eNB UE X2AP ID | M | | eNB UE X2AP ID 9.2.26 | Allocated at the source eNB | YES | reject |
| New eNB UE X2AP ID | M | | eNB UE X2AP ID 9.2.26 | Allocated at the target eNB | YES | reject |
| **SAE Bearers Subject To Status Transfer List** | | *1* | | | YES | ignore |
| **>SAE Bearers Subject To Status Transfer Item** | | *1 to <maxnoof Bearers>* | | | EACH | ignore |
| >> SAE Bearer ID | M | | 9.2.25 | | – | – |
| >>Receive Status Of UL PDCP SDUs | O | | BIT STRING (4096) | PDCP Sequence Number = (First Missing SDU Number + bit position) modulo 4096<br><br>0: PDCP SDU has not been received.<br>1: PDCP SDU has been received correctly. | – | – |
| >> UL COUNT Value | M | | COUNT Value 9.2.17 | PDCP-SN and Hyper Frame Number of the first missing UL SDU | – | – |
| >> DL COUNT Value | M | | COUNT Value 9.2.17 | PDCP-SN and Hyper frame number that the target eNB should assign for the next DL SDU not having an SN yet | – | – |

| Range bound | Explanation |
|---|---|
| maxnoofBearers | Maximum no. of SAE bearers. Value is 256. |

### 9.1.1.5 UE CONTEXT RELEASE

This message is sent by the target eNB to the source eNB to indicate that resources can be released.

Direction: target eNB → source eNB.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Message Type | M | | 9.2.15 | | YES | ignore |
| Old eNB UE X2AP ID | M | | eNB UE X2AP ID 9.2.26I | Allocated at the source eNB | YES | reject |
| New eNB UE X2AP ID | M | | eNB UE X2AP ID 9.2.26I | Allocated at the target eNB | YES | reject |

### 9.1.1.6 HANDOVER CANCEL

This message is sent by the source eNB to the target eNB to cancel an ongoing handover.

Direction: source eNB → target eNB.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Message Type | M | | 9.2.15 | | YES | ignore |
| Old eNB UE X2AP ID | M | | eNB UE X2AP ID 9.2.26 | Allocated at the source eNB | YES | reject |
| New eNB UE X2AP ID | M | | eNB UE X2AP ID 9.2.26 | Allocated at the target eNB | YES | reject |
| Cause | M | | 9.2.8 | | YES | ignore |

## 9.1.2 Messages for global procedures

### 9.1.2.1 LOAD INFORMATION

This message is sent by an eNB to neighbouring eNBs to transfer load and interference co-ordination information.

Direction: $eNB_1$ → $eNB_2$.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Message Type | M | | 9.2.15 | | YES | ignore |
| Cell Information | M | | | | YES | ignore |
| **> Cell Information Item** | | *1 to maxCellineNB* | | | EACH | ignore |
| >>Cell ID | M | | ECGI 9.2.16 | Id of the source cell | – | – |
| >>UL Interference Overload Indication | O | | 9.2.19 | | – | – |
| **> >UL High Interference Information** | | *0 to maxCellineNB* | | | – | – |
| >>>UL High Interference Indication | M | | 9.2.20 | | – | – |
| >>>Target Cell ID | M | | ECGI 9.2.16 | Id of the cell for which the HII is meant | – | – |
| >> Relative Narrowband Tx Power (RNTP) | O | | 9.2.21 | | – | – |

| Range bound | Explanation |
|---|---|
| maxCellineNB | Maximum no. cells that can be served by an eNB. Value is 256. |

### 9.1.2.2 ERROR INDICATION

This message is used to indicate that some error has been detected in the eNB.

Direction: eNB1 → eNB2

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Message Type | M | | 9.2.15 | | YES | ignore |
| Old eNB UE X2AP ID | O | | eNB UE X2AP ID 9.2.26 | Allocated at the source eNB | YES | ignore |
| New eNB UE X2AP ID | O | | eNB UE X2AP ID 9.2.26 | Allocated at the target eNB | YES | ignore |
| Cause | O | | 9.2.8 | | YES | ignore |
| Criticality Diagnostics | O | | 9.2.9 | | YES | ignore |

### 9.1.2.3 X2 SETUP REQUEST

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

Direction: eNB1 → eNB2.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Message Type | M | | 9.2.15 | | YES | reject |
| Global eNB ID | M | | 9.2.24 | | YES | reject |
| **Served Cells** | | *1 to maxCellineNB* | | This is all the eNB cells | YES | reject |
| >Served Cell Information | M | | 9.2.10 | | – | – |
| **GU Group Id List** | | *0 to maxfPools* | | This is all the pools to which the eNB belongs to | YES | reject |
| >GU Group Id | M | | 9.2.22 | | - | - |

| Range bound | Explanation |
|---|---|
| maxCellineNB | Maximum no. cells that can be served by an eNB. Value is 256. |
| maxPools | Maximum no. of pools an eNB can belong to. Value is 16 FFS. |

### 9.1.2.4 X2 SETUP RESPONSE

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

Direction: eNB2 → eNB1.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Message Type | M | | 9.2.15 | | YES | reject |
| Global eNB ID | M | | 9.2.24 | | YES | reject |
| **Served Cells** | | *1 to maxCellineNB* | | This is all the eNB cells | YES | reject |
| >Served Cell Information | M | | 9.2.10 | | – | – |
| **GU Group Id List** | | *0 to maxPools* | | This is all the pools to which the eNB belongs to | YES | reject |
| >GU Group Id | M | | 9.2.22 | | - | - |
| Criticality Diagnostics | O | | 9.2.9 | | YES | ignore |

| Range bound | Explanation |
|---|---|
| maxCellineNB | Maximum no. cells that can be served by an eNB. Value is 256. |
| maxPools | Maximum no. of pools an eNB can belong to. Value is 16 FFS. |

### 9.1.2.5 X2 SETUP FAILURE

This message is sent by the eNB to indicate X2 Setup failure.

Direction: eNB2 → eNB1.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Message Type | M | | 9.2.15 | | YES | reject |
| Cause | M | | 9.2.8 | | YES | ignore |
| Time To Wait | O | | OCTET STRING | Coding FFS | YES | ignore |
| Criticality Diagnostics | O | | 9.2.9 | | YES | ignore |

### 9.1.2.6 RESET REQUEST

This message is sent from one eNB to another eNB and is used to request that the X2 interface between the two eNB to be reset.

Direction: eNB1 → eNB2.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Message Type | M | | 9.2.15 | | YES | reject |
| Cause | M | | 9.2.8 | | YES | ignore |

### 9.1.2.7 RESET RESPONSE

This message is sent by a eNB as a response to a RESET REQUEST message.

Direction: eNB2 → eNB1.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Message Type | M | | 9.2.15 | | YES | reject |
| Criticality Diagnostics | O | | 9.2.9 | | YES | ignore |

### 9.1.2.8 ENB CONFIGURATION UPDATE

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

Direction: eNB1 → eNB2.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Message Type | M | | 9.2.15 | | YES | reject |
| **Served Cells To Add** | | *0 to maxCellineNB* | | | GLOBAL | reject |
| >Served Cell Information | M | | 9.2.10 | | – | – |
| **Served Cells To Modify** | | *0 to maxCellineNB* | | | GLOBAL | reject |
| >Old ECGI | M | | ECGI 9.2.16 | This is the old E-UTRAN Cell Global Identifier | - | - |
| >Served Cell Information | M | | 9.2.10 | | – | – |
| **Served Cells To Delete** | | *0 to maxCellineNB* | | | GLOBAL | reject |
| >Old ECGI | M | | ECGI 9.2.16 | This is the old E-UTRAN Cell Global Identifier of the cell to be deleted | - | - |
| **GU Group Id To Add List** | | *0 to maxPools* | | | GLOBAL | reject |
| >GU Group Id | M | | 9.2.22 | | - | - |
| **GU Group Id To Delete List** | | *0 to maxPools* | | | GLOBAL | reject |
| >GU Group Id | M | | 9.2.22 | | - | - |

| Range bound | Explanation |
|---|---|
| maxCellineNB | Maximum no. cells that can be served by an eNB. Value is 256. |
| maxPools | Maximum no. of pools an eNB can belong to. Value is 16 FFS. |

### 9.1.2.9 ENB CONFIGURATION UPDATE ACKNOWLEDGE

This message is sent by an eNB to a peer eNB to acknowledge update of information for a TNL association.

Direction: eNB2 → eNB1.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Message Type | M | | 9.2.15 | | YES | reject |
| Criticality Diagnostics | O | | 9.2.9 | | YES | ignore |

### 9.1.2.10 ENB CONFIGURATION UPDATE FAILURE

This message is sent by an eNB to a peer eNB to indicate eNB Configuration Update Failure.

Direction: eNB2 → eNB1.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Message Type | M | | 9.2.15 | | YES | reject |
| Cause | M | | 9.2.8 | | YES | ignore |
| Time To Wait | O | | OCTET STRING | | YES | ignore |
| Criticality Diagnostics | O | | 9.2.9 | | YES | ignore |

### 9.1.2.11 RESOURCE STATUS REQUEST

This message is sent by an eNB1 to neighbouring eNB2 to initiate the requested measurement according to the parameters given in the message.

Direction: eNB1 → eNB2.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Message Type | M | | 9.2.15 | | YES | reject |
| Registration Request | M | | ENUMERATED(Start, Stop, …) | | YES | reject |
| **Cell To Report List** | | *0 to maxCellineNB* | | Cell ID list for which measurement is needed | EACH | ignore |
| >Cell ID | M | | ECGI 9.2.16 | | | |
| Reporting Periodicity | O | | ENUMERATED (FFS, …) | Unit: FFS Range:FFS | YES | ignore |

| Range bound | Explanation |
|---|---|
| maxCellineNB | Maximum no. cells that can be served by an eNB. Value is 256. |

### 9.1.2.12 RESOURCE STATUS RESPONSE

This message is sent by the eNB2 to indicate that the requested measurements are successfully initiated. Direction: eNB2 → eNB1.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Message Type | M | | 9.2.15 | | YES | reject |
| Criticality Diagnostics | O | | 9.2.9 | | YES | ignore |

### 9.1.2.13 RESOURCE STATUS FAILURE

This message is sent by the eNB2 to indicate requested measurements cannot be initiated.

Direction: eNB2 → eNB1.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Message Type | M | | 9.2.15 | | YES | reject |
| Cause | M | | 9.2.8 | | YES | ignore |
| Criticality Diagnostics | O | | 9.2.9 | | YES | ignore |

#### 9.1.2.14 RESOURCE STATUS UPDATE

This message is sent by eNB2 to neighbouring eNB1 to report the results of the requested measurements.

Direction: eNB2 → eNB1.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Message Type | M | | 9.2.15 | | YES | ignore |
| **Cell Measurement Result** | | *1 to maxCellineNB* | | | EACH | ignore |
| >Cell ID | M | | ECGI 9.2.16 | | | |
| > Resource Status | O | | INTEGER | The content is FFS. | | |

| Range bound | Explanation |
|---|---|
| maxCellineNB | Maximum no. cells that can be served by an eNB. Value is 256. |

## 9.2 Information Element definitions

### 9.2.0 General

When specifying information elements which are to be represented by bit strings, 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 bit strings from other specifications, the first bit of the bit string contains the first bit of the concerned information.

### 9.2.1 GTP Tunnel Endpoint

The *GTP Tunnel Endpoint* IE contains a Transport Layer Address and a GTP Tunnel Endpoint Identifier. The Transport Layer Address is an IP address to be used for the user plane transport. The GTP Tunnel Endpoint Identifier is to be used for the user plane transport between eNB and the serving gateway or between eNBs.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Transport Layer Address | M | | BIT STRING (1..160, ...) | For details on the Transport Layer Address, see ref. [8] | – | – |
| GTP TEID | M | | OCTET STRING (4) | | – | – |

### 9.2.2 Trace Activation

Defines parameters related to trace activation.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Trace Reference | M | | OCTET STRING (8) | | – | – |
| **Interfaces To Trace** | | *1 to <maxInterfaces>* | | | EACH | ignore |
| >Trace Interface | M | | ENUMERATED (s1, x2 Uu, ...) | | – | – |
| >Trace Depth | M | | ENUMERATED( minimum, medium, maximum, vendorMinimum, vendorMedium, vendorMaximum, ...) | Defined in [7] | – | – |

| Range bound | Explanation |
|---|---|
| maxInterfaces | Maximum no. of Interface. Value is FFS. |

## 9.2.3 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.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| **Last Visited Cell List** | | *1 to maxnoofCells* | | Most recent information is added to the top of this list | – | – |
| >Last Visited Cell Information | M | | 9.2.4 | | – | – |

| Range bound | Explanation |
|---|---|
| maxnoofCells | Maximum number of last visited cell information records that can be reported in the IE. Value is 16 (FFS). |

## 9.2.4 Last Visited Cell Information

The Last Visited Cell Information contains information about a cell that is to be used for RRM purposes.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Global Cell ID | M | | ECGI 9.2.16 | | – | – |
| Cell Type | M | | ENUMERATED(macro, micro, pico, femto, …) | | – | – |
| Time UE Stayed In Cell | O | | INTEGER | In seconds | – | – |

Editors Note: The definition of 'Cell Type' is FFS

## 9.2.5 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 | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Serving PLMN | M | | PLMN Identity 9.2.6 | | – | – |
| **Equivalent PLMNs** | | 0..<maxnoofEPLMNs> | | Allowed PLMNs in addition to Serving PLMN. This list corresponds to the list of 'equivalent PLMNs list' as defined in [17]. | – | – |
| >PLMN Identity | M | | 9.2.6 | | – | – |
| **Forbidden TAs** | | 0..<maxnoofEPLMNsPlusOne> | | intra E-UTRAN roaming restrictions | – | – |
| >PLMN Identity | M | | 9.2.6 | The PLMN of forbidden TACs | – | – |
| **>Forbidden TACs** | | 1..<maxnoofForbTACs> | | | – | – |
| >>TAC | M | | OCTET STRING | The forbidden TAC | – | – |
| **Forbidden LAs** | | 0..<maxnoofEPLMNsPlusOne> | | inter-3GPP RAT roaming restrictions | – | – |
| >PLMN Identity | M | | 9.2.6 | | – | – |
| **>Forbidden LACs** | | 1..<maxnoofForbLACs> | | | – | – |
| >>LAC | M | | OCTET STRING(2) | | – | – |
| Forbidden inter RATs | O | | ENUMERATED(ALL, GERAN, UTRAN, …) | inter-3GPP RAT access restrictions | – | – |

| Range bound | Explanation |
|---|---|
| maxnoofEPLMNs | Maximum no. of equivalent PLMN Ids. Value is 15. |
| 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. |

## 9.2.6 PLMN Identity

This information element indicates the PLMN Identity.

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

## 9.2.7 DL Forwarding

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

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

## 9.2.8 Cause

The purpose of the cause information element is to indicate the reason for a particular event for the whole protocol.

| IE/Group Name | Presence | Range | IE Type and Reference | Semantics Description |
|---|---|---|---|---|
| CHOICE *Cause Group* | M | | | |
| *>Radio Network Layer* | | | | |
| >>Radio Network Layer Cause | M | | ENUMERATED ( Handover Desirable for Radio Reasons, Time Critical Handover, Resource Optimisation Handover, Reduce Load in Serving Cell, Partial Handover, Unknown New eNB UE X2AP ID, Unknown Old eNB UE X2AP ID, Unknown Pair of UE X2AP ID, HO Target not Allowed, $TX2_{RELOCoverall}$ Expiry, $T_{RELOCprep}$ Expiry, Cell not Available, No Radio Resources Available in Target Cell, Invalid MME Group ID, Unknown MME Code, Unspecified, ... ) | |
| *>Transport Layer* | | | | |
| >>Transport Layer Cause | M | | ENUMERATED (Transport Resource Unavailable, Unspecified, ...) | |
| *>Protocol* | | | | |
| >>Protocol Cause | M | | ENUMERATED (Transfer Syntax Error, Abstract Syntax Error (Reject), Abstract Syntax Error (Ignore and Notify), Message not Compatible with Receiver State, Semantic Error, Unspecified, Abstract Syntax Error (Falsely Constructed Message),...) | |
| *>Misc* | | | | |
| >>Miscellaneous Cause | M | | ENUMERATED | |

| | | | | |
|---|---|---|---|---|
| | | | (Control Processing Overload, Hardware Failure, O&M Intervention, Not enough User Plane Processing Resources, Unspecified,...) | |

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

| Radio Network Layer cause | Meaning |
|---|---|
| Cell not Available | The concerned cell is not available. |
| Handover Desirable for Radio Reasons | The reason for requesting handover is radio related. |
| Handover Target not Allowed | Handover to the indicated target cell is not allowed for the UE in question |
| Invalid MME Group ID | The target eNB doesn"t belong to the same pool area of the source eNB i.e. S1 handovers should be attempted instead. |
| No Radio Resources Available in Target Cell | The target cell doesn"t have sufficient radio resources available. |
| Partial Handover | Provides a reason for the handover cancellation. The target eNB did not admit all SAE Bearers included in the HANDOVER REQUEST and the source eNB estimated service continuity for the UE would be better by not proceeding with handover towards this particular target eNB. |
| Reduce Load in Serving Cell | Load on serving cell needs to be reduced. |
| Resource Optimisation Handover | The reason for requesting handover is to improve the load distribution with the neighbour cells. |
| Time Critical Handover | 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. |
| $TX2_{RELOCoverall}$ Expiry | The reason for the action is expiry of timer $TX2_{RELOCoverall}$ |
| $T_{RELOCprep}$ Expiry | Handover Preparation procedure is cancelled when timer $T_{RELOCprep}$ expires. |
| Unknown MME Code | The target eNB belongs to the same pool area of the source eNB and recognizes the MME Group ID. However, the MME Code is unknown to the target eNB. |
| Unknown New eNB UE X2AP ID | The action failed because the New eNB UE X2AP ID is unknown |
| Unknown Old eNB UE X2AP ID | The action failed because the Old eNB UE X2AP ID is unknown |
| Unknown Pair of UE X2AP ID | The action failed because the pair of UE X2 AP IDs is unknown |
| Unspecified | Sent when none of the above cause values applies but still the cause is Radio Network Layer related |

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

| Protocol cause | Meaning |
|---|---|
| Abstract Syntax Error (Reject) | The received message included an abstract syntax error and the concerned criticality indicated "reject" (see subclause 10.3) |
| Abstract Syntax Error (Ignore and Notify) | The received message included an abstract syntax error and the concerned criticality indicated "ignore and notify" (see subclause 10.3) |
| Abstract syntax error (falsely constructed message) | The received message contained IEs or IE groups in wrong order or with too many occurrences (see subclause 10.3) |
| Message not Compatible with Receiver State | The received message was not compatible with the receiver state (see subclause 10.4) |
| Semantic Error | The received message included a semantic error (see subclause 10.4) |
| Transfer Syntax Error | The received message included a transfer syntax error (see subclause 10.2) |
| Unspecified | Sent when none of the above cause values applies but still the cause is Protocol related |

| Miscellaneous cause | Meaning |
|---|---|
| Control Processing Overload | eNB control processing overload |
| Hardware Failure | eNB hardware failure |
| Not enough User Plane Processing Resources | eNB has insufficient user plane processing resources available |
| O&M Intervention | Operation and Maintenance intervention related to eNB equipment |
| Unspecified | 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 or Protocol. |

### 9.2.9 Criticality Diagnostics

The *Criticality Diagnostics* IE is sent by the RNC or the CN 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.

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

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

## 9.2.10 Served Cell Information

This IE contains cell configuration information of a cell that a neighbour eNB may need for the X2 AP interface.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| PhyCID | M | | INTEGER (1..504, …) | Physical Cell ID | – | – |
| Cell ID | M | | ECGI 9.2.16 | | – | – |
| TAC | M | | OCTET STRING | Tracking Area Code | – | – |
| **Broadcast PLMNs** | | 1..<maxnoofBPLMNs> | | Broadcast PLMNs | – | – |
| >PLMN Identity | M | | 9.2.6 | | – | – |
| UL EARFCN | M | | EARFCN 9.2.28 | Corresponds to NuL in ref. [16] | – | – |
| DL EARFCN | M | | EARFCN 9.2.28 | Corresponds to NdL in ref. [16] | – | – |
| Cell Transmission Bandwidth | M | | 9.2 29 | | – | – |

| Range bound | Explanation |
|---|---|
| maxnoofBPLMNs | Maximum no. of Broadcast PLMN Ids. Value is FFS. |

## 9.2.11 SAE Bearer Level QoS Parameters

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

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| QCI | M | | INTEGER (1..256) | QoS Class Identifier defined in [12]. Logical range and coding specified in [13]. | – | – |
| Allocation and Retention Priority | M | | INTEGER (0..15) | Priority of Allocation and Retention defined in [12]. Value 15 means 'no priority'. Values between 1 and 14 are ordered in decreasing order of priority, i.e. 1 is the highest and 14 the lowest. Value 0 shall be treated as a logical error if received. | – | – |
| GBR QoS Information | O | | 9.2.12 | This IE applies to GBR bearers only and shall be ignored otherwise. | – | – |

## 9.2.12 GBR QoS Information

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

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| SAE Bearer Maximum Bit Rate Downlink | M | | Bit Rate 9.2.13 | Maximum Bit Rate in DL (i.e. from EPC to E-UTRAN) for the bearer. Details in [12]. | – | – |
| SAE Bearer Maximum Bit Rate Uplink | M | | Bit Rate 9.2.13 | Maximum Bit Rate in UL (i.e. from E-UTRAN to EPC) for the bearer. Details in [12]. | – | – |
| SAE Bearer Guaranteed Bit Rate Downlink | M | | Bit Rate 9.2.13 | Guaranteed Bit Rate (provided that there is data to deliver) in DL (i.e. from EPC to E-UTRAN) for the bearer. Details in [12]. | – | – |
| SAE Bearer Guaranteed Bit Rate Uplink | M | | Bit Rate 9.2.13 | Guaranteed Bit Rate (provided that there is data to deliver) in UL (i.e. from E-UTRAN to EPC) for the bearer. Details in [12]. | – | – |
| | | | | | – | – |
| | | | | | – | – |

## 9.2.13 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.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|---|---|---|---|---|
| Bit Rate | M | | INTEGER (0..10,000,000,000) | The unit is: bit/s |

## 9.2.14 UE Aggregate Maximum Bit Rate

On Handover Aggregate Maximum Bitrate is transferred to the target eNB. 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.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| UE Aggregate Maximum Bit Rate Downlink | M | | Bit Rate 9.2.13 | to be added | – | – |
| UE Aggregate Maximum Bit Rate Uplink | M | | Bit Rate 9.2.13 | to be added | – | – |

## 9.2.15 Message Type

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

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|---|---|---|---|---|
| Procedure Code | M | | (INTEGER (0..255,) | "0" = Handover Preparation<br>"1" = Handover Cancel<br>"2" = Load Indication<br>"3" = Error Indication<br>"4" = SN Status Transfer<br>"5" = UE Context Release<br>"6" = X2 Setup<br>"7" = Reset<br>"8" = eNB Configuration Update<br>"9" = Resource Status Update Initiation<br>"10" = Resource Status Reporting |
| **Type of Message** | M | | CHOICE<br>(Initiating Message, Successful Outcome, Unsuccessful Outcome, …) | |

## 9.2.16 ECGI

The E-UTRAN Cell Global Identifier (ECGI) is used to globally identify a cell (see [2]).

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| PLMN Identity | M | | 9.2.6 | | – | – |
| E-UTRAN Cell Identifier | M | | BIT STRING (28) | The leftmost bits of the *E-UTRAN Cell Identifier* IE value correspond to the value of the *eNB ID* IE contained in the *Global eNB ID* IE (defined in section 9.2.24) identifying the eNB that controls the cell | – | – |

## 9.2.17 COUNT Value

This information element indicates the 12 bit PDCP sequence number and the corresponding 20 bit Hyper frame number.

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

## 9.2.18 GUMMEI

This information element indicates the globally unique MME identity.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| GU Group ID | M | | 9.2.22 | | – | – |
| MME code | M | | OCTET STRING (1) | | – | – |

## 9.2.19 UL Interference Overload Indication

This IE provides, per PRB, a report on interference overload. The interaction between the indication of UL Interference Overload and UL High Interference is implementation specific.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|---|---|---|---|---|
| **UL Interference Overload Indication List** | | 1 to <maxnoofPRBs> | | |
| >UL Interference Overload Indication | M | | ENUMERATED (high interference, medium interference, low interference, …) | Each PRB is identified by its position in the list: the first element in the list corresponds to PRB 0, the second to PRB 1, etc. |

| Range bound | Explanation |
|---|---|
| maxnoofPRBs | Maximum no. Physical Resource Blocks. Value is 100 or 110 (FFS). |

## 9.2.20 UL High Interference Indication

This IE provides, per PRB, a 2 level report on interference sensitivity. The interaction between the indication of UL Overload and UL High Interference is implementation specific.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|---|---|---|---|---|
| HII | M | | BIT STRING (1..110, …) | Each position in the bitmap represents a PRB (first bit=PRB 0 and so on), for which value ""1" indicates "high interference sensitivity" and value "0" indicates "low interference sensitivity".<br>The maximum number of Physical Resource Blocks is 100 or 110 (FFS) |

## 9.2.21 Relative Narrowband Tx Power (RNTP)

This IE provides an indication on DL power restriction per PRB in a cell and other information needed by a neighbour eNB for interference aware scheduling.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| RNTP Per PRB | M | | BIT STRING (6..110, …) | Each position in the bitmap represents a $n_{PRB}$ value (i.e. first bit=PRB 0 and so on), for which the bit value represents *RNTP ($n_{PRB}$)*, defined in [11].<br>▪ Value 0 indicates "Tx not exceeding RNTP threshold".<br>▪ Value 1 indicates "no promise on the Tx power is given" | – | – |
| RNTP Threshold | M | | ENUMERATED (-∞, -11, -10, -9, -8, -7, -6, -5, -4, -3, -2, -1, 0, 1, 2, 3, …) | $RNTP_{threshold}$ is defined in [11] | – | – |
| Number Of Cell-specific Antenna Ports | M | | ENUMERATED (1, 2, 4, …) | *P* (number of antenna ports for cell-specific reference signals) defined in [10] | – | – |
| P_B | M | | INTEGER (0..3, …) | $P_B$ is defined in [11] | – | – |
| PDCCH Interference Impact | M | | INTEGER (0..4, …) | Measured by Predicted Number Of Occupied PDCCH OFDM Symbols (see [10]).<br><br>Value 0 means "no prediction is available" | – | – |

## 9.2.22 GU Group Id

The *GU Group Id* IE is the globally unique group id corresponding to a pool area.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| PLMN Id | M | | 9.2.6 | | – | – |
| MME Group Id | M | | OCTET STRING(2) | | – | – |

## 9.2.23 Location Reporting Information

This information element indicates how the location information should be reported.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| Event | M | | ENUMERATED (Change of serving cell, …) | | – | – |
| Report Area | M | | ENUMERATED (ECGI, …) | | – | – |

## 9.2.24 Global eNB ID

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

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|---|---|---|---|---|---|
| PLMN Identity | M | | 9.2.6 | | – | – |
| CHOICE *eNB ID* | M | | | | – | – |
| *>Macro eNB ID* | | | BIT STRING (20) | Equal to the 20 leftmost bits of the value of the *E-UTRAN Cell Identifier* IE contained in the *ECGI* IE (see section 9.2.16) identifying each cell controlled by the eNB | | |
| *>Home eNB ID* | | | BIT STRING (28) | Equal to the value of the *E-UTRAN Cell Identifier* IE contained in the *ECGI* IE (see section 9.2.16) identifying the cell controlled by the eNB | | |

## 9.2.25 SAE Bearer ID

This IE uniquely identifies an SAE (or EPS) bearer for a UE.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|---|---|---|---|---|
| SAE Bearer ID | M | | INTEGER (0..15, ...) | |

## 9.2.26 eNB UE X2AP ID

This information element uniquely identifies an UE over the X2 interface within an eNB.

The Old eNB UE X2AP ID is allocated by the source eNB and the New eNB UE X2AP ID is allocated by the target eNB, as defined in [2].

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|---|---|---|---|---|
| eNB UE X2AP ID | M | | INTEGER (0..4095) | |

## 9.2.27 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 [15].

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|---|---|---|---|---|
| Subscriber Profile ID for RAT/Frequency Priority | M | | INTEGER (1..256) | |

## 9.2.28 EARFCN

The E-UTRA Absolute Radio Frequency Channel Number defines the carrier.

| IE/Group Name | Presence | Range | IE Type and Reference | Semantics Description |
|---|---|---|---|---|
| EARFCN | | | INTEGER (0..maxEARFCN) | Corresponds to: X Hz.. YMHz see ref. [16]. |

| Range bound | Explanation |
|---|---|
| maxEARFCN | Maximum no. of EARFCNs. Value is 32767 (FFS). |

## 9.2.29 Cell Transmission Bandwidth

The *Cell Transmission Bandwidth* IE is used to indicate transmission bandwidth expressed in units of resource blocks " $N_{RB}$ " [16]. The values bw6, bw15, bw25, bw50, bw75, bw100 correspond to the number of resource blocks 'NRB' 6, 15, 25, 50, 75, 100.

| IE/Group Name | Presence | Range | IE Type and Reference | Semantics Description |
|---|---|---|---|---|
| Cell Transmission Bandwidth | | | ENUMERATED (bw6, bw15, bw25, bw50, bw75, bw100,...) | |

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

## 9.3.1 General

Subclause 9.3 presents the Abstract Syntax of the X2AP 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, in which the tabular format shall take precedence.

The ASN.1 definition specifies the structure and content of X2AP messages. X2AP 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 X2AP 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 in which 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 X2AP 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 clause 10.

*Editors Note: Yellow highlight indicate text that has been proposed to be removed (further checking needed)*

## 9.3.2 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 inter-operability.
- 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.

## 9.3.3 Elementary Procedure Definitions

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

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

X2AP-PDU-Descriptions {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (21) modules (3) x2ap (2) version1 (1) x2ap-PDU-Descriptions (0) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

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

IMPORTS
    Criticality,
    ProcedureCode
FROM X2AP-CommonDataTypes


    ENBConfigurationUpdate,
    ENBConfigurationUpdateAcknowledge,
    ENBConfigurationUpdateFailure,
    ErrorIndication,
    HandoverCancel,
    HandoverPreparationFailure, HandoverRequest,
    HandoverRequestAcknowledge,


        LoadInformation,
    ResetRequest,
    ResetResponse,
    ResourceStatusFailure,
    ResourceStatusRequest,
    ResourceStatusResponse,
    ResourceStatusUpdate,
    SNStatusTransfer,
    UEContextRelease,
    X2SetupFailure, X2SetupRequest,
    X2SetupResponse



FROM X2AP-PDU-Contents

    id-eNBConfigurationUpdate,
    id-errorIndication,
    id-handoverCancel,
    id-handoverPreparation,

    id-loadIndication,
```

```
    id-reset,

    id-resourceStatusReporting,
    id-resourceStatusUpdateInitiation,
    id-snStatusTransfer,
    id-uEContextRelease,
    id-x2Setup



FROM X2AP-Constants;

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

X2AP-ELEMENTARY-PROCEDURE ::= CLASS {
    &InitiatingMessage              ,
    &SuccessfulOutcome              OPTIONAL,
    &UnsuccessfulOutcome                OPTIONAL,
    &procedureCode          ProcedureCode   UNIQUE,
    &criticality            Criticality     DEFAULT ignore
}
WITH SYNTAX {
    INITIATING MESSAGE      &InitiatingMessage
    [SUCCESSFUL OUTCOME     &SuccessfulOutcome]
    [UNSUCCESSFUL OUTCOME       &UnsuccessfulOutcome]
    PROCEDURE CODE          &procedureCode
    [CRITICALITY            &criticality]
}

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

X2AP-PDU ::= CHOICE {
    initiatingMessage   InitiatingMessage,
    successfulOutcome   SuccessfulOutcome,
    unsuccessfulOutcome UnsuccessfulOutcome,
    ...
}

InitiatingMessage ::= SEQUENCE {
    procedureCode   X2AP-ELEMENTARY-PROCEDURE.&procedureCode        ({X2AP-ELEMENTARY-PROCEDURES}),
    criticality     X2AP-ELEMENTARY-PROCEDURE.&criticality          ({X2AP-ELEMENTARY-PROCEDURES}{@procedureCode}),
    value           X2AP-ELEMENTARY-PROCEDURE.&InitiatingMessage    ({X2AP-ELEMENTARY-PROCEDURES}{@procedureCode})
}

SuccessfulOutcome ::= SEQUENCE {
```

```
    procedureCode   X2AP-ELEMENTARY-PROCEDURE.&procedureCode        ({X2AP-ELEMENTARY-PROCEDURES}),
    criticality     X2AP-ELEMENTARY-PROCEDURE.&criticality          ({X2AP-ELEMENTARY-PROCEDURES}{@procedureCode}),
    value           X2AP-ELEMENTARY-PROCEDURE.&SuccessfulOutcome    ({X2AP-ELEMENTARY-PROCEDURES}{@procedureCode})
}

UnsuccessfulOutcome ::= SEQUENCE {
    procedureCode   X2AP-ELEMENTARY-PROCEDURE.&procedureCode        ({X2AP-ELEMENTARY-PROCEDURES}),
    criticality     X2AP-ELEMENTARY-PROCEDURE.&criticality          ({X2AP-ELEMENTARY-PROCEDURES}{@procedureCode}),
    value           X2AP-ELEMENTARY-PROCEDURE.&UnsuccessfulOutcome  ({X2AP-ELEMENTARY-PROCEDURES}{@procedureCode})
}


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

X2AP-ELEMENTARY-PROCEDURES X2AP-ELEMENTARY-PROCEDURE ::= {
    X2AP-ELEMENTARY-PROCEDURES-CLASS-1          |
    X2AP-ELEMENTARY-PROCEDURES-CLASS-2          ,
    ...
}

X2AP-ELEMENTARY-PROCEDURES-CLASS-1 X2AP-ELEMENTARY-PROCEDURE ::= {
    handoverPreparation                                     |
    reset                                                   |
    x2Setup                                                 |
    resourceStatusUpdateInitiation                          |
    eNBConfigurationUpdate                                  ,
    ...
}

X2AP-ELEMENTARY-PROCEDURES-CLASS-2 X2AP-ELEMENTARY-PROCEDURE ::= {
    snStatusTransfer                        |
    uEContextRelease                        |
    handoverCancel                          |
    errorIndication                         |
    resourceStatusReporting                 |
    loadIndication                          ,
    ...

}


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

handoverPreparation X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      HandoverRequest
    SUCCESSFUL OUTCOME      HandoverRequestAcknowledge
```

```
    UNSUCCESSFUL OUTCOME    HandoverPreparationFailure
    PROCEDURE CODE          id-handoverPreparation
    CRITICALITY             reject
}

snStatusTransfer X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      SNStatusTransfer
    PROCEDURE CODE          id-snStatusTransfer
    CRITICALITY             ignore
}

uEContextRelease X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      UEContextRelease
    PROCEDURE CODE          id-uEContextRelease
    CRITICALITY             ignore
}


handoverCancel X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      HandoverCancel
    PROCEDURE CODE          id-handoverCancel
    CRITICALITY             ignore
}

errorIndication X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      ErrorIndication
    PROCEDURE CODE          id-errorIndication
    CRITICALITY             ignore
}

reset   X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      ResetRequest
    SUCCESSFUL OUTCOME      ResetResponse
    PROCEDURE CODE          id-reset
    CRITICALITY             reject
}

x2Setup X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      X2SetupRequest
    SUCCESSFUL OUTCOME      X2SetupResponse
    UNSUCCESSFUL OUTCOME    X2SetupFailure
    PROCEDURE CODE          id-x2Setup
    CRITICALITY             reject
}


loadIndication X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      LoadInformation
    PROCEDURE CODE          id-loadIndication
    CRITICALITY             ignore
}

eNBConfigurationUpdate      X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      ENBConfigurationUpdate
```

```
    SUCCESSFUL OUTCOME      ENBConfigurationUpdateAcknowledge
    UNSUCCESSFUL OUTCOME    ENBConfigurationUpdateFailure
    PROCEDURE CODE          id-eNBConfigurationUpdate
    CRITICALITY             reject
}

resourceStatusUpdateInitiation  X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      ResourceStatusRequest
    SUCCESSFUL OUTCOME      ResourceStatusResponse
    UNSUCCESSFUL OUTCOME    ResourceStatusFailure
    PROCEDURE CODE          id-resourceStatusUpdateInitiation
    CRITICALITY             reject
}

resourceStatusReporting X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      ResourceStatusUpdate
    PROCEDURE CODE          id-resourceStatusReporting
    CRITICALITY             ignore
}

END
```

## 9.3.4 PDU Definitions

```
-- ********************************************************************
--
-- PDU definitions for X2AP.
--
-- ********************************************************************

X2AP-PDU-Contents {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (21) modules (3) x2ap (2) version1 (1) x2ap-PDU-Contents (1) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

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

IMPORTS

    Bearer-ID,
    Cause,

    COUNTvalue,
    CriticalityDiagnostics,
    DL-Forwarding,
    ECGI,
```

```
    GlobalENB-ID,
    GTPtunnelEndpoint,
    GUGroupIDList,
    GUMMEI,
    HandoverRestrictionList,


    LocationReportingInformation,
    PDCP-SN,
    PLMN-Identity,

    ReceiveStatusofULPDCPSDUs,
    Registration-Request,
    RelativeNarrowbandTxPower,
    ResourceStatus,
    RRC-Context,
    SAE-BearerLevel-QoS-Parameters,
    ServedCell-Information,
    ServedCells,
    SubscriberProfileIDforRFP,
    TargeteNBtoSource-eNBTransparentContainer,
    TimeToWait,
    TraceActivation,

    TraceDepth,
    TraceReference,
    TransportLayerAddress,
    UEAggregateMaximumBitRate,
    UE-HistoryInformation,
    UE-S1AP-ID,
    UE-X2AP-ID,

    UL-HighInterferenceIndicationInfo,
    UL-InterferenceOverloadIndication


FROM X2AP-IEs

    PrivateIE-Container{},
    ProtocolExtensionContainer{},
    ProtocolIE-Container{},
    ProtocolIE-ContainerList{},
    ProtocolIE-ContainerPair{},
    ProtocolIE-ContainerPairList{},

    ProtocolIE-Single-Container{},
    X2AP-PRIVATE-IES,
    X2AP-PROTOCOL-EXTENSION,
    X2AP-PROTOCOL-IES,
    X2AP-PROTOCOL-IES-PAIR
FROM X2AP-Containers

    id-Bearers-Admitted-Item,
```

```
    id-Bearers-Admitted-List,
    id-Bearers-NotAdmitted-Item,
    id-Bearers-NotAdmitted-List,
    id-Bearers-SubjectToStatusTransfer-List,
    id-Bearers-SubjectToStatusTransfer-Item,
    id-Bearers-ToBeSetup-Item,  id-Cause,
    id-CellInformation,
    id-CellInformation-Item,
    id-CellMeasurementResult,
    id-CellMeasurementResult-Item,
    id-CellToReport,
    id-CellToReport-Item,

    id-CriticalityDiagnostics,
    id-GlobalENB-ID,
    id-GUGroupIDList,
    id-GUGroupIDListToAdd,
    id-GUGroupIDListToDelete,
    id-GUMMEI-ID,
            id-New-eNB-UE-X2AP-ID,
    id-Old-eNB-UE-X2AP-ID,
    id-Registration-Request,
    id-ReportingPeriodicity,
    id-ServedCells,
    id-ServedCellsToAdd,
    id-ServedCellsToModify,
    id-ServedCellsToDelete,
    id-TargetCell-ID,
    id-TargeteNBtoSource-eNBTransparentContainer,
    id-TimeToWait,
    id-TraceActivation,
    id-UE-ContextInformation,
    id-UE-HistoryInformation,
    id-UE-X2AP-ID,



    maxCellineNB,
    maxnoofBearers,
    maxnoofPDCP-SN

FROM X2AP-Constants;

-- **************************************************************
--
-- HANDOVER REQUEST
--
-- **************************************************************

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

```
HandoverRequest-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-Old-eNB-UE-X2AP-ID              CRITICALITY reject  TYPE UE-X2AP-ID                PRESENCE mandatory } |
    { ID id-Cause                           CRITICALITY ignore  TYPE Cause                     PRESENCE mandatory } |
    { ID id-TargetCell-ID                   CRITICALITY reject  TYPE ECGI                      PRESENCE mandatory } |
    { ID id-GUMMEI-ID                       CRITICALITY reject  TYPE GUMMEI                    PRESENCE mandatory } |
    { ID id-UE-ContextInformation           CRITICALITY reject  TYPE UE-ContextInformation     PRESENCE mandatory } |
    { ID id-UE-HistoryInformation           CRITICALITY ignore  TYPE UE-HistoryInformation     PRESENCE optional } |
    { ID id-TraceActivation                 CRITICALITY ignore  TYPE TraceActivation           PRESENCE optional } ,
    ...
}

UE-ContextInformation ::= SEQUENCE {
    mME-UE-S1AP-ID                      UE-S1AP-ID,
    uEaggregateMaximumBitRate           UEAggregateMaximumBitRate,
    subscriberProfileIDforRFP           SubscriberProfileIDforRFP       OPTIONAL,
bearers-ToBeSetup-List              Bearers-ToBeSetup-List,
    rRC-Context                         RRC-Context,
        handoverRestrictionList             HandoverRestrictionList     OPTIONAL,
    locationReportingInformation        LocationReportingInformation    OPTIONAL,
    iE-Extensions                       ProtocolExtensionContainer { {UE-ContextInformation-ExtIEs} } OPTIONAL,
    ...
}

UE-ContextInformation-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

Bearers-ToBeSetup-List ::= SEQUENCE (SIZE(1..maxnoofBearers)) OF ProtocolIE-Single-Container { {Bearers-ToBeSetup-ItemIEs} }

Bearers-ToBeSetup-ItemIEs   X2AP-PROTOCOL-IES ::= {
    { ID id-Bearers-ToBeSetup-Item   CRITICALITY ignore     TYPE Bearers-ToBeSetup-Item     PRESENCE mandatory },
    ...
}

Bearers-ToBeSetup-Item ::= SEQUENCE {
    sAE-Bearer-ID                   Bearer-ID,
    sAE-BearerLevel-QoS-Parameters      SAE-BearerLevel-QoS-Parameters,
    dL-Forwarding                   DL-Forwarding                                       OPTIONAL,
    uL-GTPtunnelEndpoint            GTPtunnelEndpoint,
    iE-Extensions                   ProtocolExtensionContainer { {Bearers-ToBeSetup-ItemExtIEs} } OPTIONAL,
    ...
}

Bearers-ToBeSetup-ItemExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}



-- **************************************************************
--
-- HANDOVER REQUEST ACKNOWLEDGE
--
-- **************************************************************
```

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

HandoverRequestAcknowledge-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-Old-eNB-UE-X2AP-ID                          CRITICALITY reject  TYPE UE-X2AP-ID
                PRESENCE mandatory} |
    { ID id-New-eNB-UE-X2AP-ID                          CRITICALITY reject  TYPE UE-X2AP-ID
                PRESENCE mandatory} |
    { ID id-Bearers-Admitted-List                       CRITICALITY ignore  TYPE Bearers-Admitted-List
            PRESENCE optional   } |
    { ID id-Bearers-NotAdmitted-List                    CRITICALITY ignore  TYPE Bearers-NotAdmitted-List
            PRESENCE optional   } |
    { ID id-TargeteNBtoSource-eNBTransparentContainer   CRITICALITY ignore  TYPE TargeteNBtoSource-eNBTransparentContainer            PRESENCE
mandatory }|
    { ID id-CriticalityDiagnostics                      CRITICALITY ignore  TYPE CriticalityDiagnostics
            PRESENCE optional },

    ...
}

Bearers-Admitted-List       ::= SEQUENCE (SIZE (1..maxnoofBearers)) OF ProtocolIE-Single-Container { {Bearers-Admitted-ItemIEs} }

Bearers-Admitted-ItemIEs X2AP-PROTOCOL-IES ::= {
    { ID id-Bearers-Admitted-Item   CRITICALITY ignore  TYPE Bearers-Admitted-Item  PRESENCE mandatory   }
}

Bearers-Admitted-Item ::= SEQUENCE {
    bearer-ID                       Bearer-ID,
    uL-GTP-TunnelEndpoint           GTPtunnelEndpoint   OPTIONAL,
    dL-GTP-TunnelEndpoint           GTPtunnelEndpoint   OPTIONAL,
    iE-Extensions                   ProtocolExtensionContainer { {Bearers-Admitted-Item-ExtIEs} } OPTIONAL,
    ...
}

Bearers-Admitted-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

Bearers-NotAdmitted-List        ::= SEQUENCE (SIZE (1..maxnoofBearers)) OF ProtocolIE-Single-Container { {Bearers-NotAdmitted-ItemIEs} }

Bearers-NotAdmitted-ItemIEs X2AP-PROTOCOL-IES ::= {
    { ID id-Bearers-NotAdmitted-Item    CRITICALITY ignore  TYPE Bearers-NotAdmitted-Item   PRESENCE mandatory   }
}

Bearers-NotAdmitted-Item ::= SEQUENCE {
    bearer-ID                       Bearer-ID,
    cause                           Cause,
    iE-Extensions                   ProtocolExtensionContainer { {Bearers-NotAdmitted-Item-ExtIEs} } OPTIONAL,
    ...
}
```

```
Bearers-NotAdmitted-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}


-- **************************************************************
--
-- HANDOVER PREPARATION FAILURE
--
-- **************************************************************

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

HandoverPreparationFailure-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-Old-eNB-UE-X2AP-ID          CRITICALITY reject  TYPE UE-X2AP-ID             PRESENCE mandatory} |
    { ID id-Cause                       CRITICALITY ignore  TYPE Cause                  PRESENCE mandatory} |
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics PRESENCE optional },

    ...
}

-- **************************************************************
--
-- SN Status Transfer
--
-- **************************************************************

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

SNStatusTransfer-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-Old-eNB-UE-X2AP-ID                      CRITICALITY reject  TYPE UE-X2AP-ID
    PRESENCE mandatory} |
    { ID id-New-eNB-UE-X2AP-ID                      CRITICALITY reject  TYPE UE-X2AP-ID
    PRESENCE mandatory} |
    { ID id-Bearers-SubjectToStatusTransfer-List    CRITICALITY ignore  TYPE Bearers-SubjectToStatusTransfer-List              PRESENCE mandatory}
,
    ...
}

Bearers-SubjectToStatusTransfer-List    ::= SEQUENCE (SIZE (1..maxnoofBearers)) OF ProtocolIE-Single-Container { { Bearers-SubjectToStatusTransfer-
ItemIEs} }

Bearers-SubjectToStatusTransfer-ItemIEs X2AP-PROTOCOL-IES ::= {
    { ID id-Bearers-SubjectToStatusTransfer-Item    CRITICALITY ignore  TYPE Bearers-SubjectToStatusTransfer-Item       PRESENCE mandatory     }
}

Bearers-SubjectToStatusTransfer-Item ::= SEQUENCE {
    bearer-ID                               Bearer-ID,
```

```
    receiveStatusofULPDCPSDUs               ReceiveStatusofULPDCPSDUs           OPTIONAL,
    uL-COUNTvalue                   COUNTvalue,
    dL-COUNTvalue                   COUNTvalue,
    iE-Extensions                           ProtocolExtensionContainer { {Bearers-SubjectToStatusTransfer-ItemExtIEs} } OPTIONAL,
    ...
}

Bearers-SubjectToStatusTransfer-ItemExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}




-- **************************************************************
--
-- UE Context Release
--
-- **************************************************************

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

UEContextRelease-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-Old-eNB-UE-X2AP-ID          CRITICALITY reject  TYPE UE-X2AP-ID             PRESENCE mandatory} |
    { ID id-New-eNB-UE-X2AP-ID          CRITICALITY reject  TYPE UE-X2AP-ID             PRESENCE mandatory} ,
    ...
}


-- **************************************************************
--
-- HANDOVER CANCEL
--
-- **************************************************************

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

HandoverCancel-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-Old-eNB-UE-X2AP-ID          CRITICALITY reject  TYPE UE-X2AP-ID             PRESENCE mandatory} |
    { ID id-New-eNB-UE-X2AP-ID          CRITICALITY reject  TYPE UE-X2AP-ID             PRESENCE mandatory} |
    { ID id-Cause                       CRITICALITY ignore  TYPE Cause                  PRESENCE mandatory} ,
    ...
}

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

```
-- ERROR INDICATION
--
-- **************************************************************

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

ErrorIndication-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-Old-eNB-UE-X2AP-ID          CRITICALITY ignore  TYPE UE-X2AP-ID                PRESENCE optional} |
    { ID id-New-eNB-UE-X2AP-ID          CRITICALITY ignore  TYPE UE-X2AP-ID                PRESENCE optional} |
    { ID id-Cause                       CRITICALITY ignore  TYPE Cause                     PRESENCE optional} |
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics    PRESENCE optional} ,
    ...
}

-- **************************************************************
--
-- Reset Request
--
-- **************************************************************


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

ResetRequest-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-Cause                       CRITICALITY ignore  TYPE Cause                     PRESENCE mandatory   },
    ...
}

-- **************************************************************
--
-- Reset Response
--
-- **************************************************************

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

ResetResponse-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-CriticalityDiagnostics  CRITICALITY ignore  TYPE CriticalityDiagnostics         PRESENCE optional },
    ...
}

-- **************************************************************
--
-- X2 SETUP REQUEST
--
```

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

X2SetupRequest ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container       {{X2SetupRequest-IEs}},
    ...
}

X2SetupRequest-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-GlobalENB-ID                CRITICALITY reject  TYPE GlobalENB-ID               PRESENCE mandatory} |
    { ID id-ServedCells                     CRITICALITY reject  TYPE ServedCells                        PRESENCE mandatory} |
    { ID id-GUGroupIDList                   CRITICALITY reject  TYPE GUGroupIDList                      PRESENCE optional},
...
}



-- **************************************************************
--
-- X2 SETUP RESPONSE
--
-- **************************************************************

X2SetupResponse ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container       {{X2SetupResponse-IEs}},
    ...
}

X2SetupResponse-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-GlobalENB-ID                CRITICALITY reject  TYPE GlobalENB-ID                PRESENCE mandatory} |
    { ID id-ServedCells                     CRITICALITY reject  TYPE ServedCells                        PRESENCE mandatory} |
    { ID id-GUGroupIDList                   CRITICALITY reject  TYPE GUGroupIDList                      PRESENCE optional}|
    { ID id-CriticalityDiagnostics          CRITICALITY ignore  TYPE CriticalityDiagnostics             PRESENCE optional },

    ...
}



-- **************************************************************
--
-- X2 SETUP FAILURE
--
-- **************************************************************

X2SetupFailure ::= SEQUENCE {
    protocolIEs                     ProtocolIE-Container       {{X2SetupFailure-IEs}},
    ...
}

X2SetupFailure-IEs X2AP-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 },
```

```
    ...
}


-- **************************************************************
--
-- LOAD INFORMATION
--
-- **************************************************************

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

LoadInformation-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-CellInformation             CRITICALITY ignore  TYPE CellInformation-List       PRESENCE mandatory} ,
    ...
}

CellInformation-List        ::= SEQUENCE (SIZE (1..maxCellineNB)) OF ProtocolIE-Single-Container { {CellInformation-ItemIEs} }

CellInformation-ItemIEs X2AP-PROTOCOL-IES ::= {
    { ID id-CellInformation-Item    CRITICALITY ignore  TYPE CellInformation-Item   PRESENCE mandatory   }
}

CellInformation-Item ::= SEQUENCE {
    cell-ID                         ECGI,
    ul-InterferenceOverloadIndication       UL-InterferenceOverloadIndication       OPTIONAL,
    ul-HighInterferenceIndicationInfo       UL-HighInterferenceIndicationInfo       OPTIONAL,
    relativeNarrowbandTxPower               RelativeNarrowbandTxPower               OPTIONAL,
    iE-Extensions                           ProtocolExtensionContainer { {CellInformation-Item-ExtIEs} } OPTIONAL,
    ...
}

CellInformation-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

-- **************************************************************
--
-- ENB CONFIGURATION UPDATE
--
-- **************************************************************

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

ENBConfigurationUpdate-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-ServedCellsToAdd        CRITICALITY reject  TYPE ServedCells                PRESENCE optional} |
    { ID id-ServedCellsToModify     CRITICALITY reject  TYPE ServedCellsToModify        PRESENCE optional} |
```

```
    { ID id-ServedCellsToDelete     CRITICALITY reject  TYPE Old-ECGIs                PRESENCE optional} |
    { ID id-GUGroupIDListToAdd      CRITICALITY reject  TYPE GUGroupIDList            PRESENCE optional} |
    { ID id-GUGroupIDListToDelete   CRITICALITY reject  TYPE GUGroupIDList            PRESENCE optional},
    ...
}

ServedCellsToModify::= SEQUENCE (SIZE (1..maxCellineNB)) OF ServedCellsToModify-Item

ServedCellsToModify-Item::= SEQUENCE {
    old-ecgi                        ECGI,
    served-cells                    ServedCell-Information,
    iE-Extensions                   ProtocolExtensionContainer { { ServedCellsToModify-Item-ExtIEs} } OPTIONAL,
    ...
}

ServedCellsToModify-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}


Old-ECGIs::= SEQUENCE (SIZE (1..maxCellineNB)) OF ECGI

-- **************************************************************
--
-- ENB CONFIGURATION UPDATE ACKNOWLEDGE
--
-- **************************************************************

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

ENBConfigurationUpdateAcknowledge-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics         PRESENCE optional       },
...
}

-- **************************************************************
--
-- ENB CONFIGURATION UPDATE FAIURE
--
-- **************************************************************

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

ENBConfigurationUpdateFailure-IEs X2AP-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 },
    ...
```

```
}


-- **************************************************************
--
-- Resource Status Request
--
-- **************************************************************

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

ResourceStatusRequest-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-Registration-Request    CRITICALITY reject  TYPE Registration-Request           PRESENCE mandatory} |
    { ID id-CellToReport            CRITICALITY ignore  TYPE CellToReport-List              PRESENCE optional} |
    { ID id-ReportingPeriodicity    CRITICALITY ignore  TYPE ReportingPeriod                PRESENCE optional} ,
    ...
}


CellToReport-List       ::= SEQUENCE (SIZE (1..maxCellineNB)) OF ProtocolIE-Single-Container { {CellToReport-ItemIEs} }

CellToReport-ItemIEs X2AP-PROTOCOL-IES ::= {
    { ID id-CellToReport-Item   CRITICALITY ignore  TYPE CellToReport-Item  PRESENCE mandatory  }
}

CellToReport-Item ::= SEQUENCE {
    cell-ID                             ECGI,
    iE-Extensions                       ProtocolExtensionContainer { {CellToReport-Item-ExtIEs} } OPTIONAL,
    ...
}

CellToReport-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}


ReportingPeriod ::= ENUMERATED {ffs,...}
-- The Report Period gives the reporting periodicity in number of ffs ms periods.
-- E.g. value ffs means ffs ms
-- Unit ms, Step ffs ms

-- **************************************************************
--
-- Resource Status Response
--
-- **************************************************************

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

```
}

ResourceStatusResponse-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-CriticalityDiagnostics  CRITICALITY ignore  TYPE CriticalityDiagnostics         PRESENCE optional },
    ...
}


-- **************************************************************
--
-- Resource Status Failure
--
-- **************************************************************

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

ResourceStatusFailure-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-Cause               CRITICALITY ignore  TYPE Cause          PRESENCE mandatory} |
    { ID id-CriticalityDiagnostics  CRITICALITY ignore  TYPE CriticalityDiagnostics         PRESENCE optional },
    ...
}


-- **************************************************************
--
-- Resource Status Update
--
-- **************************************************************

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

ResourceStatusUpdate-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-CellMeasurementResult   CRITICALITY ignore  TYPE CellMeasurementResult-List     PRESENCE mandatory},
    ...
}

CellMeasurementResult-List      ::= SEQUENCE (SIZE (1..maxCellineNB)) OF ProtocolIE-Single-Container { {CellMeasurementResult-ItemIEs} }

CellMeasurementResult-ItemIEs X2AP-PROTOCOL-IES ::= {
    { ID id-CellMeasurementResult-Item  CRITICALITY ignore  TYPE CellMeasurementResult-Item     PRESENCE mandatory      }
}

CellMeasurementResult-Item ::= SEQUENCE {
    cell-ID                         ECGI,
    resoureStatus                   ResourceStatus          OPTIONAL,
    iE-Extensions                   ProtocolExtensionContainer { {CellMeasurementResult-Item-ExtIEs} } OPTIONAL,
    ...
}
```

```
CellMeasurementResult-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}


-- ********************************************************************
--
-- PRIVATE MESSAGE
--
-- ********************************************************************

PrivateMessage ::= SEQUENCE {
    privateIEs      PrivateIE-Container  {{PrivateMessage-IEs}},
    ...
}

PrivateMessage-IEs X2AP-PRIVATE-IES ::= {
    ...
}

END
```

## 9.3.5 Information Element definitions

```
-- ********************************************************************
--
-- Information Element Definitions
--
-- ********************************************************************

X2AP-IEs {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (21) modules (3) x2ap (2) version1 (1) x2ap-IEs (2) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS
    id-InterfacesToTrace-Item,

    maxCellineNB,
    maxEARFCN,
    maxInterfaces,

    maxnoofCells,
    maxnoofBPLMNs,
    maxnoofEPLMNs,
    maxnoofEPLMNsPlusOne,
    maxnoofForbLACs,
    maxnoofForbTACs,
```

```
    maxnoofPRBs,
    maxNrOfErrors,
    maxPools

FROM X2AP-Constants

    Criticality,
    ProcedureCode,
    ProtocolIE-ID,
    TriggeringMessage
FROM X2AP-CommonDataTypes

    ProtocolExtensionContainer{},
    ProtocolIE-Single-Container{},

    X2AP-PROTOCOL-EXTENSION,
    X2AP-PROTOCOL-IES
FROM X2AP-Containers;

-- A


AllocationAndRetentionPriority ::= INTEGER (0..15)


-- B

Bearer-ID ::= INTEGER (0..15, ...)

BitRate ::= INTEGER (0..10000000000)
BroadcastPLMNs-Item ::= SEQUENCE (SIZE(1..maxnoofBPLMNs)) OF PLMN-Identity


-- C

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

CauseMisc ::= ENUMERATED {
    control-processing-overload,
    hardware-failure,
    om-intervention,
    not-enough-user-plane-processing-resources,
    unspecified,
    ...
}

CauseProtocol ::= ENUMERATED {
    transfer-syntax-error,
```

```
    abstract-syntax-error-reject,
    abstract-syntax-error-ignore-and-notify,
    message-not-compatible-with-receiver-state,
    semantic-error,
    unspecified,
    abstract-syntax-error-falsely-constructed-message,
    ...
}

CauseRadioNetwork ::= ENUMERATED {
    handover-desirable-for-radio-reasons,
    time-critical-handover,
    resource-optimisation-handover,
    reduce-load-in-serving-cell,
    partial-handover,
    unknown-new-eNB-UE-X2AP-ID,
    unknown-old-eNB-UE-X2AP-ID,
    unknown-pair-of-UE-X2AP-ID,
    ho-target-not-allowed,
    tx2relocoverall-expiry,
    trelocprep-expiry,
    cell-not-available,
    no-radio-resources-available-in-target-cell,
    invalid-MME-GroupID,
    unknown-MME-Code,
    unspecified,
    ...

}

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

CellType ::= ENUMERATED{
    macro,
    micro,
    pico,
    femto,
    ...
}


Cell-Transmission-Bandwidth ::= ENUMERATED {
        bw6,
        bw15,
        bw25,
        bw50,
        bw75,
        bw100,
        ...
}
```

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

COUNTvalue-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}


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


CriticalityDiagnostics-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

CriticalityDiagnostics-IE-List ::= SEQUENCE (SIZE (1..maxNrOfErrors)) OF
    SEQUENCE {
        iECriticality           Criticality,
        iE-ID                   ProtocolIE-ID,
        typeOfError             TypeOfError,
        iE-Extensions           ProtocolExtensionContainer { {CriticalityDiagnostics-IE-List-ExtIEs} } OPTIONAL,
        ...
}

CriticalityDiagnostics-IE-List-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}



-- D


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

-- E
```

```
EARFCN ::= INTEGER (0..maxEARFCN)

ECGI ::= SEQUENCE {
    pLMN-Identity               PLMN-Identity,
    eUTRANcellIdentifier        EUTRANCellIdentifier,
    iE-Extensions               ProtocolExtensionContainer { {ECGI-ExtIEs} } OPTIONAL,
    ...
}

ECGI-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

ENB-ID ::= CHOICE {
    macro-eNB-ID    BIT STRING (SIZE (20)),
    home-eNB-ID     BIT STRING (SIZE (28)),
    ...
}

EPLMNs ::= SEQUENCE (SIZE(1..maxnoofEPLMNs)) OF PLMN-Identity

EventType ::= ENUMERATED{
    change-of-serving-cell,
    ...
}

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

-- F

ForbiddenInterRATs ::= ENUMERATED {
    all,
    geran,
    utran,
    ...
}

ForbiddenTAs ::= SEQUENCE (SIZE(1.. maxnoofEPLMNsPlusOne)) OF ForbiddenTAs-Item

ForbiddenTAs-Item ::= SEQUENCE {
    pLMN-Identity       PLMN-Identity,
    forbiddenTACs       ForbiddenTACs
}

ForbiddenTACs ::= SEQUENCE (SIZE(1..maxnoofForbTACs)) OF TAC

ForbiddenLAs ::= SEQUENCE (SIZE(1..maxnoofEPLMNsPlusOne)) OF ForbiddenLAs-Item

ForbiddenLAs-Item ::= SEQUENCE {
    pLMN-Identity       PLMN-Identity,
    forbiddenLACs       ForbiddenLACs
}

ForbiddenLACs ::= SEQUENCE (SIZE(1..maxnoofForbLACs)) OF LAC
```

```
-- G

GBR-QosInformation ::= SEQUENCE {
    sAE-Bearer-MaximumBitrateDL         BitRate,
    sAE-Bearer-MaximumBitrateUL         BitRate,
    sAE-Bearer-GuaranteedBitrateDL      BitRate,
    sAE-Bearer-GuaranteedBitrateUL      BitRate,
    iE-Extensions                       ProtocolExtensionContainer { { GBR-QosInformation-ExtIEs} } OPTIONAL,
    ...
}

GBR-QosInformation-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

GlobalENB-ID ::= SEQUENCE {
    pLMN-Identity           PLMN-Identity,
    eNB-ID                  ENB-ID,
    iE-Extensions           ProtocolExtensionContainer { {GlobalENB-ID-ExtIEs} } OPTIONAL,
    ...
}

GlobalENB-ID-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}
GTPtunnelEndpoint ::= SEQUENCE {
    transportLayerAddress           TransportLayerAddress,
    gTP-TEID                        GTP-TEI,
    iE-Extensions                   ProtocolExtensionContainer { {GTPtunnelEndpoint-ExtIEs} } OPTIONAL,
    ...
}

GTPtunnelEndpoint-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

GTP-TEI                 ::= OCTET STRING (SIZE (4))

GUGroupIDList       ::= SEQUENCE (SIZE (1..maxPools)) OF GU-Group-ID


GU-Group-ID         ::= SEQUENCE {
    pLMN-Identity       PLMN-Identity,
    mME-Group-ID        MME-Group-ID,
    iE-Extensions       ProtocolExtensionContainer { {GU-Group-ID-ExtIEs} } OPTIONAL,
    ...
}

GU-Group-ID-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}
```

```
GUMMEI          ::= SEQUENCE {

    gU-Group-ID     GU-Group-ID,
    mMME-Code           MME-Code,
    iE-Extensions                   ProtocolExtensionContainer { {GUMMEI-ExtIEs} } OPTIONAL,
    ...
}

GUMMEI-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}



-- H

HandoverRestrictionList ::= SEQUENCE {
    servingPLMN                 PLMN-Identity,
    equivalentPLMNs             EPLMNs                  OPTIONAL,
    forbiddenTAs                ForbiddenTAs            OPTIONAL,
    forbiddenLAs                ForbiddenLAs            OPTIONAL,
    forbiddenInterRATs          ForbiddenInterRATs      OPTIONAL,
    iE-Extensions               ProtocolExtensionContainer { {HandoverRestrictionList-ExtIEs} } OPTIONAL,
    ...
}

HandoverRestrictionList-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

HFN ::= INTEGER (0..1048575)



-- I


InterfacesToTrace ::= SEQUENCE (SIZE(1..maxInterfaces)) OF ProtocolIE-Single-Container {{InterfacesToTrace-ItemIEs} }

InterfacesToTrace-ItemIEs X2AP-PROTOCOL-IES ::= {
    { ID id-InterfacesToTrace-Item  CRITICALITY ignore  TYPE InterfacesToTrace-Item     PRESENCE mandatory      }
}

InterfacesToTrace-Item ::= SEQUENCE {
    traceInterface                  TraceInterface,
    traceDepth                      TraceDepth,
    iE-Extensions                   ProtocolExtensionContainer { {InterfacesToTrace-Item-ExtIEs} } OPTIONAL,
    ...
}

InterfacesToTrace-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
```

```
}


-- J
-- K
-- L


LAC                 ::= OCTET STRING (SIZE (2)) --(EXCEPT ('0000'H|'FFFE'H))

LastVisitedCell-Item ::= SEQUENCE {
    global-Cell-ID                  ECGI,
    cellType                        CellType,
    time-UE-StayedInCell            Time-UE-StayedInCell    OPTIONAL,
    iE-Extensions                   ProtocolExtensionContainer { {LastVisitedCell-Item-ExtIEs} } OPTIONAL,
    ...
}

LastVisitedCell-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

LocationReportingInformation ::= SEQUENCE {
    eventType       EventType,
    reportArea      ReportArea,
    iE-Extensions       ProtocolExtensionContainer { {LocationReportingInformation-ExtIEs} } OPTIONAL,
    ...
}

LocationReportingInformation-ExtIEs X2AP-PROTOCOL-EXTENSION ::={
    ...
}

-- M


MME-Group-ID    ::= OCTET STRING (SIZE (2))

MME-Code        ::= OCTET STRING (SIZE (1))

-- N


-- O
-- P

PDCP-SN ::= INTEGER (0..4095)

PhyCID ::= INTEGER (1..504, ...)


PLMN-Identity ::= OCTET STRING (SIZE(3))

-- Q
```

```
QCI ::= INTEGER (1..256)

-- R


ReceiveStatusofULPDCPSDUs ::= BIT STRING (SIZE(4096))

Registration-Request    ::= ENUMERATED {
    start,
    stop,
    ...
}

RelativeNarrowbandTxPower ::= SEQUENCE {

    rNTP-PerPRB                         BIT STRING (SIZE(6..110, ...)),
    rNTP-Threshold                      RNTP-Threshold,
    numberOfCellSpecificAntennaPorts    ENUMERATED {one, two, four, ...},
    p-B                                 INTEGER (0..3,...),
    pDCCH-InterferenceImpact            INTEGER (0..4,...),
    iE-Extensions                       ProtocolExtensionContainer { { RelativeNarrowbandTxPower-ExtIEs} } OPTIONAL,
    ...
}

RelativeNarrowbandTxPower-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

ReportArea ::= ENUMERATED{
    ecgi,
    ...
}

RNTP-Threshold ::= ENUMERATED {
    minusInfinity,
    minusEleven,
    minusTen,
    minusNine,
    minusEight,
    minusSeven,
    minusSix,
    minusFive,
    minusFour,
    minusThree,
    minusTwo,
    minusOne,
    zero,
    one,
    two,
    three,
    ...
}
```

```
RRC-Context ::= OCTET STRING

ResourceStatus          ::= INTEGER


-- S


SAE-BearerLevel-QoS-Parameters ::= SEQUENCE {
    qCI             QCI,
    allocationAndRetentionPriority  AllocationAndRetentionPriority,

    gbrQosInformation               GBR-QosInformation          OPTIONAL,
    iE-Extensions                   ProtocolExtensionContainer { { SAE-BearerLevel-QoS-Parameters-ExtIEs} } OPTIONAL,
    ...
}

SAE-BearerLevel-QoS-Parameters-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}




ServedCells     ::= SEQUENCE (SIZE (1..maxCellineNB)) OF ServedCell-Information


ServedCell-Information ::= SEQUENCE {
    phyCID              PhyCID,
    cellId              ECGI,
    tAC                 TAC,
    broadcastPLMNs      BroadcastPLMNs-Item,
    uL-EARFCN           EARFCN,
    dL-EARFCN           EARFCN,
    cell-Transmission-Bandwidth     Cell-Transmission-Bandwidth,
    iE-Extensions       ProtocolExtensionContainer { {ServedCell-Information-ExtIEs} } OPTIONAL,
    ...
}

ServedCell-Information-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

SubscriberProfileIDforRFP ::= INTEGER (1..256)


-- T

TAC ::= OCTET STRING    -- FFS

TargeteNBtoSource-eNBTransparentContainer   ::= OCTET STRING

Time-UE-StayedInCell ::= INTEGER
```

```
TimeToWait ::= OCTET STRING


TraceActivation ::= SEQUENCE {
    traceReference                  TraceReference,
    interfacesToTrace               InterfacesToTrace,
    iE-Extensions                   ProtocolExtensionContainer { {TraceActivation-ExtIEs} } OPTIONAL,
    ...
}

TraceActivation-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}



TraceDepth      ::= ENUMERATED {
    minimum,
    medium,
    maximum,
    vendorMinimum,
    vendorMedium,
    vendorMaximum,
    ...
}

TraceInterface      ::= ENUMERATED {
    s1,
    x2,
    uu,
    ...
}

TraceReference                  ::= OCTET STRING (SIZE (8))


TransportLayerAddress           ::= BIT STRING (SIZE(1..160, ...))

TypeOfError ::= ENUMERATED {
    not-understood,
    missing,
    ...
}


-- U

UE-HistoryInformation ::= SEQUENCE (SIZE(1..maxnoofCells)) OF LastVisitedCell-Item


UE-S1AP-ID                  ::= INTEGER (0.. 4294967295)

UE-X2AP-ID                  ::= INTEGER (0..4095) -- Value FFS
```

```
UEAggregateMaximumBitRate ::= SEQUENCE {
    uEaggregateMaximumBitRateDownlink   BitRate,
    uEaggregateMaximumBitRateUplink     BitRate,
    iE-Extensions                       ProtocolExtensionContainer { {UEAggregate-MaximumBitrate-ExtIEs} } OPTIONAL,
    ...
}

UEAggregate-MaximumBitrate-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

UL-InterferenceOverloadIndication ::= SEQUENCE (SIZE(1..maxnoofPRBs)) OF UL-InterferenceOverloadIndication-Item

UL-InterferenceOverloadIndication-Item ::= ENUMERATED {
    high-interference,
    medium-interference,
    low-interference,
    ...
}

UL-HighInterferenceIndicationInfo ::= SEQUENCE (SIZE(1..maxCellineNB)) OF UL-HighInterferenceIndicationInfo-Item

UL-HighInterferenceIndicationInfo-Item ::= SEQUENCE {
    ul-interferenceindication       UL-HighInterferenceIndication,
    target-Cell-ID                  ECGI,
    iE-Extensions                   ProtocolExtensionContainer { { UL-HighInterferenceIndicationInfo-Item-ExtIEs} } OPTIONAL,
    ...
}

UL-HighInterferenceIndicationInfo-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}


UL-HighInterferenceIndication ::= BIT STRING (SIZE(1..110, ...))


-- V
-- W
-- X
-- Y
-- Z

END
```

## 9.3.6 Common definitions

```
-- **************************************************************
--
-- Common definitions
--
-- **************************************************************
```

```
X2AP-CommonDataTypes {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (21) modules (3) x2ap (2) version1 (1) x2ap-CommonDataTypes (3)  }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

-- ************************************************************
--
-- Extension constants
--
-- ************************************************************

maxPrivateIEs                                   INTEGER ::= 65535
maxProtocolExtensions                           INTEGER ::= 65535
maxProtocolIEs                                  INTEGER ::= 65535

-- ************************************************************
--
-- Common Data Types
--
-- ************************************************************

Criticality     ::= ENUMERATED { reject, ignore, notify }

Presence        ::= ENUMERATED { optional, conditional, mandatory }

PrivateIE-ID    ::= CHOICE {
    local               INTEGER (0.. maxPrivateIEs),
    global              OBJECT IDENTIFIER
}

ProcedureCode       ::= INTEGER (0..255)


ProtocolIE-ID       ::= INTEGER (0..maxProtocolIEs)


TriggeringMessage   ::= ENUMERATED { initiating-message, successful-outcome, unsuccessful-outcome}

END
```

## 9.3.7 Constant definitions

```
-- ************************************************************
--
-- Constant definitions
--
-- ************************************************************

X2AP-Constants {
```

```
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (21) modules (3) x2ap (2) version1 (1) x2ap-Constants (4) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS
    ProcedureCode,
    ProtocolIE-ID
FROM X2AP-CommonDataTypes;

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

id-handoverPreparation                                  ProcedureCode ::= 0
id-handoverCancel                                       ProcedureCode ::= 1
id-loadIndication                                       ProcedureCode ::= 2
id-errorIndication                                      ProcedureCode ::= 3
id-snStatusTransfer                                     ProcedureCode ::= 4
id-uEContextRelease                             ProcedureCode ::= 5
id-x2Setup                                              ProcedureCode ::= 6
id-reset                                                ProcedureCode ::= 7
id-eNBConfigurationUpdate                               ProcedureCode ::= 8
id-resourceStatusUpdateInitiation                       ProcedureCode ::= 9
id-resourceStatusReporting                              ProcedureCode ::= 10




-- ************************************************************
--
-- Lists
--
-- ************************************************************

maxEARFCN                               INTEGER ::= 32767   -- FFS Value to be checked
maxInterfaces                           INTEGER ::= 16      -- FFS Value to be checked
maxCellineNB                            INTEGER ::= 256
maxnoofCells                            INTEGER ::= 16      -- FFS Value to be checked
maxnoofBearers                          INTEGER ::= 256
maxNrOfErrors                           INTEGER ::= 256     -- FFS Value to be checked
maxnoofPDCP-SN                          INTEGER ::= 16      -- FFS Value to be checked
maxnoofEPLMNs                           INTEGER ::= 15
maxnoofEPLMNsPlusOne                    INTEGER ::= 16
maxnoofForbLACs                         INTEGER ::= 4096
maxnoofForbTACs                         INTEGER ::= 4096
maxnoofBPLMNs                           INTEGER ::= 6
maxnoofPRBs                             INTEGER ::= 110     -- FFS Value to be checked
maxPools                                INTEGER ::= 16      -- FFS Value to be checked
```

```
-- ************************************************************
--
-- IEs
--
-- ************************************************************

id-Bearers-Admitted-Item                                        ProtocolIE-ID ::= 0
id-Bearers-Admitted-List                                        ProtocolIE-ID ::= 1
id-Bearers-NotAdmitted-Item                                     ProtocolIE-ID ::= 2
id-Bearers-NotAdmitted-List                                     ProtocolIE-ID ::= 3
id-Bearers-ToBeSetup-Item                                       ProtocolIE-ID ::= 4
id-Cause                                                        ProtocolIE-ID ::= 5
id-CellInformation                                              ProtocolIE-ID ::= 6
id-CellInformation-Item                                         ProtocolIE-ID ::= 7
id-InterfacesToTrace-Item                                       ProtocolIE-ID ::= 8
id-New-eNB-UE-X2AP-ID                                           ProtocolIE-ID ::= 9
id-Old-eNB-UE-X2AP-ID                                           ProtocolIE-ID ::= 10
id-TargetCell-ID                                                ProtocolIE-ID ::= 11
id-TargeteNBtoSource-eNBTransparentContainer                    ProtocolIE-ID ::= 12
id-TraceActivation                                              ProtocolIE-ID ::= 13
id-UE-ContextInformation                                        ProtocolIE-ID ::= 14
id-UE-HistoryInformation                                        ProtocolIE-ID ::= 15
id-UE-X2AP-ID                                                   ProtocolIE-ID ::= 16
id-CriticalityDiagnostics                                       ProtocolIE-ID ::= 17
id-Bearers-SubjectToStatusTransfer-List                         ProtocolIE-ID ::= 18
id-Bearers-SubjectToStatusTransfer-Item                         ProtocolIE-ID ::= 19
id-ServedCells                                                  ProtocolIE-ID ::= 20
id-GlobalENB-ID                                                 ProtocolIE-ID ::= 21
id-TimeToWait                                                   ProtocolIE-ID ::= 22
id-GUMMEI-ID                                                    ProtocolIE-ID ::= 23
id-GUGroupIDList                                                ProtocolIE-ID ::= 24
id-ServedCellsToAdd                                             ProtocolIE-ID ::= 25
id-ServedCellsToModify                                          ProtocolIE-ID ::= 26
id-ServedCellsToDelete                                          ProtocolIE-ID ::= 27
id-Registration-Request                                         ProtocolIE-ID ::= 28
id-CellToReport                                                 ProtocolIE-ID ::= 29
id-ReportingPeriodicity                                         ProtocolIE-ID ::= 30
id-CellToReport-Item                                            ProtocolIE-ID ::= 31
id-CellMeasurementResult                                        ProtocolIE-ID ::= 32
id-CellMeasurementResult-Item                                   ProtocolIE-ID ::= 33
id-GUGroupIDListToAdd                                           ProtocolIE-ID ::= 34
id-GUGroupIDListToDelete                                        ProtocolIE-ID ::= 35


END
```

## 9.3.8 Container definitions

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

```
--
-- Container definitions
--
-- ************************************************************

X2AP-Containers {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (21) modules (3) x2ap (2) version1 (1) x2ap-Containers (5)  }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

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

IMPORTS
    maxPrivateIEs,
    maxProtocolExtensions,
    maxProtocolIEs,
    Criticality,
    Presence,
    PrivateIE-ID,
    ProtocolIE-ID
FROM X2AP-CommonDataTypes;

-- ************************************************************
--
-- Class Definition for Protocol IEs
--
-- ************************************************************

X2AP-PROTOCOL-IES ::= CLASS {
    &id             ProtocolIE-ID           UNIQUE,
    &criticality    Criticality,
    &Value,
    &presence       Presence
}
WITH SYNTAX {
    ID              &id
    CRITICALITY     &criticality
    TYPE            &Value
    PRESENCE        &presence
}

-- ************************************************************
--
-- Class Definition for Protocol IEs
--
-- ************************************************************
```

```
X2AP-PROTOCOL-IES-PAIR ::= CLASS {
    &id                     ProtocolIE-ID       UNIQUE,
    &firstCriticality       Criticality,
    &FirstValue,
    &secondCriticality      Criticality,
    &SecondValue,
    &presence               Presence
}
WITH SYNTAX {
    ID                      &id
    FIRST CRITICALITY       &firstCriticality
    FIRST TYPE              &FirstValue
    SECOND CRITICALITY      &secondCriticality
    SECOND TYPE             &SecondValue
    PRESENCE                &presence
}

-- **************************************************************
--
-- Class Definition for Protocol Extensions
--
-- **************************************************************

X2AP-PROTOCOL-EXTENSION ::= CLASS {
    &id                 ProtocolIE-ID       UNIQUE,
    &criticality        Criticality,
    &Extension,
    &presence           Presence
}
WITH SYNTAX {
    ID                  &id
    CRITICALITY         &criticality
    EXTENSION           &Extension
    PRESENCE            &presence
}

-- **************************************************************
--
-- Class Definition for Private IEs
--
-- **************************************************************

X2AP-PRIVATE-IES ::= CLASS {
    &id                 PrivateIE-ID,
    &criticality        Criticality,
    &Value,
    &presence           Presence
}
WITH SYNTAX {
    ID                  &id
    CRITICALITY         &criticality
    TYPE                &Value
    PRESENCE            &presence
}
```

```
-- ********************************************************
--
-- Container for Protocol IEs
--
-- ********************************************************

ProtocolIE-Container {X2AP-PROTOCOL-IES : IEsSetParam} ::=
    SEQUENCE (SIZE (0..maxProtocolIEs)) OF
    ProtocolIE-Field {{IEsSetParam}}

ProtocolIE-Single-Container {X2AP-PROTOCOL-IES : IEsSetParam} ::=
    ProtocolIE-Field {{IEsSetParam}}

ProtocolIE-Field {X2AP-PROTOCOL-IES : IEsSetParam} ::= SEQUENCE {
    id              X2AP-PROTOCOL-IES.&id                   ({IEsSetParam}),
    criticality     X2AP-PROTOCOL-IES.&criticality          ({IEsSetParam}{@id}),
    value           X2AP-PROTOCOL-IES.&Value                ({IEsSetParam}{@id})
}

-- ********************************************************
--
-- Container for Protocol IE Pairs
--
-- ********************************************************

ProtocolIE-ContainerPair {X2AP-PROTOCOL-IES-PAIR : IEsSetParam} ::=
    SEQUENCE (SIZE (0..maxProtocolIEs)) OF
    ProtocolIE-FieldPair {{IEsSetParam}}

ProtocolIE-FieldPair {X2AP-PROTOCOL-IES-PAIR : IEsSetParam} ::= SEQUENCE {
    id                  X2AP-PROTOCOL-IES-PAIR.&id                  ({IEsSetParam}),
    firstCriticality    X2AP-PROTOCOL-IES-PAIR.&firstCriticality    ({IEsSetParam}{@id}),
    firstValue          X2AP-PROTOCOL-IES-PAIR.&FirstValue          ({IEsSetParam}{@id}),
    secondCriticality   X2AP-PROTOCOL-IES-PAIR.&secondCriticality   ({IEsSetParam}{@id}),
    secondValue         X2AP-PROTOCOL-IES-PAIR.&SecondValue         ({IEsSetParam}{@id})
}

-- ********************************************************
--
-- Container Lists for Protocol IE Containers
--
-- ********************************************************

ProtocolIE-ContainerList {INTEGER : lowerBound, INTEGER : upperBound, X2AP-PROTOCOL-IES : IEsSetParam} ::=
    SEQUENCE (SIZE (lowerBound..upperBound)) OF
    ProtocolIE-Container {{IEsSetParam}}

ProtocolIE-ContainerPairList {INTEGER : lowerBound, INTEGER : upperBound, X2AP-PROTOCOL-IES-PAIR : IEsSetParam} ::=
    SEQUENCE (SIZE (lowerBound..upperBound)) OF
    ProtocolIE-ContainerPair {{IEsSetParam}}

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

```
-- Container for Protocol Extensions
--
-- ************************************************************

ProtocolExtensionContainer {X2AP-PROTOCOL-EXTENSION : ExtensionSetParam} ::=
    SEQUENCE (SIZE (1..maxProtocolExtensions)) OF
    ProtocolExtensionField {{ExtensionSetParam}}

ProtocolExtensionField {X2AP-PROTOCOL-EXTENSION : ExtensionSetParam} ::= SEQUENCE {
    id                  X2AP-PROTOCOL-EXTENSION.&id             ({ExtensionSetParam}),
    criticality         X2AP-PROTOCOL-EXTENSION.&criticality    ({ExtensionSetParam}{@id}),
    extensionValue      X2AP-PROTOCOL-EXTENSION.&Extension      ({ExtensionSetParam}{@id})
}

-- ************************************************************
--
-- Container for Private IEs
--
-- ************************************************************

PrivateIE-Container {X2AP-PRIVATE-IES : IEsSetParam} ::=
    SEQUENCE (SIZE (1..maxPrivateIEs)) OF
    PrivateIE-Field {{IEsSetParam}}

PrivateIE-Field {X2AP-PRIVATE-IES : IEsSetParam} ::= SEQUENCE {
    id              X2AP-PRIVATE-IES.&id            ({IEsSetParam}),
    criticality     X2AP-PRIVATE-IES.&criticality   ({IEsSetParam}{@id}),
    value           X2AP-PRIVATE-IES.&Value         ({IEsSetParam}{@id})
}

END
```

## 9.4 Message transfer syntax

X2AP shall use the ASN.1 Basic Packed Encoding Rules (BASIC-PER) Aligned Variant as transfer syntax as specified in ref. [5].

## 9.5 Timers

$T_{RELOCprep}$

- Specifies the maximum time for the Handover Preparation procedure in the source eNB.

$TX2_{RELOCoverall}$

- Specifies the maximum time for the protection of the overall handover procedure in the source eNB.

# 10 Handling of unknown, unforeseen and erroneous protocol data

Section 10 of [4] is applicable for the purposes of the present document.

# Annex A (informative): Change history

| Change history | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Date** | **TSG #** | **TSG Doc.** | **CR** | **Rev** | **Subject/Comment** | **Old** | **New** |
| 2007-02 | | | | | First draft | | 0.0.1 |
| 2007-03 | | | | | Minor editorials according to discussion at RAN3#55. | 0.0.1 | 0.0.2 |
| 2007-06 | | | | | Following email discussion on RAN3 reflector:<br>Added text on HO Cancel (email discussion 07)l<br>Added text on HO Preparation (email discussion 06)<br>Editorial changes:<br>Correction of numbering and format changes<br>Moved editors note into section 9.1<br>Correction of wording in 8.4.1<br>Other changes:<br>Added FFS on GTP tunnel endpoints<br>Added FFS on how target eNB contacts MME | | |
| 2007-08 | | | | | Updates according to discussions in RAN3#57 | 0.1.0 | 0.2.0 |
| 2007-09 | 37 | RP-070585 | | | Presentation to TSG-RAN for information -version 1.0.0 | 0.2.0 | 1.0.0 |
| 2007-10 | | | | | Inclusion of agreements from RAN3#57bis as well as editorials | 1.0.0 | 1.0.1 |
| 2007-11 | | | | | Inclusion of agreements from RAN3#58 as well as editorials | 1.0.1 | 1.1.0 |
| 2007-11 | 38 | RP-070856 | | | Presentation to TSG-RAN for approval - version 2.0.0 | 1.1.0 | 2.0.0 |
| 2007-12 | 38 | | | | Approved at TSG-RAN and placed under change control | 2.0.0 | 8.0.0 |
| 2008-03 | 39 | RP-080081 | 41 | | RAN3 agreed changes for TS 36.423 | 8.0.0 | 8.1.0 |
| 2008-06 | 40 | RP-080305 | 42 | 1 | RAN3 agreed changes for TS 36.423 | 8.1.0 | 8.2.0 |
| 2008-09 | 41 | RP-080585 | 144 | | changes to TS36.423 agreed in RAN3#61 | 8.2.0 | 8.3.0 |

# History

| Document history | | |
|---|---|---|
| V8.2.0 | November 2008 | Publication |
| V8.3.0 | November 2008 | Publication |
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