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Foreword

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Contents

Foreword

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

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

Version x.y.z

where:

- x the first digit:
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- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document specifies the 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 TS 36.401 [2] and TS 36.420 [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 (2002-07): "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] Void.

[18] 3GPP TS 33.401: "Security architecture".

[19] 3GPP TS 36.414: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 data transport".

[20] 3GPP TS 23.216: "Single Radio Voice Call Continuity (SRVCC)".

[21] 3GPP TS 36.422: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 signaling transport".

[22] 3GPP TS 36.314: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Layer 2 - Measurements".

[23] Void.

[24] 3GPP TS 25.413: "UTRAN Iu interface RANAP signalling"

[25] 3GPP TS 37.320: "Universal Terrestrial Radio Access (UTRA) and Evolved Universal Terrestrial Radio Access (E-UTRA); Radio measurement collection for Minimization of Drive Tests (MDT);Overall description; Stage 2".

[26] 3GPP TS 29.281: "General Packet Radio Service (GPRS); Tunnelling Protocol User Plane (GTPv1-U)".

[27] ITU-T Recommendation X.680 (2002-07): 'Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation'.

[28] ITU-T Recommendation X.681 (2002-07): 'Information technology – Abstract Syntax Notation One (ASN.1): Information object specification'.

[29] 3GPP TS 23.003: "Technical Specification Group Core Network and Terminals; Numbering, addressing and identification".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

Elementary Procedure: 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.

E-RAB: Defined in TS 36.401 [2].

CSG Cell: as defined in TS 36.300 [15].

Hybrid cell: as defined in TS 36.300 [15].

3.2 Symbols

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

<symbol> <Explanation>

3.3 Abbreviations

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

ABS	Almost Blank Subframe
CCO	Cell Change Order
DL	Downlink
EARFCN	E-UTRA Absolute Radio Frequency Channel Number
eNB	E-UTRAN NodeB
EP	Elementary Procedure
EPC	Evolved Packet Core
E-RAB	E-UTRAN Radio Access Bearer
E-UTRAN	Evolved UTRAN
GUMMEI	Globally Unique MME Identifier
HFN	Hyper Frame Number
IE	Information Element
MDT	Minimization of Drive Tests
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. *E-RAB 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 sub clause 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 UE 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

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

X2 signalling transport is described in TS 36.422 [21].

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 reset the X2 interface.
- Setting up the X2. This function is used to exchange necessary data for the eNB for setup the X2 interface and implicitly perform an X2 Reset.
- eNB Configuration Update. This function allows updating of application level data needed for two eNBs to interoperate correctly over the X2 interface.
- Mobility Parameters Management. This function allows the eNB to coordinate adaptation of mobility parameter settings with a peer eNB.
- Mobility Robustness Optimisation. This function allows reporting of information related to mobility failure events.
- Energy Saving. This function allows decreasing energy consumption by enabling indication of cell activation/deactivation 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 b) SN Status Transfer c) UE Context Release d) Handover Cancel
Load Management	a) Load Indication b) Resource Status Reporting Initiation c) Resource Status Reporting
Reporting of General Error Situations	Error Indication
Resetting the X2	Reset
Setting up the X2	X2 Setup
eNB Configuration Update	a) eNB Configuration Update b) Cell Activation
Mobility Parameters Management	Mobility Settings Change
Mobility Robustness Optimisation	a) Radio Link Failure Indication b) Handover Report
Energy Saving	a) eNB Configuration Update b) Cell Activation

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
Mobility Settings Change	MOBILITY CHANGE REQUEST	MOBILITY CHANGE ACKNOWLEDGE	MOBILITY CHANGE FAILURE
Cell Activation	CELL ACTIVATION REQUEST	CELL ACTIVATION RESPONSE	CELL ACTIVATION 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
Radio Link Failure Indication	RLF INDICATION
Handover Report	HANDOVER REPORT

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.

The procedure uses UE-associated signalling.

8.2.1.2 Successful Operation

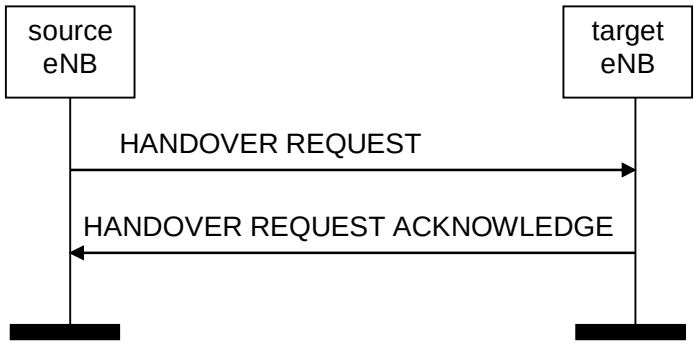

Figure 8.2.1.2-1: Handover Preparation, successful operation

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 $T_{RELOCprep.}$

The allocation of resources according to the values of the *Allocation and Retention Priority* IE included in the *E-RAB Level QoS Parameters* IE shall follow the principles described for the E-RAB Setup procedure in TS 36.413 [4].

The source eNB may include in the *GUMMEI* IE any GUMMEI corresponding to the source MME node.

If at least one of the requested non-GBR E-RABs is admitted to the cell indicated by the *Target Cell ID* IE, 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 E-RABs for which resources have been prepared at the target cell in the *E-RABs Admitted List* IE. The target eNB shall include the E-RABs that have not been admitted in the *E-RABs Not Admitted List* IE with an appropriate cause value.

At reception of the HANDOVER REQUEST message the target eNB shall:

- prepare the configuration of the AS security relation between the UE and the target eNB by using the information in the *UE Security Capabilities* IE and the *AS Security Information* IE in the *UE Context Information* IE**.**

For each E-RAB for which the source eNB proposes to do forwarding of downlink data, the source eNB shall include the *DL Forwarding* IE within the *E-RABs To be Setup Item* IE of the HANDOVER REQUEST message. For each E-RAB that it has decided to admit, the target eNB may include the *DL GTP Tunnel Endpoint* IE within the *E-RABs Admitted Item* 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 *E-RAB To Be Switched in Downlink List* IE of the PATH SWITCH REQUEST message (see TS 36.413 [4]) depending on implementation choice.

For each bearer in the *E-RABs Admitted List* IE, the target eNB may include the *UL GTP Tunnel Endpoint* IE to indicate that 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 shall, if supported, initiate the requested trace function as described in TS 32.422 [6]. In particular, the target eNB shall, if supported:

- if the *Trace Activation* IE does not include the *MDT Configuration* IE, initiate the requested trace session as described in TS 32.422 [6];

- if the *Trace Activation* IE includes the *MDT Activation* IE, within the *MDT Configuration* IE, set to 'Immediate MDT and Trace' initiate the requested trace session and MDT session as described in TS 32.422 [6];

- if the *Trace Activation* IE includes the *MDT Activation* IE, within the *MDT Configuration* IE, set to 'Immediate MDT Only' initiate the requested MDT session as described in TS 32.422 [6] and the target eNB shall ignore *Interfaces To Trace* IE, and *Trace Depth* IE.

If the *Management Based MDT Allowed* IE is contained in the HANDOVER REQUEST message, the target eNB shall, if supported, store the received information in the UE context, and use this information to allow subsequent selection of the UE for management based MDT defined in TS 32.422 [6].

The source eNB shall, if supported, include the *Management Based MDT Allowed* IE, if this information is available in the UE context, in the HANDOVER REQUEST message, except if the source eNB selects a serving PLMN in the target eNB different from the serving PLMN in the source eNB.

If the *Handover Restriction List* IE is

- contained in the HANDOVER REQUEST message, the target eNB shall store the information received in the *Handover Restriction List* IE in the UE context and the target eNB shall use this information to determine a target for the UE during subsequent mobility action for which the eNB provides information about the target of the mobility action towards the UE, except when one of the E-RABs has a particular ARP value (TS 23.401 [12]) in which case the information shall not apply.

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

If the *Location Reporting Information* IE is included in the HANDOVER REQUEST message then the target eNB should initiate the requested location reporting functionality as defined in TS 36.413 [4].

If the *SRVCC Operation Possible* IE is included in the HANDOVER REQUEST message, the target eNB shall store the content of such IE in the UE context and use it as defined in TS 23.216 [20].

If the *UE Security Capabilities* IE included in the HANDOVER REQUEST message only contains the EIA0 algorithm as defined in TS 33.401 [18] and if this EIA0 algorithm is defined in the configured list of allowed integrity protection algorithms in the eNB (TS 33.401 [18]), the eNB shall take it into use and ignore the keys received in the *AS Security Information* IE.

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 TS 36.300 [15].

Upon reception of *UE History Information* IE in the HANDOVER REQUEST message, the target eNB shall collect the information defined as mandatory in the *UE History Information* IE and shall, if supported, collect the information defined as optional in the *UE History Information* IE, for as long as the UE stays in one of its cells, and store the collected information to be used for future handover preparations.

8.2.1.3 Unsuccessful Operation

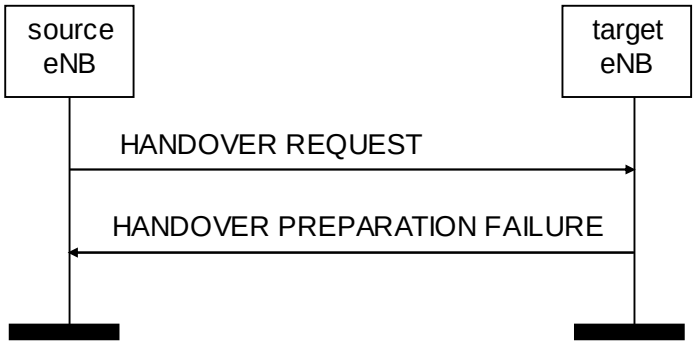

Figure 8.2.1.3-1: Handover Preparation, unsuccessful operation

If the target eNB does not admit at least one non-GBR E-RAB, 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.

If the target eNB receives a HANDOVER REQUEST message containing *RRC Context* IE that does not include required information as specified in TS 36.331 [9], the target eNB shall send the HANDOVER PREPARATION FAILURE message to the source eNB.

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. The source eNB shall ignore any HANDOVER REQUEST ACKNOWLEDGE or HANDOVER PREPARATION FAILURE message received after the initiation of the Handover Cancel procedure and remove any reference and release any resources related to the concerned X2 UE-associated signalling.

8.2.1.4 Abnormal Conditions

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

If the target eNB receives a HANDOVER REQUEST message containing a *E-RAB Level QoS Parameters* IE which contains a *QCI* IE indicating a GBR bearer (as defined in TS 23.203 [13]), and which does not contain the *GBR QoS Information* IE, the target eNB shall not admit the corresponding E-RAB.

If the supported algorithms for encryption defined in the *Encryption Algorithms* IE in the *UE Security Capabilities* IE in the *UE Context Information* IE, plus the mandated support of EEA0 in all UEs (TS 33.401 [18]), do not match any algorithms defined in the configured list of allowed encryption algorithms in the target eNB (TS 33.401 [18]), the target eNB shall reject the procedure using the HANDOVER PREPARATION FAILURE message.

If the supported algorithms for integrity defined in the *Integrity Protection Algorithms* IE in the *UE Security Capabilities* IE in the *UE Context Information* IE, plus the mandated support of the EIA0 algorithm in all UEs (TS 33.401 [18]), do not match any algorithms defined in the configured list of allowed integrity protection algorithms in the eNB (TS 33.401 [18]), the eNB shall reject the procedure using the HANDOVER PREPARATION FAILURE message.

If the target eNB receives a HANDOVER REQUEST message which does not contain the *Handover Restriction List* IE, and the PLMN to be used cannot be determined otherwise, the target eNB shall reject the procedure using the HANDOVER PREPARATION FAILURE message.

If the target eNB receives a HANDOVER REQUEST message containing the *Handover Restriction List* IE, and the serving PLMN is not supported by the target cell, the target eNB shall reject the procedure using the HANDOVER PREPARATION FAILURE message.

If the target eNB receives a HANDOVER REQUEST message which does not contain the *CSG Membership Status* IE, and the target cell is a hybrid cell, the target eNB shall reject the procedure using the HANDOVER PREPARATION FAILURE message.

If the target cell is a CSG or hybrid cell and the target eNB has not received any CSG ID of the source cell, the target eNB shall reject the procedure using the HANDOVER PREPARATION FAILURE message.

If the CSG ID of the source cell is different from the CSG ID of the target cell, the target eNB shall reject the procedure using the HANDOVER PREPARATION FAILURE message.

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 E-RAB for which PDCP SN and HFN status preservation applies.

The procedure uses UE-associated signalling.

8.2.2.2 Successful Operation

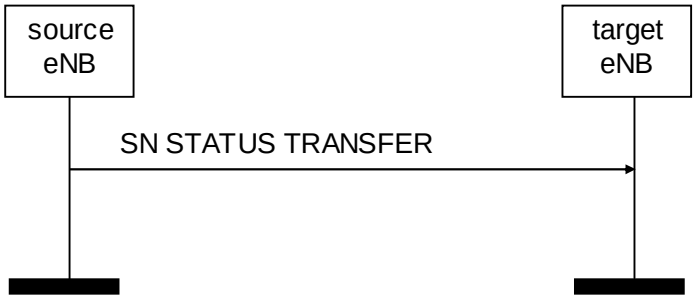

Figure 8.2.2.2-1: SN Status Transfer, successful operation

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.

The *E-RABs Subject To Status Transfer List* IE included in the SN STATUS TRANSFER message contains the E-RAB ID(s) corresponding to the E-RAB(s) for which PDCP SN and HFN status preservation shall be applied.

If the source eNB includes in the SN STATUS TRANSFER message, the information on the missing and received uplink SDUs in the *Receive Status Of UL PDCP SDUs* IE for each E-RAB for which the source eNB has accepted the request from the target eNB for uplink forwarding, then the target eNB may use it in a Status Report message sent to the UE over the radio.

For each E-RAB for which the *DL COUNT Value* IE is received in the SN STATUS TRANSFER message, 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.

For each E-RAB for which the *UL COUNT Value* IE is received in the SN STATUS TRANSFER message, the target eNB shall not deliver any uplink packet which has a PDCP SN lower than the value contained in the *PDCP-SN* IE of this IE.

8.2.2.3 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 indicate to the source eNB that radio and control plane resources for the associated UE context are allowed to be released.

The procedure uses UE-associated signalling.

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 the UE CONTEXT RELEASE message the target eNB informs the source eNB of Handover success and triggers the release of resources.

Upon reception of the UE CONTEXT RELEASE message, the source eNB may release radio and control plane related resources associated to the UE context. For E-RABs 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 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 to serve the UE.

8.2.4 Handover Cancel

8.2.4.1 General

The Handover Cancel procedure is used to enable a source eNB to cancel an ongoing handover preparation or an already prepared handover.

The procedure uses UE-associated signalling.

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.

The *New eNB UE X2AP ID* IE shall be included if it has been obtained from the target eNB.

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 eNBs controlling intra-frequency neighboring cells.

The procedure uses non UE-associated signalling.

8.3.1.2 Successful Operation

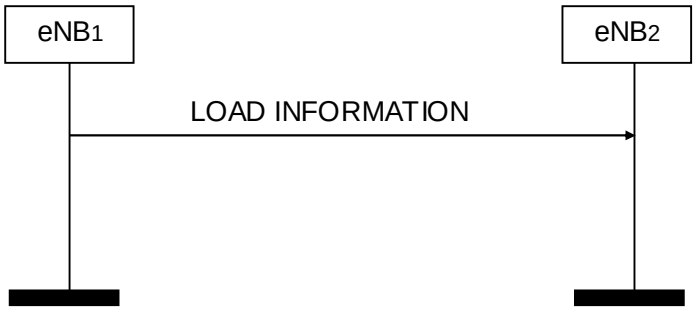

Figure 8.3.1.2-1: Load Indication, successful operation

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

If the *UL Interference Overload Indication* IE is received in the LOAD INFORMATION message, it indicates the interference level experienced by the indicated cell on all resource blocks, per PRB. 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.

If the *ABS Information* IE is included in the LOAD INFORMATION message, the *ABS Pattern Info* IE indicates the subframes designated as almost blank subframes by the sending eNB for the purpose of interference coordination. The receiving eNB may take such information into consideration when scheduling UEs.

The receiving eNB may use the *Measurement Subset* IE received in the LOAD INFORMATION message, for the configuration of specific measurements towards the UE.

The receiving eNB shall consider the received information as immediately applicable. The receiving eNB shall consider the value of the *ABS Information* IE valid until reception of a new LOAD INFORMATION message carrying an update.

If an ABS indicated in the *ABS pattern info* IE coincides with a MBSFN subframe, the receiving eNB shall consider that the subframe is designated as almost blank subframe by the sending eNB.

If the *Invoke Indication* IE is included in the LOAD INFORMATION message, it indicates which type of information the sending eNB would like the receiving eNB to send back. The receiving eNB may take such request into account.

If the *Invoke Indication* IE is set to "ABS Information", it indicates the sending eNB would like the receiving eNB to initiate the Load Indication procedure, with the LOAD INFORMATION message containing the *ABS Information* IE indicating non-zero ABS patterns in the relevant cells.

8.3.1.3 Unsuccessful Operation

Not applicable.

8.3.1.4 Abnormal Conditions

Void.

8.3.2 Error Indication

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 configuration data needed for two eNBs to interoperate correctly over the X2 interface. This procedure erases any existing application level configuration data in the two nodes and replaces it by the one received. This procedure also resets the X2 interface like a Reset procedure would do.

The procedure uses non UE-associated signalling.

8.3.3.2 Successful Operation

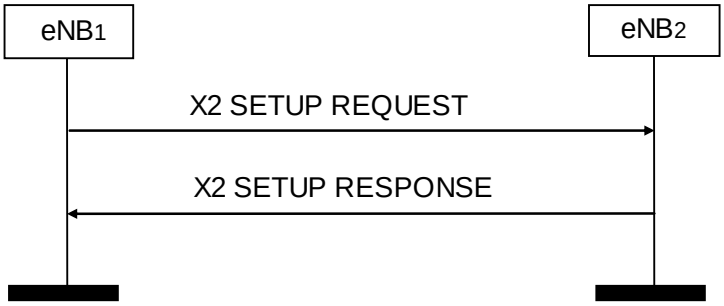

Figure 8.3.3.2-1: X2 Setup, successful operation

An eNB_1 initiates the procedure by sending the X2 SETUP REQUEST message to a candidate eNB_2. The candidate eNB_2 replies with the X2 SETUP RESPONSE message. The initiating eNB_1 shall transfer the complete list of its served cells and, if available, a list of supported GU Group Ids to the candidate eNB_2. The candidate eNB_2 shall reply with the complete list of its served cells and shall include, if available, a list of supported GU Group Ids in the reply.

If a cell is switched off for energy savings reasons, it should be activated before initiating or responding to the X2 Setup procedure and shall still be included in the list of served cells.

The initiating eNB_1 may include the *Neighbour Information* IE in the X2 SETUP REQUEST message. The candidate eNB_2 may also include the *Neighbour Information* IE in the X2 SETUP RESPONSE message. The *Neighbour Information* IE shall only include E-UTRAN cells that are direct neighbours of cells in the reporting eNB_2. A direct neighbour of one cell of eNB_2 may be any cell belonging to an eNB that is a neighbour of that eNB_2 cell e.g. even if the cell has not been reported by a UE. The initiating eNB1 may include the *TAC* IE with the *Neighbour Information* IE in the X2 SETUP REQUEST message. The candidate eNB2 may also include the *TAC* IE with the *Neighbour Information* IE in the X2 SETUP RESPONSE message. The eNB receiving the IE may use it according to TS 36.300 [15].

The initiating eNB_1 may include the *Number of Antenna Ports* IE in the X2 SETUP REQUEST message. The candidate eNB_2 may also include the *Number of Antenna Ports* IE in the X2 SETUP RESPONSE message. The eNB receiving the IE may use it according to TS 36.331 [9].

The initiating eNB_1 may include the *PRACH Configuration* IE in the X2 SETUP REQUEST message. The candidate eNB_2 may also include the *PRACH Configuration* IE in the X2 SETUP RESPONSE message. The eNB receiving the IE may use this information for RACH optimisation.

The initiating eNB_1 may include the *MBSFN Subframe Info* IE in the X2 SETUP REQUEST message. The candidate eNB_2 may also include the *MBSFN Subframe Info* IE in the X2 SETUP RESPONSE message. The eNB receiving the IE may use it according to TS 36.331 [9].

For each CSG cell or hybrid cell served by the initiating eNB_1 the X2 SETUP REQUEST message shall contain the *CSG ID* IE. For each CSG cell or hybrid cell served by the candidate eNB_2 the X2 SETUP RESPONSE message shall

contain the *CSG ID* IE. The eNB receiving the IE shall take this information into account when further deciding whether X2 handover between the source cell and the target cell may be performed.

The initiating eNB1 may include the *MBMS Service Area Identity List* IE in the X2 SETUP REQUEST message. The candidate eNB2 may also include the *MBMS Service Area Identity List* IE in the X2 SETUP RESPONSE message. The eNB receiving the IE may use it according to TS 36.300 [15].

For each cell served by the initiating eNB1 the X2 SETUP REQUEST message may contain the *MultibandInfoList* IE. For cell served by the candidate eNB2 the X2 SETUP RESPONSE message may contain the *MultibandInfoList* IE. The eNB receiving the IE shall, if supported, take this information into account when further deciding whether subsequent mobility actions between the source cell and the target cell may be performed.

8.3.3.3 Unsuccessful Operation

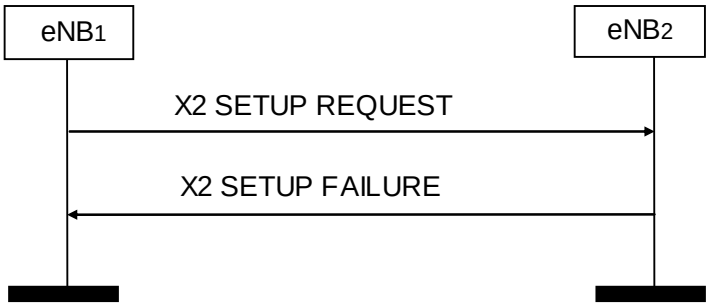

Figure 8.3.3.3-1: X2 Setup, unsuccessful operation

If the candidate eNB_2 cannot accept the setup it shall respond with an X2 SETUP FAILURE message with appropriate cause value.

If the X2 SETUP FAILURE messages includes the *Time To Wait* IE the initiating eNB_1 shall wait at least for the indicated time before reinitiating the X2 Setup procedure towards the same eNB_2.

8.3.3.4 Abnormal Conditions

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

If the initiating eNB_1 does not receive either X2 SETUP RESPONSE message or X2 SETUP FAILURE message, the eNB_1 may reinitiate the X2 Setup procedure towards the same eNB, provided that the content of the new X2 SETUP REQUEST message is identical to the content of the previously unacknowledged X2 SETUP REQUEST message.

If the initiating eNB_1 receives an X2 SETUP REQUEST message from the peer entity on the same X2 interface:

- In case the eNB_1 answers with an X2 SETUP RESPONSE message and receives a subsequent X2 SETUP FAILURE message, the eNB_1 shall consider the X2 interface as non operational and the procedure as unsuccessfully terminated according to sub clause 8.3.3.3.

- In case the eNB_1 answers with an X2 SETUP FAILURE message and receives a subsequent X2 SETUP RESPONSE message, the eNB_1 shall ignore the X2 SETUP RESPONSE message and consider the X2 interface as non operational.

8.3.4 Reset

8.3.4.1 General

The purpose of the Reset procedure is to align the resources in eNB_1 and eNB_2 in the event of an abnormal failure. The procedure resets the X2 interface. This procedure doesn"t affect the application level configuration data exchanged during, e.g., the X2 Setup procedure.

The procedure uses non UE-associated signalling.

8.3.4.2 Successful Operation

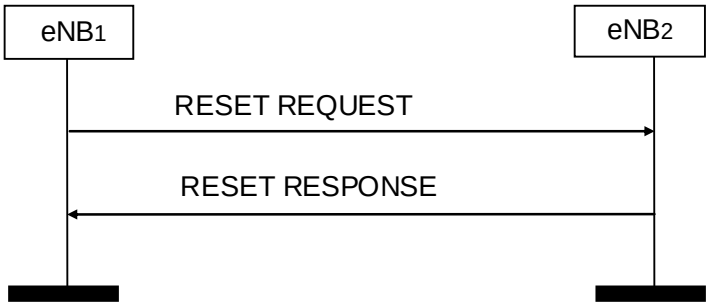

Figure 8.3.4.2-1: Reset, successful operation

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, except the application level configuration data exchanged during the X2 Setup or eNB Configuration Update procedures, and release the corresponding resources. 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 the eNB_2 receives the RESET REQUEST message from the peer entity on the same X2 interface, the eNB_2 shall respond with the RESET RESPONSE message as described in 8.3.4.2.

If the initiating eNB does not receive RESET RESPONSE message, the eNB_1 may reinitiate the Reset procedure towards the same eNB, provided that the content of the new RESET REQUEST message is identical to the content of the previously unacknowledged RESET REQUEST message.

8.3.5 eNB Configuration Update

8.3.5.1 General

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

The procedure uses non UE-associated signalling.

8.3.5.2 Successful Operation

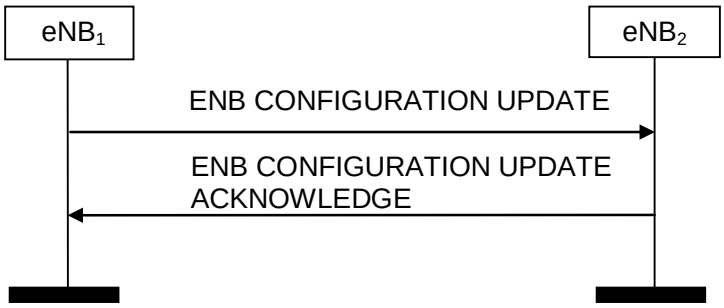

Figure 8.3.5.2-1: eNB Configuration Update, successful operation

An eNB_1 initiates the procedure by sending an ENB CONFIGURATION UPDATE message to a peer eNB_2. Such message shall include an appropriate set of up-to-date configuration data, including, but not limited to, the complete lists of added, modified and deleted served cells, that eNB_1 has just taken into operational use.

Upon reception of an ENB CONFIGURATION UPDATE message, eNB_2 shall update the information for eNB_1 as follows:

Update of Served Cell Information:

- If *Served Cells To Add* IE is contained in the ENB CONFIGURATION UPDATE message, eNB_2 shall add cell information according to the information in the *Served Cell Information* IE.

- If *Number of Antenna Ports* IE is contained in the *Served Cell Information* IE in the ENB CONFIGURATION UPDATE message, eNB_2 may use this information according to TS 36.331 [9].

- If the *PRACH Configuration* IE is contained in the *Served Cell Information* IE in the ENB CONFIGURATION UPDATE message, the eNB receiving the IE may use this information for RACH optimisation.

- If *Served Cells To Modify* IE is contained in the ENB CONFIGURATION UPDATE message, eNB_2 shall modify information of cell indicated by *Old ECGI* IE according to the information in the *Served Cell Information* IE.

- If *MBSFN Subframe Info* IE is contained in the *Served Cell Information* IE in the ENB CONFIGURATION UPDATE message, eNB_2 may use this information according to TS 36.331 [9]. If a MBSFN subframe indicated in the *MBSFN Subframe Info* IE coincides with an ABS, the eNB_2 shall consider that the subframe is designated as ABS by the sending eNB.

  When either served cell information or neighbour information of an existing served cell in eNB_1 need to be updated, the whole list of neighbouring cells, if any, shall be contained in the Neighbour Information IE.

  If the *Deactivation Indication* IE is contained in *Served Cells To Modify* IE, it indicates that the concerned cell was switched off to lower energy consumption.

  The eNB_2 shall overwrite the served cell information and the whole list of neighbour cell information for the affected served cell.

- If *Served Cells To Delete* IE is contained in the ENB CONFIGURATION UPDATE message, eNB_2 shall delete information of cell indicated by *Old ECGI* IE.

- If *MBMS Service Area Identity List* IE is contained in the *Served Cell Information* IE in the ENB CONFIGURATION UPDATE message, the eNB receiving the IE may use it according to TS 36.300 [15].

  When the MBMS Service Area Identities of a cell in eNB1 need to be updated, the whole list of MBMS Service Area Identities of the affected cell shall be contained in the *Served Cell Information* IE.

Update of GU Group ID List:

- If *GU Group Id To Add List* IE is contained in the ENB CONFIGURATION UPDATE message, eNB_2 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, eNB_2 shall remove the GU Group Id from its GU Group Id List.

If *Neighbour Information* IE is contained in the ENB CONFIGURATION UPDATE message, eNB_2 may use this information to update its neighbour cell relations, or use it for other functions, like PCI selection. The *Neighbour Information* IE shall only include E-UTRAN cells that are direct neighbours of cells in the reporting eNB. A direct neighbour of one cell of eNB_2 may be any cell belonging to an eNB that is a neighbour of that eNB_2 cell e.g. even if that cell has not been reported by a UE. The *Neighbour Information* IE may contain the *TAC* IE of the included cells. The receiving eNB may use *TAC* IE, as described in TS 36.300 [15].

After successful update of requested information, eNB_2 shall reply with the ENB CONFIGURATION UPDATE ACKNOWLEDGE message to inform the initiating eNB_1 that the requested update of application data was performed successfully. In case the peer eNB_2 receives an ENB CONFIGURATION UPDATE without any IE except for *Message Type* IE it shall reply with ENB CONFIGURATION UPDATE ACKNOWLEDGE message without performing any updates to the existing configuration.

The eNB_1 may initiate a further eNB Configuration Update procedure only after a previous eNB Configuration Update procedure has been completed.

8.3.5.3 Unsuccessful Operation

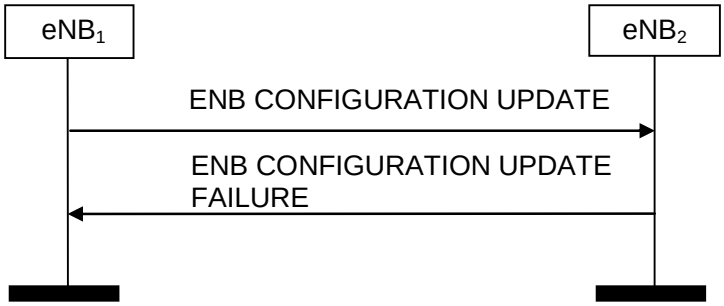

Figure 8.3.5.3-1: eNB Configuration Update, unsuccessful operation

If the eNB_2 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_1 shall wait at least for the indicated time before reinitiating the eNB Configuration Update procedure towards the same eNB_2. Both nodes shall continue to operate the X2 with their existing configuration data.

8.3.5.4 Abnormal Conditions

If the eNB_1 after initiating eNB Configuration Update procedure receives neither ENB CONFIGURATION UPDATE ACKNOWLEDGE message nor ENB CONFIGURATION UPDATE FAILURE message, the eNB_1 may reinitiate the eNB Configuration Update procedure towards the same eNB_2, provided that the content of the new ENB CONFIGURATION UPDATE message is identical to the content of the previously unacknowledged ENB CONFIGURATION UPDATE message.

8.3.6 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.

The procedure uses non UE-associated signalling.

8.3.6.2 Successful Operation

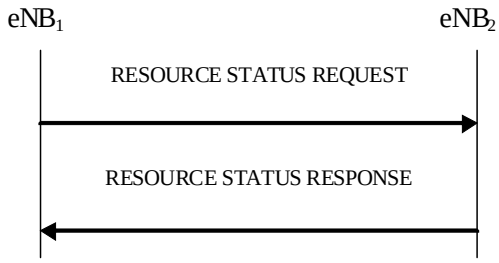

Figure 8.3.6.2-1: Resource Status Reporting Initiation, successful operation

The procedure is initiated with a RESOURCE STATUS REQUEST message sent from eNB_1 to eNB_2. Upon receipt, eNB_2 shall initiate the requested measurement according to the parameters given in the request in case the *Registration Request* IE set to "start" and shall stop all cells measurements and terminate the reporting in case the *Registration Request* IE is set to 'stop".

If the *Registration Request* IE is set to "start" then the *Report Characteristics* IE shall be included in RESOURCE STATUS REQUEST message.

The *Report Characteristics* IE indicates the type of objects eNB_2 shall perform measurements on.

For each cell, the eNB_2 shall include in the RESOURCE STATUS UPDATE message:

- the *Radio Resource Status* IE, if the first bit, 'PRB Periodic' of the *Report Characteristics* IE included in the RESOURCE STATUS REQUEST message is set to 1,
- the *S1 TNL Load Indicator* IE, if the second bit, 'TNL Load Ind Periodic' of the *Report Characteristics* IE included in the RESOURCE STATUS REQUEST message is set to 1,
- the *Hardware Load Indicator* IE, if the third bit, 'HW Load Ind Periodic' of the *Report Characteristics* IE included in the RESOURCE STATUS REQUEST message is set to 1,
- the *Composite Available Capacity Group* IE, if the fourth bit, 'Composite Available Capacity Periodic' of the *Report Characteristics* IE included in the RESOURCE STATUS REQUEST message is set to 1. If *Cell Capacity Class Value* IE is included within the *Composite Available Capacity Group* IE, this IE is used to assign weights to the available capacity indicated in the *Capacity Value* IE.
- the *ABS Status* IE, if the fifth bit, 'ABS Status Periodic' of the *Report Characteristics* IE included in the RESOURCE STATUS REQUEST message is set to 1 and eNB_1 had indicated the ABS pattern to eNB_2.

If the *Reporting Periodicity* IE is included in the RESOURCE STATUS REQUEST message, eNB_2 shall use its value as the time interval between two subsequent measurement reports.

If eNB_2 is capable to provide all requested resource status information, it shall initiate the measurement as requested by eNB_1, and respond with the RESOURCE STATUS RESPONSE message.

If eNB_2 is capable to provide some but not all of the requested resource status information and the *Partial Success Indicator* IE is present in the RESOURCE STATUS REQUEST message, it shall initiate the measurement for the admitted measurement objects and include the *Measurement Initiation Result* IE in the RESOURCE STATUS RESPONSE message.

If the eNB_2 received a RESOURCE STATUS REQUEST message which includes the *Registration Request* IE set to "stop", the *Cell To Report* IE list shall be ignored.

8.3.6.3 Unsuccessful Operation

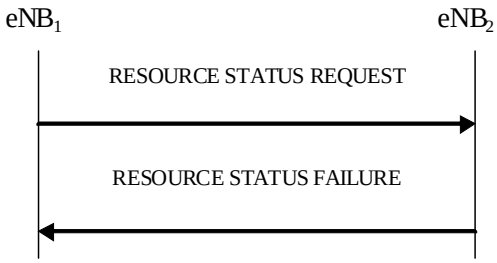

Figure 8.3.6.3-1: Resource Status Reporting Initiation, unsuccessful operation

If none of the requested measurements can be initiated, eNB_2 shall send a RESOURCE STATUS FAILURE message. The Cause IE shall be set to an appropriate value e.g. "Measurement Temporarily not Available" or "Measurement not Supported For The Object" for each requested measurement object. The eNB may use the *Complete Failure Cause Information* IE to enhance the failure cause information per measurement in the RESOURCE STATUS FAILURE message.

8.3.6.4 Abnormal Conditions

If the initiating eNB_1 does not receive either RESOURCE STATUS RESPONSE message or RESOURCE STATUS FAILURE message, the eNB_1 may reinitiate the Resource Status Reporting Initiation procedure towards the same eNB, provided that the content of the new RESOURCE STATUS REQUEST message is identical to the content of the previously unacknowledged RESOURCE STATUS REQUEST message.

If the initiating eNB_1 receives the RESOURCE STATUS RESPONSE message including the *Measurement Initiation Result* IE containing no admitted measurements, the eNB_1 shall consider the procedure as failed.

If the *Report Characteristics* IE bitmap is set to "0" (all bits are set to "0") in the RESOURCE STATUS REQUEST message then eNB_2 shall initiate a RESOURCE STATUS FAILURE message, the cause shall be set to appropriate value e.g. "ReportCharacteristicsEmpty".

If the *Reporting Periodicity* IE value is not specified when at least one of the bits of the *Report Characteristics* IE, for which semantics is specified, is set to 1 then eNB_2 shall initiate a RESOURCE STATUS FAILURE message, the cause shall be set to appropriate value e.g. "NoReportPeriodicity".

If the eNB_2 received a RESOURCE STATUS REQUEST message which includes the *Registration Request* IE set to "start" and the *eNB1Measurement ID* IE corresponding to an existing on-going load measurement reporting, then eNB_2 shall initiate a RESOURCE STATUS FAILURE message, the cause shall be set to appropriate value e.g. "ExistingMeasurementID".

If the *Registration Request* IE is set to "stop" and the RESOURCE STATUS REQUEST message does not contain *eNB2 Measurement ID* IE, eNB_2 shall consider the procedure as failed and respond with the RESOURCE STATUS FAILURE message, the cause shall be set to appropriate value e.g. "Unknown eNB Measurement ID".

8.3.7 Resource Status Reporting

8.3.7.1 General

This procedure is initiated by eNB_2 to report the result of measurements admitted by eNB_2 following a successful Resource Status Reporting Initiation procedure.

The procedure uses non UE-associated signalling.

8.3.7.2 Successful Operation

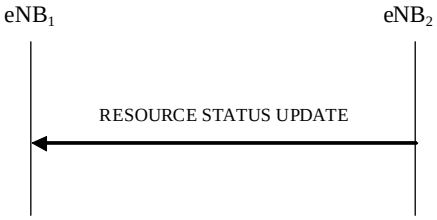

Figure 8.3.7.2-1: Resource Status Reporting, successful operation

The eNB_2 shall report the results of the admitted measurements in RESOURCE STATUS UPDATE message. The admitted measurements are the measurements that were successfully initiated during the preceding Resource Status Reporting Initiation procedure, and thus not reported in the *Measurement Failed Report Characteristics* IE for the concerned cell in the RESOURCE STATUS RESPONSE message.

8.3.7.3 Unsuccessful Operation

Not applicable.

8.3.7.4 Abnormal Conditions

If the eNB_1 receives a RESOURCE STATUS UPDATE message which includes the *ABS Status* IE, and all bits in the *Usable ABS Pattern Info* IE are set to '0', the eNB1 shall ignore the *DL ABS Status* IE.

8.3.8 Mobility Settings Change

8.3.8.1 General

This procedure enables an eNB to negotiate the handover trigger settings with a peer eNB controlling neighbouring cells.

The procedure uses non UE-associated signalling.

8.3.8.2 Successful Operation

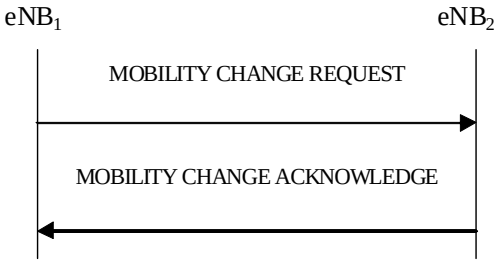

Figure 8.3.8.2-1: Mobility Settings Change, successful operation

The procedure is initiated with a MOBILITY CHANGE REQUEST message sent from eNB_1 to eNB_2.

Upon receipt, eNB_2 shall evaluate if the proposed eNB_2 handover trigger modification may be accepted. If eNB_2 is able to successfully complete the request it shall reply with MOBILITY CHANGE ACKNOWLEDGE.

8.3.8.3 Unsuccessful Operation

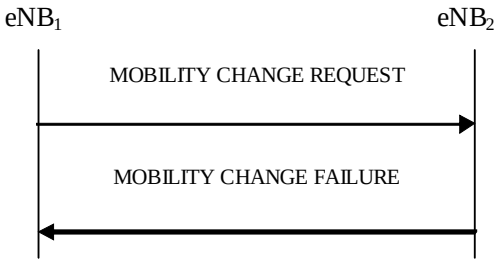

Figure 8.3.8.3-1: Mobility Settings Change, unsuccessful operation

If the requested parameter modification is refused by the eNB_2, or if the eNB_2 is not able to complete the procedure, the eNB_2 shall send a MOBILITY CHANGE FAILURE message with the *Cause* IE set to an appropriate value. The eNB_2 may include *eNB2 Mobility Parameters Modification Range* IE in MOBILITY CHANGE FAILURE message, for example in cases when the proposed change is out of permitted range.

8.3.8.4 Abnormal Conditions

Void.

8.3.9 Radio Link Failure Indication

8.3.9.1 General

The purpose of the Radio Link Failure Indication procedure is to transfer information regarding RRC re-establishment attempts, or received RLF Reports, between eNBs controlling neighbouring cells. The signalling takes place from the eNB at which a re-establishment attempt is made, or an RLF Report is received, to an eNB to which the UE concerned may have previously been attached prior to the connection failure. This may aid the detection of radio link failure and handover failure cases (TS 36.300 [15]).

The procedure uses non UE-associated signalling.

8.3.9.2 Successful Operation

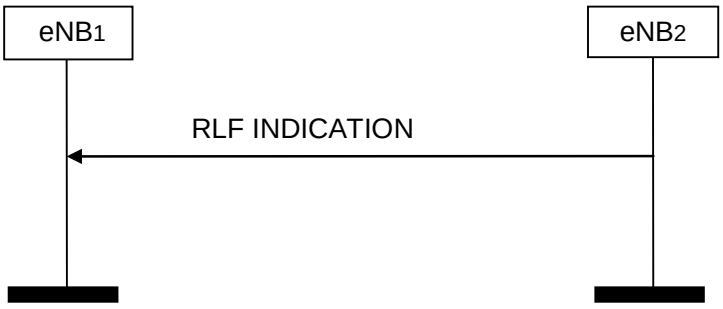

Figure 8.3.9.2-1: Radio Link Failure Indication, successful operation

eNB_2 initiates the procedure by sending the RLF INDICATION message to eNB_1 following a re-establishment attempt or an RLF Report reception from a UE at eNB_2, when eNB_2 considers that the UE may have previously suffered a connection failure at a cell controlled by eNB_1.

eNB_2 may include the ShortMAC-I IE in the RLF INDICATION message, e.g., in order to aid the eNB_1 to resolve a potential PCI confusion situation or to aid the eNB_1 to identify the UE.

eNB_2 may include the *UE RLF Report Container* IE in the RLF INDICATION message, which may be used by the eNB_1 to determine the nature of the failure.

eNB_2 may include the *RRC Conn Setup Indicator* IE in the RLF INDICATION message, which indicates that the RLF Report is retrieved after an RRC connection setup.

If the *RRC Conn Setup Indicator* IE is present in the RLF INDICATION message, the eNB_1 shall ignore the values in the *Failure cell PCI* IE, *Re-establishment cell ECGI* IE, *C-RNTI* IE and *ShortMAC-I* IE.

eNB_2 may include the *RRC Conn Reestab Indicator* IE in the RLF INDICATION message, which may be used by the eNB_1 to determine where the failure occurred.

8.3.9.3 Unsuccessful Operation

Not applicable.

8.3.9.4 Abnormal Conditions

Void.

8.3.10 Handover Report

8.3.10.1 General

The purpose of the Handover Report procedure is to transfer mobility related information between eNBs controlling neighbouring cells.

The procedure uses non UE-associated signalling.

8.3.10.2 Successful Operation

Figure 8.3.10.2-1: Handover Report, successful operation

An eNB initiates the procedure by sending an HANDOVER REPORT message to another eNB controlling neighbouring cells. By sending the message eNB_1 indicates to eNB_2 that a mobility-related problem was detected.

If the *Handover Report Type* IE is set to "HO too early" or "HO to wrong cell", then the eNB_1 indicates to eNB_2 that, following a successful handover from a cell of eNB_2 to a cell of eNB_1, a radio link failure occurred and the UE attempted RRC Re-establishment either at the original cell of eNB_2 (Handover Too Early), or at another cell (Handover to Wrong Cell). The detection of Handover Too Early and Handover to Wrong Cell events is made according to TS 36.300 [15].

If the *Handover Report Type* IE is set to "InterRAT ping-pong", then the eNB_1 indicates to eNB_2 that a successful handover from a cell of eNB_2 to a cell in other RAT might have resulted in an inter-RAT ping-pong and the UE was successfully handed over to a cell of eNB_1 (indicated with *Failure cell ECGI* IE).

The report contains the source and target cells, and cause of the handover. If the *Handover Report Type* IE is set to "HO to wrong cell", then the *Re-establishment cell ECGI* IE shall be included in the HANDOVER REPORT message. If the *Handover Report Type* IE is set to "InterRAT ping-pong", then the *Target cell in UTRAN* IE shall be included in the HANDOVER REPORT message.

8.3.10.3 Unsuccessful Operation

Not applicable.

8.3.10.4 Abnormal Conditions

Void.

8.3.11 Cell Activation

8.3.11.1 General

The purpose of the Cell Activation procedure is to request to a neighbouring eNB to switch on one or more cells, previously reported as inactive due to energy saving reasons.

The procedure uses non UE-associated signalling.

8.3.11.2 Successful Operation

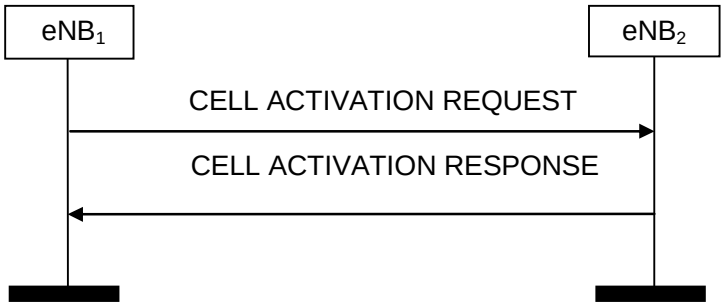

Figure 8.3.11.2-1: Cell Activation, successful operation

An eNB_1 initiates the procedure by sending a CELL ACTIVATION REQUEST message to a peer eNB_2.

Upon receipt of this message, eNB_2 should activate the cell/s indicated in the CELL ACTIVATION REQUEST message and shall indicate in the CELL ACTIVATION RESPONSE message for which cells the request was fulfilled.

Interactions with eNB Configuration Update procedure:

eNB_2 shall not send an ENB CONFIGURATION UPDATE message to eNB_1 just for the reason of the cell/s indicated in the CELL ACTIVATION REQUEST message changing state, as the receipt of the CELL ACTIVATION RESPONSE message by eNB_1 is used to update the information about cell activation state of eNB_2 cells in eNB_1.

8.3.11.3 Unsuccessful Operation

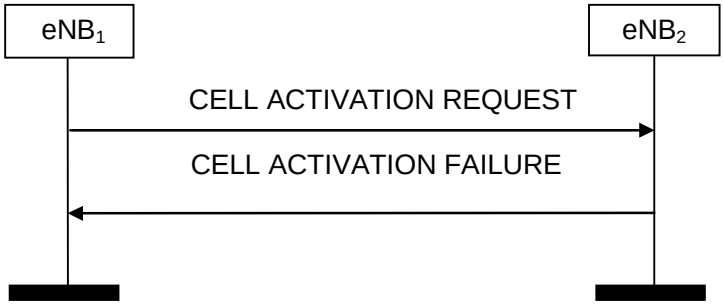

Figure 8.3.11.3-1: Cell Activation, unsuccessful operation

If the eNB_2 cannot activate any of the cells indicated in the CELL ACTIVATION REQUEST message, it shall respond with a CELL ACTIVATION FAILURE message with an appropriate cause value.

8.3.11.4 Abnormal Conditions

Not applicable.

9 Elements for X2AP Communication

9.0 General

Sub clauses 9.1 and 9.2 describe the structure of the messages and information elements required for the X2AP protocol in tabular format. Sub clause 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 TS 36.413 [4].

9.1 Message Functional Definition and Content

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 $\rightarrow$ target eNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
Old eNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the source eNB	YES	reject
Cause	M		9.2.6		YES	ignore
Target Cell ID	M		ECGI 9.2.14		YES	reject
GUMMEI	M		9.2.16		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	–	–
>UE Security Capabilities	M		9.2.29		–	–
>AS Security Information	M		9.2.30		–	–
>UE Aggregate Maximum Bit Rate	M		9.2.12		–	–
>Subscriber Profile ID for RAT/Frequency priority	O		9.2.25		–	–
>E-RABs To Be Setup List		*1*			–	–
>>E-RABs To Be Setup Item		*1 .. <maxnoof Bearers>*			EACH	ignore
>>>E-RAB ID	M		9.2.23		–	–
>>>E-RAB Level QoS Parameters	M		9.2.9	Includes necessary QoS parameters	–	–
>>>DL Forwarding	O		9.2.5		–	–
>>>UL GTP Tunnel Endpoint	M		GTP Tunnel Endpoint 9.2.1	SGW endpoint of the S1 transport bearer. For delivery of UL PDUs.	–	–
>RRC Context	M		OCTET STRING	Includes the RRC Handover Preparation Information message as defined in subclause 10.2.2 of TS 36.331 [9].	–	–
>Handover Restriction List	O		9.2.3		–	–
>Location Reporting Information	O		9.2.21	Includes the necessary parameters for location reporting	–	–
>Management Based MDT Allowed	O		9.2.59		YES	ignore
UE History Information	M		9.2.38	Same definition as in TS 36.413 [4].	YES	ignore
Trace Activation	O		9.2.2		YES	ignore
SRVCC Operation Possible	O		9.2.33		YES	ignore
CSG Membership Status	O		9.2.52		YES	reject

Range bound	Explanation
maxnoofBearers	Maximum no. of E-RABs. 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		9.2.13		YES	reject
Old eNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the source eNB	YES	ignore
New eNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the target eNB	YES	ignore
E-RABs Admitted List		*1*			YES	ignore
> E-RABs Admitted Item		*1 .. <maxnoof Bearers>*			EACH	ignore
>> E-RAB ID	M		9.2.23		–	–
>> UL GTP Tunnel Endpoint	O		GTP Tunnel Endpoint 9.2.1	Identifies the X2 transport bearer used for forwarding of UL PDUs	–	–
>> DL GTP Tunnel Endpoint	O		GTP Tunnel Endpoint 9.2.1	Identifies the X2 transport bearer. used for forwarding of DL PDUs	–	–
E-RABs Not Admitted List	O		E-RAB List 9.2.28	a value for *E-RAB ID* shall only be present once in *E-RABs Admitted List* IE + in *E-RABs Not Admitted List* IE	YES	ignore
Target eNB To Source eNB Transparent Container	M		OCTET STRING	Includes the RRC E-UTRA Handover Command message as defined in subclause 10.2.2 in TS 36.331 [9].	YES	ignore
Criticality Diagnostics	O		9.2.7		YES	ignore

Range bound	Explanation
maxnoofBearers	Maximum no. of E-RABs. 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		9.2.13		YES	reject
Old eNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the source eNB	YES	ignore
Cause	M		9.2.6		YES	ignore
Criticality Diagnostics	O		9.2.7		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 and HFN 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		9.2.13		YES	ignore
Old eNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the source eNB	YES	reject
New eNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the target eNB	YES	reject
E-RABs Subject To Status Transfer List		*1*			YES	ignore
>E-RABs Subject To Status Transfer Item		*1 .. <maxnoof Bearers>*			EACH	ignore
>> E-RAB ID	M		9.2.23		–	–
>>Receive Status Of UL PDCP SDUs	O		BIT STRING (4096)	PDCP Sequence Number = (First Missing SDU Number + bit position) modulo 4096 0: PDCP SDU has not been received. 1: PDCP SDU has been received correctly.	–	–
>> UL COUNT Value	M		COUNT Value 9.2.15	PDCP-SN and Hyper Frame Number of the first missing UL SDU	–	–
>> DL COUNT Value	M		COUNT Value 9.2.15	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 E-RABs. 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		9.2.13		YES	ignore
Old eNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the source eNB	YES	reject
New eNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	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		9.2.13		YES	ignore
Old eNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the source eNB	YES	reject
New eNB UE X2AP ID	O		eNB UE X2AP ID 9.2.24	Allocated at the target eNB	YES	ignore
Cause	M		9.2.6		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: $eNB_1 \rightarrow eNB_2$.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	ignore
Cell Information	M				YES	ignore
>Cell Information Item		*1 .. <maxCellineNB>*			EACH	ignore
>>Cell ID	M		ECGI 9.2.14	Id of the source cell	–	–
>>UL Interference Overload Indication	O		9.2.17		–	–
>>UL High Interference Information		*0 .. <maxCellineNB>*			–	–
>>>Target Cell ID	M		ECGI 9.2.14	Id of the cell for which the HII is meant	–	–
>>>UL High Interference Indication	M		9.2.18		–	–
>>Relative Narrowband Tx Power (RNTP)	O		9.2.19		–	–
>>ABS Information	O		9.2.54		YES	ignore
>>Invoke Indication	O		9.2.55		YES	ignore

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: $eNB_1 \rightarrow eNB_2$.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	ignore
Old eNB UE X2AP ID	O		eNB UE X2AP ID 9.2.24	Allocated at the source eNB	YES	ignore
New eNB UE X2AP ID	O		eNB UE X2AP ID 9.2.24	Allocated at the target eNB	YES	ignore
Cause	O		9.2.6		YES	ignore
Criticality Diagnostics	O		9.2.7		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: $eNB_1 \rightarrow eNB_2$.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
Global eNB ID	M		9.2.22		YES	reject
Served Cells		*1 .. <maxCellineNB>*		Complete list of cells served by the eNB	YES	reject
>Served Cell Information	M		9.2.8		–	–
>Neighbour Information		*0 .. <maxnoofNeighbours>*			–	–
>>ECGI	M		ECGI 9.2.14	E-UTRAN Cell Global Identifier of the neighbour cell	–	–
>>PCI	M		INTEGER (0..503, …)	Physical Cell Identifier of the neighbour cell	–	–
>>EARFCN	M		9.2.26	DL EARFCN for FDD and EARFCN for TDD	–	–
>>TAC	O		OCTET STRING (2)	Tracking Area Code	YES	ignore
GU Group Id List		*0 .. <maxfPools>*		This is all the pools to which the eNB belongs to	GLOBAL	reject
>GU Group Id	M		9.2.20		-	-

Range bound	Explanation
maxCellineNB	Maximum no. cells that can be served by an eNB. Value is 256.
maxnoofNeighbours	Maximum no. of neighbour cells associated to a given served cell. Value is 512.
maxPools	Maximum no. of pools an eNB can belong to. Value is 16.

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: $eNB_2 \rightarrow eNB_1$.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
Global eNB ID	M		9.2.22		YES	reject
Served Cells		*1 .. <maxCellineNB>*		Complete list of cells served by the eNB	YES	reject
>Served Cell Information	M		9.2.8		–	–
>Neighbour Information		*0 .. <maxnoofNeighbours>*			–	–
>>ECGI	M		ECGI 9.2.14	E-UTRAN Cell Global Identifier of the neighbour cell	–	–
>>PCI	M		INTEGER (0..503, …)	Physical Cell Identifier of the neighbour cell	–	–
>>EARFCN	M		9.2.26	DL EARFCN for FDD and EARFCN for TDD	–	–
>>TAC	O		OCTET STRING (2)	Tracking Area Code	YES	ignore
GU Group Id List		*0 .. <maxPools>*		This is all the pools to which the eNB belongs to	GLOBAL	reject
>GU Group Id	M		9.2.20		-	-
Criticality Diagnostics	O		9.2.7		YES	ignore

Range bound	Explanation
maxCellineNB	Maximum no. cells that can be served by an eNB. Value is 256.
maxnoofNeighbours	Maximum no. of neighbour cells associated to a given served cell. Value is 512.
maxPools	Maximum no. of pools an eNB can belong to. Value is 16.

9.1.2.5 X2 SETUP FAILURE

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

Direction: $eNB_2 \rightarrow eNB_1$.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
Cause	M		9.2.6		YES	ignore
Time To Wait	O		9.2.32		YES	ignore
Criticality Diagnostics	O		9.2.7		YES	ignore

9.1.2.6 RESET REQUEST

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

Direction: $eNB_1 \rightarrow eNB_2$.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
Cause	M		9.2.6		YES	ignore

9.1.2.7 RESET RESPONSE

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

Direction: $eNB_2 \rightarrow eNB_1$.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
Criticality Diagnostics	O		9.2.7		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: $eNB_1 \rightarrow eNB_2$.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
Served Cells To Add		*0 .. <maxCellineNB>*		Complete list of added cells served by the eNB	GLOBAL	reject
>Served Cell Information	M		9.2.8		–	–
>Neighbour Information		*0 .. <maxnoofNeighbours>*			–	–
>>ECGI	M		ECGI 9.2.14	E-UTRAN Cell Global Identifier of the neighbour cell	–	–
>>PCI	M		INTEGER (0..503, …)	Physical Cell Identifier of the neighbour cell	–	–
>>EARFCN	M		9.2.26	DL EARFCN for FDD and EARFCN for TDD	–	–
>>TAC	O		OCTET STRING (2)	Tracking Area Code	YES	ignore
Served Cells To Modify		*0 .. <maxCellineNB>*		Complete list of modified cells served by the eNB	GLOBAL	reject
>Old ECGI	M		ECGI 9.2.14	This is the old E-UTRAN Cell Global Identifier	-	-
>Served Cell Information	M		9.2.8		–	–
>Neighbour Information		*0 .. <maxnoofNeighbours>*			–	–
>>ECGI	M		ECGI 9.2.14	E-UTRAN Cell Global Identifier of the neighbour cell	–	–
>>PCI	M		INTEGER (0..503, …)	Physical Cell Identifier of the neighbour cell	–	–
>>EARFCN	M		9.2.26	DL EARFCN for FDD and EARFCN for TDD	–	–
>>TAC	O		OCTET STRING (2)	Tracking Area Code	YES	ignore
>Deactivation Indication	O		ENUMERATED(deactivated, …)	Indicates the concerned cell is switched off for energy saving reasons	YES	ignore
Served Cells To Delete		*0 .. <maxCellineNB>*		Complete list of deleted cells served by the eNB	GLOBAL	reject
>Old ECGI	M		ECGI 9.2.14	This is the old E-UTRAN Cell Global Identifier of the cell to be deleted	-	-
GU Group Id To Add List		*0 .. <maxPools>*			GLOBAL	reject
>GU Group Id	M		9.2.20		-	-
GU Group Id To Delete List		*0 .. <maxPools>*			GLOBAL	reject
>GU Group Id	M		9.2.20		-	-

Range bound	Explanation
maxCellineNB	Maximum no. cells that can be served by an eNB. Value is 256.
maxnoofNeighbours	Maximum no. of neighbour cells associated to a given served cell. Value is 512.
maxPools	Maximum no. of pools an eNB can belong to. Value is 16.

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: $eNB_2 \rightarrow eNB_1$.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
Criticality Diagnostics	O		9.2.7		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: $eNB_2 \rightarrow eNB_1$.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
Cause	M		9.2.6		YES	ignore
Time To Wait	O		9.2.32		YES	ignore
Criticality Diagnostics	O		9.2.7		YES	ignore

9.1.2.11 RESOURCE STATUS REQUEST

This message is sent by an eNB_1 to neighbouring eNB_2 to initiate the requested measurement according to the parameters given in the message.

Direction: $eNB_1 \rightarrow eNB_2$.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
eNB1 Measurement ID	M		INTEGER (1..4095,...)	Allocated by eNB_1	YES	reject
eNB2 Measurement ID	C-ifRegistrationRequestStop		INTEGER (1..4095,...)	Allocated by eNB_2	YES	ignore
Registration Request	M		ENUMERATED(start, stop, …)	A value set to 'stop', indicates a request to stop all cells measurements.	YES	reject
Report Characteristics	O		BITSTRING (SIZE(32))	Each position in the bitmap indicates measurement object the eNB_2 is requested to report. First Bit = PRB Periodic, Second Bit= TNL load Ind Periodic, Third Bit = HW Load Ind Periodic, Fourth Bit = Composite Available Capacity Periodic, Fifth Bit = ABS Status Periodic. Other bits shall be ignored by the eNB_2	YES	reject
Cell To Report		*1*		Cell ID list for which measurement is needed	YES	ignore
>Cell To Report Item		*1 .. <maxCellineNB>*			EACH	ignore
>>Cell ID	M		ECGI 9.2.14		–	–
Reporting Periodicity	O		ENUMERATED(1000ms, 2000ms, 5000ms,10000ms, …)		YES	ignore
Partial Success Indicator	O		ENUMERATED(partial success allowed, ...)	Included if partial success is allowed.	YES	ignore

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

Condition	Explanation
ifRegistrationRequestStop	This IE shall be present if the *Registration Request* IE is set to the value 'stop'.

9.1.2.12 RESOURCE STATUS RESPONSE

This message is sent by the eNB_2 to indicate that the requested measurement, for all or for a subset of the measurement objects included in the measurement is successfully initiated.

Direction: $eNB_2 \rightarrow eNB_1$.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
eNB1 Measurement ID	M		INTEGER (1..4095,...)	Allocated by eNB_1	YES	reject
eNB2 Measurement ID	M		INTEGER (1..4095,...)	Allocated by eNB_2	YES	reject
Criticality Diagnostics	O		9.2.7		YES	ignore
Measurement Initiation Result		*0..1*		List of all cells in which measurement objects were requested, included when indicating partial success.	YES	ignore
>**Measurement Initiation Result Item**		*1 .. <maxCellineNB>*			EACH	ignore
>>Cell ID	M		ECGI 9.2.14		–	–
>>**Measurement Failure Cause List**		*0..1*		It indicates that eNB_2 could not initiate the measurement for at least one of the requested measurement objects in the cell.	–	–
>>>**Measurement Failure Cause Item**		*1 .. <maxFailedMeasObjects>*			EACH	ignore
>>>>Measurement Failed Report Characteristics	M		BITSTRING (SIZE(32))	Each position in the bitmap indicates measurement object that failed to be initiated in the eNB_2. First Bit = PRB Periodic, Second Bit= TNL load Ind Periodic, Third Bit = HW Load Ind Periodic, Fourth Bit = Composite Available Capacity Periodic, Fifth Bit = ABS Status Periodic. Other bits shall be ignored by the eNB_1.	–	–
>>>>Cause	M		9.2.6	Failure cause for measurement objects for which the measurement cannot be initiated.	–	–

Range bound	Explanation
maxFailedMeasObjects	Maximum number of measurement objects that can fail per measurement. Value is 32.
maxCellineNB	Maximum no. cells that can be served by an eNB. Value is 256.

9.1.2.13 RESOURCE STATUS FAILURE

This message is sent by the eNB_2 to indicate that for none of the requested measurement objects the measurement can be initiated.

Direction: $eNB_2 \rightarrow eNB_1$.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
eNB1 Measurement ID	M		INTEGER (1..4095,...)	Allocated by eNB_1	YES	reject
eNB2 Measurement ID	M		INTEGER (1..4095,...)	Allocated by eNB_2	YES	reject
Cause	M		9.2.6	Ignored by the receiver when the Complete Failure Cause Information IE is included.	YES	ignore
Criticality Diagnostics	O		9.2.7		YES	ignore
Complete Failure Cause Information		*0..1*		Complete list of failure causes for all requested cells.	YES	ignore
>**Complete Failure Cause Information Item**		*1 .. <maxCellineNB>*			EACH	ignore
>>Cell ID	M		ECGI 9.2.14		–	–
>>**Measurement Failure Cause List**		*1*			–	–
>>>**Measurement Failure Cause Item**		*1 .. <maxFailedMeasObjects>*			EACH	ignore
>>>>Measurement Failed Report Characteristics	M		BITSTRING (SIZE(32))	Each position in the bitmap indicates measurement object that failed to be initiated in the eNB_2. First Bit = PRB Periodic, Second Bit= TNL load Ind Periodic, Third Bit = HW Load Ind Periodic, Fourth Bit = Composite Available Capacity Periodic, Fifth Bit = ABS Status Periodic. Other bits shall be ignored by the eNB_1.	–	–
>>>>Cause	M		9.2.6	Failure cause for measurements that cannot be initiated.	–	–

Range bound	Explanation
maxCellineNB	Maximum no. cells that can be served by an eNB. Value is 256.
maxMeasurementsineNB	Number of defined measurements. Value is 4.
maxFailedMeasObjects	Max number of measurement objects that can fail per measurement. Value is 32.

9.1.2.14 RESOURCE STATUS UPDATE

This message is sent by eNB_2 to neighbouring eNB_1 to report the results of the requested measurements.

Direction: $eNB_2 \rightarrow eNB_1$.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	ignore
eNB1 Measurement ID	M		INTEGER (1..4095,...)	Allocated by eNB_1	YES	reject
eNB2 Measurement ID	M		INTEGER (1..4095,...)	Allocated by eNB_2	YES	reject
Cell Measurement Result		*1*			YES	ignore
>Cell Measurement Result Item		*1 .. <maxCellineNB>*			EACH	ignore
>>Cell ID	M		ECGI 9.2.14			
>>Hardware Load Indicator	O		9.2.34			
>>S1 TNL Load Indicator	O		9.2.35			
>>Radio Resource Status	O		9.2.37			
>>Composite Available Capacity Group	O		9.2.44		YES	ignore
>>ABS Status	O		9.2.58		YES	ignore

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

9.1.2.15 MOBILITY CHANGE REQUEST

This message is sent by an eNB_1 to neighbouring eNB_2 to initiate adaptation of mobility parameters.

Direction: $eNB_1 \rightarrow eNB_2$.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
eNB1 Cell ID	M		ECGI 9.2.14		YES	reject
eNB2 Cell ID	M		ECGI 9.2.14		YES	reject
eNB1 Mobility Parameters	O		Mobility Parameters Information 9.2.48	Configuration change in eNB_1 cell.	YES	ignore
eNB2 Proposed Mobility Parameters	M		Mobility Parameters Information 9.2.48	Proposed configuration change in eNB_2 cell.	YES	reject
Cause	M		9.2.6		YES	reject

9.1.2.16 MOBILITY CHANGE ACKNOWLEDGE

This message is sent by the eNB_2 to indicate that the eNB_2 Proposed Mobility Parameter proposed by eNB_1 was accepted.

Direction: $eNB_2 \rightarrow eNB_1$.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
eNB1 Cell ID	M		ECGI 9.2.14		YES	reject
eNB2 Cell ID	M		ECGI 9.2.14		YES	reject
Criticality Diagnostics	O		9.2.7		YES	ignore

9.1.2.17 MOBILITY CHANGE FAILURE

This message is sent by the eNB_2 to indicate that the eNB_2 Proposed Mobility Parameter proposed by eNB_1 was refused.

Direction: $eNB_2 \rightarrow eNB_1$.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
eNB1 Cell ID	M		ECGI 9.2.14		YES	ignore
eNB2 Cell ID	M		ECGI 9.2.14		YES	ignore
Cause	M		9.2.6		YES	ignore
eNB2 Mobility Parameters Modification Range	O		9.2.49		YES	ignore
Criticality Diagnostics	O		9.2.7		YES	ignore

9.1.2.18 RLF INDICATION

This message is sent by the eNB_2 to indicate an RRC re-establishment attempt or a reception of an RLF Report from a UE that suffered a connection failure at eNB_1.

Direction: $eNB_2 \rightarrow eNB_1$.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	ignore
Failure cell PCI	M		INTEGER (0..503, …)	Physical Cell Identifier	YES	ignore
Re-establishment cell ECGI	M		ECGI 9.2.14		YES	ignore
C-RNTI	M		BIT STRING (SIZE (16))	C-RNTI contained in the RRC Re-establishment Request message (TS 36.331 [9])	YES	ignore
ShortMAC-I	O		BIT STRING (SIZE (16))	ShortMAC-I contained in the RRC Re-establishment Request message (TS 36.331 [9])	YES	ignore
UE RLF Report Container	O		OCTET STRING	RLF Report contained in the UEInformationResponse message (TS 36.331 [9])	YES	ignore
RRC Conn Setup Indicator	O		ENUMERATED(RRC Conn Setup, ...)	Included if the RLF Report within the *UE RLF Report Container* IE is retrieved after an RRC connection setup.	YES	reject
RRC Conn Reestab Indicator	O		ENUMERATED(reconfigurationFailure, handoverFailure, otherFailure, ...)	The ReestablishmentCause in RRCConnectionReestablishmentRequest message(TS 36.331 [9])	YES	ignore

9.1.2.19 HANDOVER REPORT

This message is sent by the eNB_1 to report a handover failure event or other critical mobility problem.

Direction: $eNB_1 \rightarrow eNB_2$.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	ignore
Handover Report Type	M		ENUMERATED (HO too early, HO to wrong cell, …, InterRAT ping-pong)		YES	ignore
Handover Cause	M		9.2.6	Indicates handover cause employed for handover from eNB_2	YES	ignore
Source cell ECGI	M		ECGI 9.2.14	ECGI of source cell for handover procedure (in eNB_2)	YES	ignore
Failure cell ECGI	M		ECGI 9.2.14	ECGI of target cell for handover procedure (in eNB_1)	YES	ignore
Re-establishment cell ECGI	C-ifHandoverReportType HoToWrongCell		ECGI 9.2.14	ECGI of cell where UE attempted re-establishment	YES	ignore
Target cell in UTRAN	C-ifHandoverReportType InterRATpingpong		OCTET STRING	Encoded according to *UTRAN Cell ID* in the *Last Visited UTRAN Cell Information* IE, as defined in in TS 25.413 [24]	YES	ignore

Condition	Explanation
ifHandoverReportType HoToWrongCell	This IE shall be present if the *Handover Report Type* IE is set to the value "HO to wrong cell"
ifHandoverReportType InterRATpingpong	This IE shall be present if the *Handover Report Type* IE is set to the value "InterRAT ping-pong"

9.1.2.20 CELL ACTIVATION REQUEST

This message is sent by an eNB to a peer eNB to request a previously switched-off cell/s to be re-activated.

Direction: $eNB_1 \rightarrow eNB_2$.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
Served Cells To Activate		*1 .. <maxCellineNB>*			GLOBAL	reject
>**ECGI**	M		9.2.14		-	-

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

9.1.2.21 CELL ACTIVATION RESPONSE

This message is sent by an eNB to a peer eNB to indicate that one or more cell(s) previously switched-off has(have) been activated.

Direction: $eNB_2 \rightarrow eNB_1$.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
Activated Cell List		*1 .. <maxCellineNB>*			GLOBAL	ignore
>ECGI	M		9.2.14		-	-
Criticality Diagnostics	O		9.2.7		YES	ignore

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

9.1.2.22 CELL ACTIVATION FAILURE

This message is sent by an eNB to a peer eNB to indicate cell activation failure.

Direction: $eNB_2 \rightarrow eNB_1$.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
Cause	M		9.2.6		YES	ignore
Criticality Diagnostics	O		9.2.7		YES	ignore

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 identifies an X2 transport bearer or the S-GW endpoint of the S1 transport bearer associated to an E-RAB. It contains a Transport Layer Address and a GTP Tunnel Endpoint Identifier. The Transport Layer Address is an IP address to be used for the X2 user plane transport (see TS 36.424 [8]) or for the S1 user plane transport (see TS 36.414 [19]). The GTP Tunnel Endpoint Identifier is to be used for the user plane transport between eNB and the S-GW 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. TS 36.424 [8], TS 36.414 [19]	–	–
GTP TEID	M		OCTET STRING (4)	For details and range, see TS 29.281 [26]	–	–

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
E-UTRAN Trace ID	M		OCTET STRING (8)	The E-UTRAN Trace ID IE is composed of the following: Trace Reference defined in TS 32.422 [6] (leftmost 6 octets, with PLMN information coded as in 9.2.4), and Trace Recording Session Reference defined in TS 32.422 [6] (last 2 octets)	–	–
Interfaces To Trace	M		BIT STRING (8)	Each position in the bitmap represents a eNB interface first bit =S1-MME, second bit =X2, third bit =Uu. Other bits reserved for future use. Value "1" indicates "should be traced" . Value "0" indicates "should not be traced".	–	–
Trace Depth	M		ENUMERATED(minimum, medium, maximum, MinimumWithoutVendorSpecificExtension, MediumWithoutVendorSpecificExtension, MaximumWithoutVendorSpecificExtension, ...)	Defined in TS 32.421 [7]	–	–
Trace Collection Entity IP Address	M		BIT STRING (1..160,…)	For details on the Transport Layer Address, see ref. TS 36.424 [8], TS 36.414 [19]	–	–
MDT Configuration	O		9.2.56		YES	ignore

9.2.3 Handover Restriction List

This IE defines area roaming or access restrictions for subsequent mobility action for which the eNB provides information about the target of the mobility action towards the UE, e.g., handover and CCO.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Serving PLMN	M		PLMN Identity 9.2.4		–	–
Equivalent PLMNs		*0..<maxnoof EPLMNs>*		Allowed PLMNs in addition to Serving PLMN. This list corresponds to the list of 'equivalent PLMNs list' as defined in TS 24.301 [14].	–	–
>PLMN Identity	M		9.2.4		–	–
Forbidden TAs		*0..<maxnoof EPLMNsPlusOne>*		intra E-UTRAN roaming restrictions	–	–
>PLMN Identity	M		9.2.4	The PLMN of forbidden TACs	–	–
>Forbidden TACs		*1..<maxnoof ForbTACs>*			–	–
>>TAC	M		OCTET STRING(2)	The forbidden TAC	–	–
Forbidden LAs		*0..<maxnoof EPLMNsPlusOne>*		inter-3GPP RAT roaming restrictions	–	–
>PLMN Identity	M		9.2.4		–	–
>Forbidden LACs		*1..<maxnoof ForbLACs>*			–	–
>>LAC	M		OCTET STRING(2)		–	–
Forbidden inter RATs	O		ENUMERATED(ALL, GERAN, UTRAN, CDMA2000, …,GERAN and UTRAN, CDMA2000 and UTRAN)	inter-3GPP and 3GPP2 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.

9.2.4 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, - 1111 used as filler digit, two digits per octet, - bits 4 to 1 of octet n encoding digit 2n-1 - bits 8 to 5 of octet n encoding digit 2n -The PLMN identity consists of 3 digits from MCC followed by either -a filler digit plus 2 digits from MNC (in case of 2 digit MNC) or -3 digits from MNC (in case of a 3 digit MNC).

9.2.5 DL Forwarding

This element indicates that the E-RAB 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, …)	

9.2.6 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, Encryption And/Or Integrity Protection Algorithms Not Supported, ReportCharacteristicsEmpty, NoReportPeriodicity, ExistingMeasurementID, Unknown eNB Measurement ID, Measurement Temporarily not Available, Unspecified, ..., Load Balancing, Handover Optimisation, Value out of allowed range, Multiple E-RAB ID instances, Switch Off Ongoing, Not supported QCI value, Measurement not supported for the object)	
>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 E-RABs 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
Encryption And/Or Integrity Protection Algorithms Not Supported	The target eNB is unable to support any of the encryption and/or integrity protection algorithms supported by the UE.
ReportCharacteristicsEmpty	The action failed because there is no characteristic reported.
NoReportPeriodicity	The action failed because the periodicity is not defined.
ExistingMeasurementID	The action failed because measurement-ID is already used.
Unknown eNB Measurement ID	The action failed because some eNB Measurement-ID is unknown.
Measurement Temporarily not Available	The eNB can temporarily not provide the requested measurement object.
Load Balancing	The reason for mobility settings change is load balancing.
Handover Optimisation	The reason for mobility settings change is handover optimisation.
Value out of allowed range	The action failed because the proposed Handover Trigger parameter change in the eNB_2 Proposed Mobility Parameters IE is too low or too high.
Multiple E-RAB ID Instances	The action failed because multiple instances of the same E-RAB had been provided to the eNB.
Switch Off Ongoing	The reason for the action is an ongoing switch off i.e. the concerned cell will be switched off after offloading and not be available. It aides the receiving eNB in taking subsequent actions, e.g. selecting the target cell for subsequent handovers.
Not supported QCI value	The action failed because the requested QCI is not supported
Unspecified	Sent when none of the above cause values applies but still the cause is Radio Network Layer related
Measurement not Supported For The Object	At least one of the concerned cell(s) does not support the requested measurement.

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 sub clause 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 sub clause 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 sub clause 10.3)
Message not Compatible with Receiver State	The received message was not compatible with the receiver state (see sub clause 10.4)
Semantic Error	The received message included a semantic error (see sub clause 10.4)
Transfer Syntax Error	The received message included a transfer syntax error (see sub clause 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.

9.2.7 Criticality Diagnostics

The *Criticality Diagnostics* IE is sent by the eNB 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)	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 .. <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.

9.2.8 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
PCI	M		INTEGER (0..503, …)	Physical Cell ID	–	–
Cell ID	M		ECGI 9.2.14		–	–
TAC	M		OCTET STRING(2)	Tracking Area Code	–	–
Broadcast PLMNs		*1..<maxnoof BPLMNs>*		Broadcast PLMNs	–	–
>PLMN Identity	M		9.2.4		–	–
CHOICE *EUTRA-Mode-Info*	M				–	–
>FDD						
>>FDD Info		*1*			–	–
>>>UL EARFCN	M		EARFCN 9.2.26	Corresponds to N_{UL} in ref. TS 36.104 [16].	–	–
>>>DL EARFCN	M		EARFCN 9.2.26	Corresponds to N_{DL} in ref. TS 36.104 [16].	–	–
>>>UL Transmission Bandwidth	M		Transmission Bandwidth 9.2 27		–	–
>>>DL Transmission Bandwidth	M		Transmission Bandwidth 9.2 27	Same as UL Transmission Bandwidth in this release.	–	–
>TDD					–	–
>>TDD Info		*1*			–	–
>>>EARFCN	M		9.2.26	Corresponds to N_{DL}/N_{UL} in ref. TS 36.104 [16].	–	–
>>>Transmission Bandwidth	M		Transmission Bandwidth 9.2 27		–	–
>>>Subframe Assignment	M		ENUMERATED (sa0, sa1, sa2, sa3, sa4, sa5, sa6,…)	Uplink-downlink subframe configurationinformation defined in ref. TS 36.211 [10].	–	–
>>>Special Subframe Info		*1*		Special subframe configurationinformation defined in ref. TS 36.211 [10].	–	–
>>>>Special Subframe Patterns	M		ENUMERATED (ssp0, ssp1, ssp2, ssp3, ssp4, ssp5, ssp6, ssp7, ssp8, …, ssp9)		–	–
>>>>Cyclic Prefix DL	M		ENUMERATED (Normal, Extended,…)		–	–
>>>>Cyclic Prefix UL	M		ENUMERATED (Normal, Extended,…)		–	–
Number of Antenna Ports	O		9.2.43		YES	ignore
PRACH Configuration	O		PRACH Configuration 9.2.50		YES	ignore
MBSFN Subframe Info		*0 .. <maxnoofMBSFN>*		MBSFN subframe defined in TS	GLOBAL	ignore

				36.331 [9].		
>Radioframe Allocation Period	M		ENUMERATED (n1, n2, n4, n8, n16, n32, …)		–	–
>Radioframe Allocation Offset	M		INTEGER (0..7, ...)		–	–
>Subframe Allocation	M		9.2.51		–	–
CSG Id	O		9.2.53		YES	ignore
MBMS Service Area Identity List		*0 .. <maxnoofMBMSServiceAreaIdentities >*		Supported MBMS Service Area Identities in the cell.	GLOBAL	ignore
>MBMS Service Area Identity			OCTET STRING(2)	MBMS Service Area Identities as defined in TS 23.003 [xx].		
MultibandInfoList	O		9.2.60		YES	ignore

Range bound	Explanation
maxnoofBPLMNs	Maximum no. of Broadcast PLMN Ids. Value is 6.
maxnoofMBSFN	Maximum no. of MBSFN frame allocation with different offset. Value is 8.
maxnoofMBMSServiceAreaIdentities	Maximum no. of MBMS Service Area Identities. Value is 256.

9.2.9 E-RAB Level QoS Parameters

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

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
QCI	M		INTEGER (0..255)	QoS Class Identifier defined in TS 23.401 [12]. Logical range and coding specified in TS 23.203 [13].	–	–
Allocation and Retention Priority	M		9.2.31		–	–
GBR QoS Information	O		9.2.10	This IE applies to GBR bearers only and shall be ignored otherwise.	–	–

9.2.10 GBR QoS Information

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

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
E-RAB Maximum Bit Rate Downlink	M		Bit Rate 9.2.11	Maximum Bit Rate in DL (i.e. from EPC to E-UTRAN) for the bearer. Details in TS 23.401 [12].	–	–
E-RAB Maximum Bit Rate Uplink	M		Bit Rate 9.2.11	Maximum Bit Rate in UL (i.e. from E-UTRAN to EPC) for the bearer. Details in TS 23.401 [12].	–	–
E-RAB Guaranteed Bit Rate Downlink	M		Bit Rate 9.2.11	Guaranteed Bit Rate (provided that there is data to deliver) in DL (i.e. from EPC to E-UTRAN) for the bearer. Details in TS 23.401 [12].	–	–
E-RAB Guaranteed Bit Rate Uplink	M		Bit Rate 9.2.11	Guaranteed Bit Rate (provided that there is data to deliver) in UL (i.e. from E-UTRAN to EPC) for the bearer. Details in TS 23.401 [12].	–	–

9.2.11 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 E-RAB, 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

9.2.12 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 9.2.11		–	–
UE Aggregate Maximum Bit Rate Uplink	M		Bit Rate 9.2.11		–	–

9.2.13 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 "1" = Handover Cancel "2" = Load Indication "3" = Error Indication "4" = SN Status Transfer "5" = UE Context Release "6" = X2 Setup "7" = Reset "8" = eNB Configuration Update "9" = Resource Status Reporting Initiation "10" = Resource Status Reporting '11' = Private Message "12" = Mobility Settings Change '13' = Radio Link Failure Indication '14' = Handover Report '15' = Cell Activation
Type of Message	M		CHOICE (Initiating Message, Successful Outcome, Unsuccessful Outcome, …)	

9.2.14 ECGI

The E-UTRAN Cell Global Identifier (ECGI) is used to globally identify a cell (see TS 36.401 [2]).

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
PLMN Identity	M		9.2.4		–	–
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 9.2.22) identifying the eNB that controls the cell	–	–

9.2.15 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)		–	–

9.2.16 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		9.2.20		–	–
MME code	M		OCTET STRING (1)		–	–

9.2.17 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 .. <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 110.

9.2.18 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". The maximum number of Physical Resource Blocks is 110

9.2.19 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 TS 36.213 [11]. Value 0 indicates "Tx not exceeding RNTP threshold". 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 TS 36.213 [11]	–	–
Number Of Cell-specific Antenna Ports	M		ENUMERATED (1, 2, 4, …)	*P* (number of antenna ports for cell-specific reference signals) defined in TS 36.211 [10]	–	–
P_B	M		INTEGER (0..3, …)	P_B is defined in TS 36.213 [11]	–	–
PDCCH Interference Impact	M		INTEGER (0..4, …)	Measured by Predicted Number Of Occupied PDCCH OFDM Symbols (see TS 36.211 [10]). Value 0 means "no prediction is available"	–	–

9.2.20 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		9.2.4		–	–
MME Group Id	M		OCTET STRING(2)		–	–

9.2.21 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, …)		–	–

9.2.22 Global eNB ID

This IE is used to globally identify an eNB (see TS 36.401 [2]).

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
PLMN Identity	M		9.2.4		–	–
CHOICE *eNB ID*	M				–	–
>Macro eNB ID	M		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 9.2.14) identifying each cell controlled by the eNB	–	–
>Home eNB ID	M		BIT STRING (28)	Equal to the value of the *E-UTRAN Cell Identifier* IE contained in the *ECGI* IE (see section 9.2.14) identifying the cell controlled by the eNB	–	–

9.2.23 E-RAB ID

This IE uniquely identifies an E-RAB for a UE.

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

9.2.24 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 TS 36.401 [2].

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

9.2.25 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 (TS 36.300 [15]).

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

9.2.26 EARFCN

The E-UTRA Absolute Radio Frequency Channel Number defines the carrier frequency used in a cell for a given direction (UL or DL) in FDD or for both UL and DL directions in TDD.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
EARFCN	M		INTEGER (0..maxEARFCN)	The relation between EARFCN and carrier frequency (in MHz) are defined in TS 36.104 [16].

Range bound	Explanation
maxEARFCN	Maximum value of EARFCNs. Value is 65535.

9.2.27 Transmission Bandwidth

The *Transmission Bandwidth* IE is used to indicate the UL or DL transmission bandwidth expressed in units of resource blocks " N_{RB} " (TS 36.104 [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
Transmission Bandwidth	**M**		ENUMERATED (bw6, bw15, bw25, bw50, bw75, bw100,...)	

9.2.28 E-RAB List

The IE contains a list of E-RAB identities with a cause value. It is used for example to indicate not admitted bearers.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
E-RAB List Item		*1 .. <maxnoofBearers>*			EACH	ignore
>E-RAB ID	M		9.2.23		–	–
>Cause	M		9.2.6		–	–

Range bound	Explanation
maxnoofBearers	Maximum no. of E-RABs. Value is 256.

9.2.29 UE Security Capabilities

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

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
Encryption Algorithms	M		BIT STRING (16, ...)	Each position in the bitmap represents an encryption algorithm: "all bits equal to 0" - UE supports no other algorithm than EEA0 'first bit' - 128-EEA1, 'second bit' - 128-EEA2, 'third bit' - 128-EEA3, other bits reserved for future use. Value "1" indicates support and value '0' indicates no support of the algorithm. Algorithms are defined in TS 33.401 [18].
Integrity Protection Algorithms	M		BIT STRING (16, ...)	Each position in the bitmap represents an integrity protection algorithm: all bits equal to 0" - UE supports no other algorithm than EIA0 (TS 33.401 [18]) 'first bit' - 128-EIA1, 'second bit' - 128-EIA2, 'third bit' - 128-EIA3, other bits reserved for future use. Value "1" indicates support and value '0' indicates no support of the algorithm. Algorithms are defined in TS 33.401 [18].

9.2.30 AS Security Information

The *AS Security Information* IE is used to generate the key material to be used for AS security with the UE.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
Key eNodeB Star	M		BIT STRING (256)	The KeNB* as defined in TS 36.331 [9]
Next Hop Chaining Count	M		INTEGER (0..7)	Next Hop Chaining Count (NCC) defined in TS 33.401 [18]

9.2.31 Allocation and Retention Priority

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

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Priority Level	M		INTEGER (0..15)	**Desc.:** This IE should be understood as 'priority of allocation and retention' (see TS 23.401 [12]). **Usage:** 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.
Pre-emption Capability	M		ENUMERATED(shall not trigger pre-emption, may trigger pre-emption)	**Descr.:** This IE indicates the pre-emption capability of the request on other E-RABs **Usage:** The E-RAB shall not pre-empt other E-RABs or, the E-RAB may pre-empt other E-RABs The Pre-emption Capability indicator applies to the allocation of resources for an E-RAB and as such it provides the trigger to the pre-emption procedures/processes of the eNB.
Pre-emption Vulnerability	M		ENUMERATED(not pre-emptable, pre-emptable)	**Desc.:** This IE indicates the vulnerability of the E-RAB to pre-emption of other E-RABs. **Usage**: The E-RAB shall not be pre-empted by other E-RABs or the E-RAB may be pre-empted by other RABs. Pre-emption Vulnerability indicator applies for the entire duration of the E-RAB, unless modified, and as such indicates whether the E-RAB is a target of the pre-emption procedures/processes of the eNB.

9.2.32 Time to Wait

This IE defines the minimum allowed waiting times.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Time to Wait	M		ENUMERATED(1s, 2s, 5s, 10s, 20s, 60s, …)	

9.2.33 SRVCC Operation Possible

The IE indicates that both the UE and the MME are SRVCC-capable. E-UTRAN behaviour on reception of this is specified in TS 23.216 [20].

IE/Group Name	Presence	Range	IE type and reference	Semantics description
SRVCC Operation Possible	M		ENUMERATED(Possible, …)	

9.2.34 Hardware Load Indicator

The *Hardware Load Indicator* IE indicates the status of the Hardware Load experienced by the cell.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
DL Hardware Load Indicator	M		9.2.36	
UL Hardware Load Indicator	M		9.2.36	

9.2.35 S1 TNL Load Indicator

The *S1 TNL Load Indicator* IE indicates the status of the S1 Transport Network Load experienced by the cell.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
DL S1TNL Load Indicator	M		9.2.36	
UL S1TNL Load Indicator	M		9.2.36	

9.2.36 Load Indicator

The *Load Indicator* IE indicates the status of Load.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Load Indicator	M		ENUMERATED (LowLoad, MediumLoad, HighLoad, Overload, ...)	

9.2.37 Radio Resource Status

The *Radio Resource Status* IE indicates the usage of the PRBs for all traffic in Downlink and Uplink (TS 36.314 [22], TS 23.203 [13]).

IE/Group Name	Presence	Range	IE type and reference	Semantics description
DL GBR PRB usage	M		INTEGER (0..100)	
UL GBR PRB usage	M		INTEGER (0..100)	
DL non-GBR PRB usage	M		INTEGER (0..100)	
UL non-GBR PRB usage	M		INTEGER (0..100)	
DL Total PRB usage	M		INTEGER (0..100)	
UL Total PRB usage	M		INTEGER (0..100)	

9.2.38 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. The overall mechanism is described in TS 36.300 [15].

NOTE: The definition of this IE is aligned with the definition of the *UE History Information* IE in TS 36.413 [4].

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Last Visited Cell List		*1 .. <maxnoofCells>*		Most recent information is added to the top of this list	–	–
>Last Visited Cell Information	M		9.2.39		–	–

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

9.2.39 Last Visited Cell Information

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

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
CHOICE *Last Visited Cell Information*	M				-	-
>E-UTRAN Cell					-	-
>>Last Visited E-UTRAN Cell Information	M		9.2.40		-	-
>UTRAN Cell					-	-
>>Last Visited UTRAN Cell Information	M		OCTET STRING	Defined in TS 25.413 [24]		
>GERAN Cell					-	-
>>Last Visited GERAN Cell Information	M		9.2.41		-	-

9.2.40 Last Visited E-UTRAN Cell Information

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

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Global Cell ID	M		ECGI 9.2.14		-	-
Cell Type	M		9.2.42		-	-
Time UE stayed in Cell	M		INTEGER (0..4095)	The duration of the time the UE stayed in the cell in seconds. If the UE stays in a cell more than 4095s, this IE is set to 4095	-	-
Time UE stayed in Cell Enhanced Granularity	O		INTEGER (0..40950)	The duration of the time the UE stayed in the cell in 1/10 seconds. If the UE stays in a cell more than 4095s, this IE is set to 40950.	YES	ignore
HO Cause Value	O		9.2.1.3	The cause for the handover from the E-UTRAN cell.	YES	ignore

9.2.41 Last Visited GERAN Cell Information

The Last Visited Cell Information for GERAN is currently undefined.

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

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
CHOICE *Last Visited GERAN Cell Information*	M				-	-
>Undefined	M		NULL		-	-

9.2.42 Cell Type

The cell type provides the cell coverage area.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Cell Size	M		ENUMERATED (verysmall, small, medium, large, …)		-	-

9.2.43 Number of Antenna Ports

The *Number of Antenna Ports* IE is used to indicate the number of cell specific antenna ports.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
Number of Antenna Ports			ENUMERATED (an1, an2, an4,...)	an1 = One antenna port an2 = Two antenna ports an4 = Four antenna ports

9.2.44 Composite Available Capacity Group

The *Composite Available Capacity Group* IE indicates the overall available resource level in the cell in Downlink and Uplink.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Composite Available Capacity Downlink	M		Composite Available Capacity 9.2.45	For the Downlink	-	-
Composite Available Capacity Uplink	M		Composite Available Capacity 9.2.45	For the Uplink	-	-

9.2.45 Composite Available Capacity

The *Composite Available Capacity* IE indicates the overall available resource level in the cell in either Downlink or Uplink.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Cell Capacity Class Value	O		9.2.46		-	-
Capacity Value	M		9.2.47	"0" indicates no resource is available, Measured on a linear scale.	-	-

9.2.46 Cell Capacity Class Value

The *Cell Capacity Class Value* IE indicates the the value that classifies the cell capacity with regards to the other cells. The *Cell Capacity Class Value* IE only indicates resources that are configured for traffic purposes.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Cell Capacity Class Value	M		INTEGER (1..100,...)	Value 1 shall indicate the minimum cell capacity, and 100 shall indicate the maximum cell capacity. There should be linear relation between cell capacity and Cell Capacity Class Value	-	-

9.2.47 Capacity Value

The *Capacity Value* IE indicates the amount of resources that are available relative to the total E-UTRAN resources. The *Capacity Value* IE can be weighted according to the ratio of cell capacity class values, if available.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Capacity Value	M		INTEGER (0..100)	Value 0 shall indicate no available capacity, and 100 shall indicate maximum available capacity . Capacity Value should be measured on a linear scale.	-	-

9.2.48 Mobility Parameters Information

The *Mobility Parameters Information* IE contains the change of the Handover Trigger as compared to its current value. The Handover Trigger corresponds to the threshold at which a cell initialises the handover preparation procedure towards a specific neighbour cell. Positive value of the change means the handover is proposed to take place later.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Handover Trigger Change	M		INTEGER (-20..20)	The actual value is IE value * 0.5 dB.

9.2.49 Mobility Parameters Modification Range

The *Mobility Parameters Modification Range* IE contains the range of *Handover Trigger Change* values permitted by the eNB_2 at the moment the MOBILITY CHANGE FAILURE message is sent.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Handover Trigger Change Lower Limit	M		INTEGER (-20..20)	The actual value is IE value * 0.5 dB.
Handover Trigger Change Upper Limit	M		INTEGER (-20..20)	The actual value is IE value * 0.5 dB.

9.2.50 PRACH Configuration

This IE indicates the PRACH resources used in neighbor cell.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
RootSequenceIndex	M		INTEGER (0..837)	See section 5.7.2. in TS 36.211 [10]	–	–
ZeroCorrelationZoneConfiguration	M		INTEGER (0..15)	See section 5.7.2. in TS 36.211 [10]	–	–
HighSpeedFlag	M		BOOLEAN	TRUE corresponds to Restricted set and FALSE to Unrestricted set, see section 5.7.2 in TS 36.211 [10]	–	–
PRACH-FrequencyOffset	M		INTEGER (0..94)	See section 5.7.1 of TS 36.211 [10]	–	–
PRACH-ConfigurationIndex	O		INTEGER (0..63)	Mandatory for TDD, shall not be present for FDD. See section 5.7.1. in TS 36.211 [10]	–	–

9.2.51 Subframe Allocation

The *Subframe Allocation* IE is used to indicate the subframes that are allocated for MBSFN within the radio frame allocation period as defined in TS 36.331 [9].

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
CHOICE *Subframe Allocation*	M			
>*Oneframe*	M		BITSTRING (SIZE(6))	
>*Fourframes*	M		BITSTRING (SIZE(24))	

9.2.52 CSG Membership Status

This element indicates the membership status of the UE to a particular CSG.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
CSG Membership Status	M		ENUMERATED (member, not-member)		-	-

9.2.53 CSG ID

This element indicates the identifier of the Closed Subscriber Group.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
CSG ID	M		BIT STRING (SIZE (27))		-	-

9.2.54 ABS Information

This IE provides information about which sub frames the sending eNB is configuring as almost blank subframes and which subset of almost blank subframes are recommended for configuring measurements towards the UE. Almost blank subframes are subframes with reduced power on some physical channels and/or reduced activity.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE *ABS Information*	M		–	–
>FDD			–	–
>>ABS Pattern Info	M		BIT STRING (SIZE(40))	Each position in the bitmap represents a DL subframe, for which value "1" indicates "ABS" and value "0" indicates "non ABS". The first position of the ABS pattern corresponds to subframe 0 in a radio frame where *SFN* = 0. The ABS pattern is continuously repeated in all radio frames. The maximum number of subframes is 40.
>>Number Of Cell-specific Antenna Ports	M		ENUMERATED (1, 2, 4, …)	*P* (number of antenna ports for cell-specific reference signals) defined in TS 36.211 [10]
>>Measurement Subset	M		BIT STRING (SIZE(40))	Indicates a subset of the ABS Pattern Info above, and is used to configure specific measurements towards the UE.
>TDD			–	–
>>ABS Pattern Info	M		BIT STRING (1..70, ...)	Each position in the bitmap represents a DL subframe for which value "1" indicates "ABS" and value "0" indicates "non ABS". The maximum number of subframes depends on UL/DL subframe configuration. The maximum number of subframes is 20 for UL/DL subframe configuration 1~5; 60 for UL/DL subframe configuration 6; 70 for UL/DL subframe configuration 0. UL/DL subframe configuration defined in TS 36.211 [10]. The first position of the ABS pattern corresponds to subframe 0 in a radio frame where *SFN* = 0. The ABS pattern is continuously repeated in all radio frames, and restarted each time *SFN* = 0.
>>Number Of Cell-specific Antenna Ports	M		ENUMERATED (1, 2, 4, …)	*P* (number of antenna ports for cell-specific reference signals) defined in TS 36.211 [10]
>>Measurement Subset	M		BIT STRING (1..70, ...)	Indicates a subset of the ABS Pattern Info above, and is used to configure specific measurements towards the UE
>ABS Inactive	M		NULL	Indicates that interference coordination by means of almost blank sub frames is not active

9.2.55 Invoke Indication

This IE provides an indication about which type of information the sending eNB would like the receiving eNB to send back.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Invoke Indication	M		ENUMERATED (ABS Information, …)	–

9.2.56 MDT Configuration

The IE defines the MDT configuration parameters.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
MDT Activation	M		ENUMERATED(Immediate MDT only, Immediate MDT and Trace, …)	
CHOICE *Area Scope of MDT*	M			
>*Cell Based*				
>>**Cell ID List for MDT**		*1 .. <maxnoofCellIDforMDT>*		
>>>E-CGI	M		9.2.14	
>*TA Based*				
>>**TA List for MDT**		*1 .. <maxnoofTAforMDT>*		
>>>TAC	M		OCTET STRING (2)	Tracking Area Code
>*PLMN Wide*			NULL	
Measurements to Activate	M		BITSTRING (SIZE(8))	Each position in the bitmap indicates a MDT measurement, as defined in TS 37.320 [25]. First Bit = M1, Second Bit = M2 Other bits are reserved for future use and are ignored if received. Value '1' indicates 'activate' and value '0' indicates 'do not activate'.
Reporting Trigger MDT	M		ENUMERATED (periodic, A2event-triggered, …)	
Threshold Event A2	C-ifM1A2trigger			Included in case of event-triggered reporting for measurement M1.
>CHOICE *Threshold*	M			
>>*RSRP*				
>>>Threshold RSRP	M		INTEGER (0..97)	This IE is defined in TS 36.331 [9].
>>*RSRQ*				
>>>Threshold RSRQ	M		INTEGER (0..34)	This IE is defined in TS 36.331 [9].
Periodic reporting MDT	C-ifperiodicMDT			Included in case of periodic reporting.
>Report interval	M		ENUMERATED (ms120, ms240, ms480, ms640, ms1024, ms2048, ms5120, ms10240, , min1, min6, min12, min30, min60)	This IE is defined in TS 36.331 [9].
>Report amount	M		ENUMERATED (1, 2, 4, 8, 16, 32, 64, infinity)	Number of reports.

Range bound	Explanation
maxnoofCellIDforMDT	Maximum no. of Cell ID subject for MDT scope. Value is 32.
maxnoofTAforMDT	Maximum no. of TA subject for MDT scope. Value is 8.

Condition	Explanation
ifM1A2trigger	This IE shall be present if the *Measurements to Activate* IE has the first bit set to "1" and the *Reporting Trigger* IE is set to "A2event-triggered".
ifperiodicMDT	This IE shall be present if the *Reporting Trigger* IE is set to "periodic".

9.2.57 Void

9.2.58 ABS Status

The *ABS Status* IE is used to aid the eNB designating ABS to evaluate the need for modification of the ABS pattern.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
DL ABS status	M		INTEGER (0..100)	Percentage of used ABS resources. The numerator of the percentage calculation consists of resource blocks within the ABS indicated in the *Usable ABS Pattern Info* IE allocated by the eNB_2 for UEs needing protection by ABS from inter-cell interference for DL scheduling, or allocated by the eNB_2 for other reasons (e.g. some control channels). The denominator of the percentage calculation is the total quantity of resource blocks within the ABS indicated in the *Usable ABS Pattern Info* IE.
CHOICE *Usable ABS Information*	M		–	–
>FDD			–	–
>>Usable ABS Pattern Info	M		BIT STRING (SIZE(40))	Each position in the bitmap represents a subframe, for which value "1" indicates "ABS that has been designated as protected from inter-cell interference by the eNB_1, and available to serve this purpose for DL scheduling in the eNB_2" and value "0" is used for all other subframes. The pattern represented by the bitmap is a subset of, or the same as, the corresponding *ABS Pattern Info* IE conveyed in the LOAD INFORMATION message from the eNB_1.
>TDD			–	–
>>Usable ABS Pattern Info	M		BIT STRING (1..70)	Each position in the bitmap represents a subframe, for which value "1" indicates "ABS that has been designated as protected from inter-cell interference by the eNB_1, and available to serve this purpose for DL scheduling in the eNB_2" and value "0" is used for all other subframes. The pattern represented by the bitmap is a subset of, or the same as, the corresponding *ABS Pattern Info* IE conveyed in the LOAD INFORMATION message from the eNB_1.

9.2.59 Management Based MDT Allowed

This information element is used by the eNB to allow selection of the UE for management based MDT as described in TS 32.422 [6].

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Management Based MDT Allowed	M		ENUMERATED (Allowed, ...)	

9.2.60 MultibandInfoList

The *MultibandInfoList* IE contains all the frequency bands that a cell belongs to listed in decreasing order of preference.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
BandInfo		*1 .. <maxnoofBands>*			–	–
>FrequencyBandIndicator	M		INTEGER (1..64)	indicates the E-UTRA operating band as defined in TS 36.101 [42, table 5.5-1].	–	–

Range bound	Explanation
maxnoofBands	Maximum number of frequency bands that a cell belongs to.

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

9.3.1 General

X2AP ASN.1 definition conforms to ITU-T Rec. X.680 [27] and ITU-T Rec. X.681 [28].

Sub clause 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 sub clause and the tabular format in sub clause 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:

- 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.

NOTE: In the above 'IE' means an IE in the object set with an explicit ID. If one IE needs to appear more than once in one object set, then the different occurrences have different IE IDs.

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.

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


    CellActivationRequest,
    CellActivationResponse,
    CellActivationFailure,
    ENBConfigurationUpdate,
    ENBConfigurationUpdateAcknowledge,
    ENBConfigurationUpdateFailure,
    ErrorIndication,
    HandoverCancel,
    HandoverReport,
    HandoverPreparationFailure,
    HandoverRequest,
    HandoverRequestAcknowledge,
    LoadInformation,
    PrivateMessage,
    ResetRequest,
    ResetResponse,
    ResourceStatusFailure,
    ResourceStatusRequest,
    ResourceStatusResponse,
    ResourceStatusUpdate,
    RLFIndication,
    SNStatusTransfer,
    UEContextRelease,
    X2SetupFailure,
    X2SetupRequest,
    X2SetupResponse,
    MobilityChangeRequest,
    MobilityChangeAcknowledge,
    MobilityChangeFailure
```

```
FROM X2AP-PDU-Contents

    id-cellActivation,
    id-eNBConfigurationUpdate,
    id-errorIndication,
    id-handoverCancel,
    id-handoverReport,
    id-handoverPreparation,

    id-loadIndication,
    id-privateMessage,
    id-reset,

    id-resourceStatusReporting,
    id-resourceStatusReportingInitiation,
    id-rLFIndication,
    id-snStatusTransfer,
    id-uEContextRelease,
    id-x2Setup,
    id-mobilitySettingsChange



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                                                 |
    resourceStatusReportingInitiation                       |
    eNBConfigurationUpdate                                  |
    mobilitySettingsChange                                  |
    cellActivation                                          ,
    ...
}

X2AP-ELEMENTARY-PROCEDURES-CLASS-2 X2AP-ELEMENTARY-PROCEDURE ::= {
    snStatusTransfer                        |
    uEContextRelease                        |
```

```
    handoverCancel                          |
    errorIndication                         |
    resourceStatusReporting                 |
    loadIndication                          |
    privateMessage                          |
    rLFIndication                           |   handoverReport,
    ...

}


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

handoverReport X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      HandoverReport
    PROCEDURE CODE          id-handoverReport
    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
}

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

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

rLFIndication X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      RLFIndication
    PROCEDURE CODE          id-rLFIndication
    CRITICALITY             ignore
}

privateMessage          X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      PrivateMessage
```

```
    PROCEDURE CODE          id-privateMessage
    CRITICALITY             ignore
}

mobilitySettingsChange  X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      MobilityChangeRequest
    SUCCESSFUL OUTCOME      MobilityChangeAcknowledge
    UNSUCCESSFUL OUTCOME    MobilityChangeFailure
    PROCEDURE CODE          id-mobilitySettingsChange
    CRITICALITY             reject
}

cellActivation  X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      CellActivationRequest
    SUCCESSFUL OUTCOME      CellActivationResponse
    UNSUCCESSFUL OUTCOME    CellActivationFailure
    PROCEDURE CODE          id-cellActivation
    CRITICALITY             reject
}


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
    ABSInformation,
    ABS-Status,
    AS-SecurityInformation,
    Cause,
    CompositeAvailableCapacityGroup,
    COUNTvalue,
    CriticalityDiagnostics,
```

```
    CRNTI,
    CSGMembershipStatus,
    CSG-Id,
    DeactivationIndication,
    DL-Forwarding,
    ECGI,
    E-RAB-ID,
    E-RAB-Level-QoS-Parameters,
    E-RAB-List,
    EUTRANTraceID,
    GlobalENB-ID,
    GTPtunnelEndpoint,
    GUGroupIDList,
    GUMMEI,
    HandoverReportType,
    HandoverRestrictionList,
    InvokeIndication,
    LocationReportingInformation,
    MDT-Configuration,
    ManagementBasedMDTallowed,
    Neighbour-Information,
    PCI,
    PDCP-SN,
    PLMN-Identity,
    ReceiveStatusofULPDCPSDUs,
    Registration-Request,
    RelativeNarrowbandTxPower,
    RadioResourceStatus,
    RRCConnReestabIndicator,
    RRCConnSetupIndicator,
    UE-RLF-Report-Container,
    RRC-Context,
    ServedCell-Information,
    ServedCells,
    ShortMAC-I,
    SRVCCOperationPossible,
    SubscriberProfileIDforRFP,
    TargetCellInUTRAN,
    TargeteNBtoSource-eNBTransparentContainer,
    TimeToWait,
    TraceActivation,
    TraceDepth,

    TransportLayerAddress,
    UEAggregateMaximumBitRate,
    UE-HistoryInformation,
    UE-S1AP-ID,
    UESecurityCapabilities,
    UE-X2AP-ID,
    UL-HighInterferenceIndicationInfo,
    UL-InterferenceOverloadIndication,
    HWLoadIndicator,
    S1TNLLoadIndicator,
    Measurement-ID,
```

```
    ReportCharacteristics,
    MobilityParametersInformation,
    MobilityParametersModificationRange



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-ABSInformation,
    id-ActivatedCellList,
    id-Cause,
    id-CellInformation,
    id-CellInformation-Item,
    id-CellMeasurementResult,
    id-CellMeasurementResult-Item,
    id-CellToReport,
    id-CellToReport-Item,
    id-CompositeAvailableCapacityGroup,
    id-CriticalityDiagnostics,
    id-DeactivationIndication,
    id-E-RABs-Admitted-Item,
    id-E-RABs-Admitted-List,
    id-E-RABs-NotAdmitted-List,
    id-E-RABs-SubjectToStatusTransfer-List,
    id-E-RABs-SubjectToStatusTransfer-Item,
    id-E-RABs-ToBeSetup-Item,
    id-GlobalENB-ID,
    id-GUGroupIDList,
    id-GUGroupIDToAddList,
    id-GUGroupIDToDeleteList,
    id-GUMMEI-ID,
    id-InvokeIndication,
    id-New-eNB-UE-X2AP-ID,
    id-Old-eNB-UE-X2AP-ID,
    id-Registration-Request,
    id-ReportingPeriodicity,
    id-ServedCells,
    id-ServedCellsToActivate,
    id-ServedCellsToAdd,
    id-ServedCellsToModify,
```

```
    id-ServedCellsToDelete,
    id-SRVCCOperationPossible,
    id-TargetCell-ID,
    id-TargeteNBtoSource-eNBTransparentContainer,
    id-TimeToWait,
    id-TraceActivation,
    id-UE-ContextInformation,
    id-UE-HistoryInformation,
    id-UE-X2AP-ID,
    id-Measurement-ID,
    id-ReportCharacteristics,
    id-ENB1-Measurement-ID,
    id-ENB2-Measurement-ID,
    id-ENB1-Cell-ID,
    id-ENB2-Cell-ID,
    id-ENB2-Proposed-Mobility-Parameters,
    id-ENB1-Mobility-Parameters,
    id-ENB2-Mobility-Parameters-Modification-Range,
    id-FailureCellPCI,
    id-Re-establishmentCellECGI,
    id-FailureCellCRNTI,
    id-ShortMAC-I,
    id-SourceCellECGI,
    id-FailureCellECGI,
    id-HandoverReportType,
    id-UE-RLF-Report-Container,
    id-PartialSuccessIndicator,
    id-MeasurementInitiationResult-List,
    id-MeasurementInitiationResult-Item,
    id-MeasurementFailureCause-Item,
    id-CompleteFailureCauseInformation-List,
    id-CompleteFailureCauseInformation-Item,
    id-CSGMembershipStatus,
    id-CSG-Id,
    id-MDTConfiguration,
    id-ManagementBasedMDTallowed,
    id-ABS-Status,
    id-RRCConnSetupIndicator,
    id-RRCConnReestabIndicator,
    id-TargetCellInUTRAN,

    maxCellineNB,
    maxnoofBearers,
    maxnoofPDCP-SN,
    maxFailedMeasObjects,
    maxnoofCellIDforMDT,
    maxnoofTAforMDT

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 mandatory }|
    { ID id-TraceActivation                 CRITICALITY ignore  TYPE TraceActivation           PRESENCE optional}|
    { ID id-SRVCCOperationPossible          CRITICALITY ignore  TYPE SRVCCOperationPossible    PRESENCE optional}|
    { ID id-CSGMembershipStatus             CRITICALITY reject  TYPE CSGMembershipStatus       PRESENCE optional},
    ...
}

UE-ContextInformation ::= SEQUENCE {
    mME-UE-S1AP-ID                      UE-S1AP-ID,
    uESecurityCapabilities              UESecurityCapabilities,
    aS-SecurityInformation              AS-SecurityInformation,
    uEaggregateMaximumBitRate           UEAggregateMaximumBitRate,
    subscriberProfileIDforRFP           SubscriberProfileIDforRFP       OPTIONAL,
    e-RABs-ToBeSetup-List               E-RABs-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 ::= {
{ ID id-ManagementBasedMDTallowed   CRITICALITY ignore  EXTENSION ManagementBasedMDTallowed     PRESENCE optional },
    ...
}

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

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

E-RABs-ToBeSetup-Item ::= SEQUENCE {
    e-RAB-ID                    E-RAB-ID,
    e-RAB-Level-QoS-Parameters      E-RAB-Level-QoS-Parameters,
    dL-Forwarding                   DL-Forwarding                                       OPTIONAL,
    uL-GTPtunnelEndpoint            GTPtunnelEndpoint,
    iE-Extensions                   ProtocolExtensionContainer { {E-RABs-ToBeSetup-ItemExtIEs} } OPTIONAL,
    ...
}
```

```
E-RABs-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 ignore  TYPE UE-X2AP-ID                                 PRESENCE mandatory} |
    { ID id-New-eNB-UE-X2AP-ID                          CRITICALITY ignore  TYPE UE-X2AP-ID                                 PRESENCE mandatory} |
    { ID id-E-RABs-Admitted-List                        CRITICALITY ignore  TYPE E-RABs-Admitted-List                       PRESENCE mandatory} |
    { ID id-E-RABs-NotAdmitted-List                     CRITICALITY ignore  TYPE E-RAB-List                                 PRESENCE optional} |
    { ID id-TargeteNBtoSource-eNBTransparentContainer   CRITICALITY ignore  TYPE TargeteNBtoSource-eNBTransparentContainer   PRESENCE mandatory }|
    { ID id-CriticalityDiagnostics                      CRITICALITY ignore  TYPE CriticalityDiagnostics                     PRESENCE optional },
    ...
}

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

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

E-RABs-Admitted-Item ::= SEQUENCE {
    e-RAB-ID                    E-RAB-ID,
    uL-GTP-TunnelEndpoint           GTPtunnelEndpoint                                       OPTIONAL,
    dL-GTP-TunnelEndpoint           GTPtunnelEndpoint                                       OPTIONAL,
    iE-Extensions                   ProtocolExtensionContainer { {E-RABs-Admitted-Item-ExtIEs} }   OPTIONAL,
    ...
}

E-RABs-Admitted-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 ignore  TYPE UE-X2AP-ID             PRESENCE mandatory} |
    { ID id-Cause                       CRITICALITY ignore  TYPE Cause                  PRESENCE mandatory} |
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics PRESENCE optional },

    ...
}

-- **************************************************************
--
-- Handover Report
--
-- **************************************************************

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

HandoverReport-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-HandoverReportType          CRITICALITY ignore  TYPE HandoverReportType PRESENCE mandatory}|
    { ID id-Cause                       CRITICALITY ignore  TYPE Cause              PRESENCE mandatory} |
    { ID id-SourceCellECGI              CRITICALITY ignore  TYPE ECGI               PRESENCE mandatory}|
    { ID id-FailureCellECGI             CRITICALITY ignore  TYPE ECGI               PRESENCE mandatory} |
    { ID id-Re-establishmentCellECGI    CRITICALITY ignore  TYPE ECGI               PRESENCE conditional} -- The IE shall be present if the
Handover Report Type IE is set to 'HO to Wrong Cell' -- |
    { ID id-TargetCellInUTRAN           CRITICALITY ignore  TYPE TargetCellInUTRAN  PRESENCE conditional} -- The IE shall be present if the
Handover Report Type IE is set to "InterRAT ping-pong" --,
    ...
}

-- **************************************************************
--
-- 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-E-RABs-SubjectToStatusTransfer-List CRITICALITY ignore  TYPE E-RABs-SubjectToStatusTransfer-List    PRESENCE mandatory} ,
    ...
}
```

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

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

E-RABs-SubjectToStatusTransfer-Item ::= SEQUENCE {
    e-RAB-ID                                E-RAB-ID,

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

E-RABs-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 ignore  TYPE UE-X2AP-ID             PRESENCE optional} |
    { 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 ::= {
{ ID id-ABSInformation          CRITICALITY ignore  EXTENSION ABSInformation        PRESENCE optional }|
{ ID id-InvokeIndication        CRITICALITY ignore  EXTENSION InvokeIndication      PRESENCE optional },
    ...
}

-- **************************************************************
--
-- 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-GUGroupIDToAddList      CRITICALITY reject  TYPE GUGroupIDList             PRESENCE optional} |
    { ID id-GUGroupIDToDeleteList   CRITICALITY reject  TYPE GUGroupIDList             PRESENCE optional},
    ...
}

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

ServedCellsToModify-Item::= SEQUENCE {
    old-ecgi                        ECGI,
    servedCellInfo                  ServedCell-Information,
    neighbour-Info                  Neighbour-Information          OPTIONAL,
    iE-Extensions                   ProtocolExtensionContainer { { ServedCellsToModify-Item-ExtIEs} } OPTIONAL,
    ...
}

ServedCellsToModify-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
{ ID id-DeactivationIndication          CRITICALITY ignore  EXTENSION DeactivationIndication                    PRESENCE optional },
    ...
}


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-ENB1-Measurement-ID     CRITICALITY reject  TYPE Measurement-ID               PRESENCE mandatory}|
    { ID id-ENB2-Measurement-ID     CRITICALITY ignore  TYPE Measurement-ID               PRESENCE conditional}|-- The IE shall be present if the
Registration Request IE is set to 'Stop'--
    { ID id-Registration-Request    CRITICALITY reject  TYPE Registration-Request         PRESENCE mandatory}|
    { ID id-ReportCharacteristics   CRITICALITY reject  TYPE ReportCharacteristics        PRESENCE optional}|
    { ID id-CellToReport            CRITICALITY ignore  TYPE CellToReport-List            PRESENCE mandatory}|
    { ID id-ReportingPeriodicity    CRITICALITY ignore  TYPE ReportingPeriodicity         PRESENCE optional}|
    { ID id-PartialSuccessIndicator CRITICALITY ignore  TYPE PartialSuccessIndicator      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 ::= {
    ...
}
```

```
ReportingPeriodicity ::= ENUMERATED {
    one-thousand-ms,
    two-thousand-ms,
    five-thousand-ms,
    ten-thousand-ms,
...
}

PartialSuccessIndicator ::= ENUMERATED {
    partial-success-allowed,
...
}

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

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

ResourceStatusResponse-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-ENB1-Measurement-ID                CRITICALITY reject  TYPE Measurement-ID                      PRESENCE mandatory}|
    { ID id-ENB2-Measurement-ID                CRITICALITY reject  TYPE Measurement-ID                      PRESENCE mandatory}|
    { ID id-CriticalityDiagnostics             CRITICALITY ignore  TYPE CriticalityDiagnostics              PRESENCE optional}|
    { ID id-MeasurementInitiationResult-List   CRITICALITY ignore  TYPE MeasurementInitiationResult-List    PRESENCE optional},
    ...
}


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

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

MeasurementInitiationResult-Item ::= SEQUENCE {
    cell-ID                                     ECGI,
    measurementFailureCause-List                MeasurementFailureCause-List    OPTIONAL,
    iE-Extensions                               ProtocolExtensionContainer { { MeasurementInitiationResult-Item-ExtIEs} }   OPTIONAL,
    ...
}

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

MeasurementFailureCause-List    ::= SEQUENCE (SIZE (1..maxFailedMeasObjects)) OF ProtocolIE-Single-Container { { MeasurementFailureCause-ItemIEs} }
```

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

MeasurementFailureCause-Item ::= SEQUENCE {
    measurementFailedReportCharacteristics          ReportCharacteristics,
    cause                                           Cause,
    iE-Extensions                                   ProtocolExtensionContainer { { MeasurementFailureCause-Item-ExtIEs} }       OPTIONAL,
    ...
}

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

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

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

ResourceStatusFailure-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-ENB1-Measurement-ID                     CRITICALITY reject  TYPE Measurement-ID                             PRESENCE mandatory}|
    { ID id-ENB2-Measurement-ID                     CRITICALITY reject  TYPE Measurement-ID                             PRESENCE mandatory}|
    { ID id-Cause                                   CRITICALITY ignore  TYPE Cause                                      PRESENCE mandatory}|
    { ID id-CriticalityDiagnostics                  CRITICALITY ignore  TYPE CriticalityDiagnostics                     PRESENCE optional}|
    { ID id-CompleteFailureCauseInformation-List    CRITICALITY ignore  TYPE CompleteFailureCauseInformation-List       PRESENCE optional},
    ...
}

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

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

CompleteFailureCauseInformation-Item ::= SEQUENCE {
    cell-ID                                         ECGI,
    measurementFailureCause-List                    MeasurementFailureCause-List,
    iE-Extensions                                   ProtocolExtensionContainer { { CompleteFailureCauseInformation-Item-ExtIEs} }      OPTIONAL,
    ...
}

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

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

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

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

ResourceStatusUpdate-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-ENB1-Measurement-ID     CRITICALITY reject  TYPE Measurement-ID                PRESENCE mandatory}|
    { ID id-ENB2-Measurement-ID     CRITICALITY reject  TYPE Measurement-ID                PRESENCE mandatory}|
    { 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,
    hWLoadIndicator             HWLoadIndicator     OPTIONAL,
    s1TNLLoadIndicator          S1TNLLoadIndicator  OPTIONAL,
    radioResourceStatus             RadioResourceStatus                                         OPTIONAL,
    iE-Extensions                   ProtocolExtensionContainer { {CellMeasurementResult-Item-ExtIEs} }   OPTIONAL,
    ...
}

CellMeasurementResult-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    { ID id-CompositeAvailableCapacityGroup CRITICALITY ignore  EXTENSION CompositeAvailableCapacityGroup              PRESENCE optional}|
    { ID id-ABS-Status                      CRITICALITY ignore  EXTENSION ABS-Status                                  PRESENCE optional},
    ...
}


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

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

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

```
-- ********************************************************
--
-- MOBILITY CHANGE REQUEST
--
-- ********************************************************

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

MobilityChangeRequest-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-ENB1-Cell-ID                        CRITICALITY reject  TYPE ECGI                                                    PRESENCE
mandatory   }|
    { ID id-ENB2-Cell-ID                        CRITICALITY reject  TYPE ECGI                                                    PRESENCE
mandatory   }|
    { ID id-ENB1-Mobility-Parameters            CRITICALITY ignore  TYPE MobilityParametersInformation                       PRESENCE optional
    }|
    { ID id-ENB2-Proposed-Mobility-Parameters   CRITICALITY reject  TYPE MobilityParametersInformation                       PRESENCE mandatory
    }|
    { ID id-Cause                               CRITICALITY reject  TYPE Cause                                                   PRESENCE
mandatory   },
    ...
}

-- ********************************************************
--
-- MOBILITY CHANGE ACKNOWLEDGE
--
-- ********************************************************

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

MobilityChangeAcknowledge-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-ENB1-Cell-ID            CRITICALITY reject  TYPE ECGI                          PRESENCE mandatory   }|
    { ID id-ENB2-Cell-ID            CRITICALITY reject  TYPE ECGI                          PRESENCE mandatory   }|
    { ID id-CriticalityDiagnostics  CRITICALITY ignore  TYPE CriticalityDiagnostics        PRESENCE optional },
    ...
}


-- ********************************************************
--
-- MOBILITY CHANGE FAILURE
--
-- ********************************************************

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

```
MobilityChangeFailure-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-ENB1-Cell-ID                                CRITICALITY ignore  TYPE ECGI                                                PRESENCE
mandatory   }|
    { ID id-ENB2-Cell-ID                                CRITICALITY ignore  TYPE ECGI                                                PRESENCE
mandatory   }|
    { ID id-Cause                                       CRITICALITY ignore  TYPE Cause
            PRESENCE mandatory  }|
    { ID id-ENB2-Mobility-Parameters-Modification-Range  CRITICALITY ignore  TYPE MobilityParametersModificationRange              PRESENCE
optional    }|
    { ID id-CriticalityDiagnostics                      CRITICALITY ignore  TYPE CriticalityDiagnostics
    PRESENCE optional },
    ...
}

-- **************************************************************
--
-- Radio Link Failure Indication
--
-- **************************************************************

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

RLFIndication-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-FailureCellPCI              CRITICALITY ignore  TYPE PCI                      PRESENCE mandatory}|
    { ID id-Re-establishmentCellECGI    CRITICALITY ignore  TYPE ECGI                     PRESENCE mandatory}|
    { ID id-FailureCellCRNTI            CRITICALITY ignore  TYPE CRNTI                    PRESENCE mandatory}|
    { ID id-ShortMAC-I                  CRITICALITY ignore  TYPE ShortMAC-I               PRESENCE optional}|
    { ID id-UE-RLF-Report-Container     CRITICALITY ignore  TYPE UE-RLF-Report-Container  PRESENCE optional}|
    { ID id-RRCConnSetupIndicator       CRITICALITY reject  TYPE RRCConnSetupIndicator    PRESENCE optional}|
    { ID id-RRCConnReestabIndicator     CRITICALITY ignore  TYPE RRCConnReestabIndicator  PRESENCE optional},
    ...
}


-- **************************************************************
--
-- Cell Activation Request
--
-- **************************************************************

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

CellActivationRequest-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-ServedCellsToActivate   CRITICALITY reject  TYPE ServedCellsToActivate      PRESENCE mandatory },
    ...
}
```

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

ServedCellsToActivate-Item::= SEQUENCE {
    ecgi                        ECGI,
    iE-Extensions                   ProtocolExtensionContainer { { ServedCellsToActivate-Item-ExtIEs} } OPTIONAL,
    ...
}

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

-- **************************************************************
--
-- Cell Activation Response
--
-- **************************************************************

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

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

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

ActivatedCellList-Item::= SEQUENCE {
    ecgi                            ECGI,
    iE-Extensions                   ProtocolExtensionContainer { { ActivatedCellList-Item-ExtIEs} } OPTIONAL,
    ...
}

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

--**************************************************************
--
-- CELL ACTIVATION FAILURE
--
-- **************************************************************

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

CellActivationFailure-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-Cause                       CRITICALITY ignore  TYPE Cause                      PRESENCE mandatory }|
```

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

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-E-RAB-Item,
    id-Number-of-Antennaports,
    id-MBSFN-Subframe-Info,
    id-PRACH-Configuration,
    id-CSG-Id,
    id-MDTConfiguration,
    id-MultibandInfoList,
    id-NeighbourTAC,
    id-Time-UE-StayedInCell-EnhancedGranularity,
    id-MBMS-Service-Area-List,
    id-HO-cause,
    maxnoofBearers,
    maxCellineNB,
    maxEARFCN,
    maxInterfaces,

    maxnoofBands,
    maxnoofBPLMNs,
    maxnoofCells,
    maxnoofEPLMNs,
    maxnoofEPLMNsPlusOne,
    maxnoofForbLACs,
    maxnoofForbTACs,
    maxnoofNeighbours,
    maxnoofPRBs,
    maxNrOfErrors,
    maxPools,
    maxnoofMBSFN,
    maxnoofTAforMDT,
```

```
    maxnoofCellIDforMDT,
    maxnoofMBMSServiceAreaIdentities

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

ABSInformation ::= CHOICE {
    fdd                 ABSInformationFDD,
    tdd                 ABSInformationTDD,
    abs-inactive        NULL,
    ...
}

ABSInformationFDD ::= SEQUENCE {
    abs-pattern-info                    BIT STRING (SIZE(40)),
    numberOfCellSpecificAntennaPorts    ENUMERATED {one, two, four, ...},
    measurement-subset                  BIT STRING (SIZE(40)),
    iE-Extensions                       ProtocolExtensionContainer { { ABSInformationFDD-ExtIEs} } OPTIONAL,
    ...
}

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

ABSInformationTDD ::= SEQUENCE {
    abs-pattern-info                    BIT STRING (SIZE(1..70, ...)),
    numberOfCellSpecificAntennaPorts    ENUMERATED {one, two, four, ...},
    measurement-subset                  BIT STRING (SIZE(1..70, ...)),
    iE-Extensions                       ProtocolExtensionContainer { { ABSInformationTDD-ExtIEs} } OPTIONAL,
    ...
}

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

ABS-Status ::= SEQUENCE {
    dL-ABS-status                           DL-ABS-status,
    usableABSInformation                    UsableABSInformation,
```

```
    iE-Extensions                               ProtocolExtensionContainer { {ABS-Status-ExtIEs} } OPTIONAL,
    ...
}

ABS-Status-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

DL-ABS-status::= INTEGER (0..100)

AS-SecurityInformation ::= SEQUENCE {
    key-eNodeB-star     Key-eNodeB-Star,
    nextHopChainingCount            NextHopChainingCount,
    iE-Extensions                       ProtocolExtensionContainer { { AS-SecurityInformation-ExtIEs} } OPTIONAL,
    ...
}

AS-SecurityInformation-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}


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

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

AreaScopeOfMDT ::= CHOICE {
    cellBased                   CellBasedMDT,
    tABased                     TABasedMDT,
    pLMNWide                    NULL,
    ...
}

-- B


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


-- C

CapacityValue ::= INTEGER (0..100)

CellCapacityClassValue ::= INTEGER (1..100, ...)
```

```
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,
    encryption-and-or-integrity-protection-algorithms-not-supported,
    reportCharacteristicsEmpty,
    noReportPeriodicity,
    existingMeasurementID,
    unknown-eNB-Measurement-ID,
    measurement-temporarily-not-available,
    unspecified,
    ...,
    load-balancing,
    handover-optimisation,
```

```
    value-out-of-allowed-range,
    multiple-E-RAB-ID-instances,
    switch-off-ongoing,
    not-supported-QCI-value,
    measurement-not-supported-for-the-object

}

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

CellBasedMDT::= SEQUENCE {
    cellIdListforMDT    CellIdListforMDT,
    iE-Extensions       ProtocolExtensionContainer { {CellBasedMDT-ExtIEs} } OPTIONAL,
    ...
}

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

CellIdListforMDT ::= SEQUENCE (SIZE(1..maxnoofCellIDforMDT)) OF ECGI

Cell-Size ::= ENUMERATED {verysmall, small, medium, large, ... }


CellType ::= SEQUENCE {
    cell-Size                       Cell-Size,
    iE-Extensions                   ProtocolExtensionContainer { { CellType-ExtIEs}}    OPTIONAL,
    ...
}

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

CompositeAvailableCapacityGroup ::= SEQUENCE {
    dL-CompositeAvailableCapacity                   CompositeAvailableCapacity,
    uL-CompositeAvailableCapacity                   CompositeAvailableCapacity,
    iE-Extensions                                   ProtocolExtensionContainer { { CompositeAvailableCapacityGroup-ExtIEs} } OPTIONAL,
    ...
}

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

CompositeAvailableCapacity ::= SEQUENCE {
    cellCapacityClassValue                          CellCapacityClassValue              OPTIONAL,
    capacityValue                                   CapacityValue,
    iE-Extensions                                   ProtocolExtensionContainer { { CompositeAvailableCapacity-ExtIEs} } OPTIONAL,
```

```
    ...
}

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

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 ::= {
    ...
}

CRNTI ::= BIT STRING (SIZE (16))

CSGMembershipStatus ::= ENUMERATED {
    member,
    not-member
}

CSG-Id ::= BIT STRING (SIZE (27))
```

```
CyclicPrefixDL ::= ENUMERATED {
    normal,
    extended,
    ...
}

CyclicPrefixUL ::= ENUMERATED {
    normal,
    extended,
    ...
}


-- D

DeactivationIndication::= ENUMERATED {
    deactivated,
    ...
}

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

DL-GBR-PRB-usage::= INTEGER (0..100)

DL-non-GBR-PRB-usage::= INTEGER (0..100)

DL-Total-PRB-usage::= INTEGER (0..100)

-- E

EARFCN ::= INTEGER (0..maxEARFCN)

FDD-Info ::= SEQUENCE {
    uL-EARFCN                       EARFCN,
    dL-EARFCN                       EARFCN,
    uL-Transmission-Bandwidth       Transmission-Bandwidth,
    dL-Transmission-Bandwidth       Transmission-Bandwidth,
    iE-Extensions               ProtocolExtensionContainer { {FDD-Info-ExtIEs} } OPTIONAL,
    ...
}

FDD-Info-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

TDD-Info ::= SEQUENCE {
    eARFCN                          EARFCN,
    transmission-Bandwidth          Transmission-Bandwidth,
    subframeAssignment              SubframeAssignment,
    specialSubframe-Info                SpecialSubframe-Info,
```

```
    iE-Extensions               ProtocolExtensionContainer { {TDD-Info-ExtIEs} } OPTIONAL,
    ...
}
TDD-Info-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

EUTRA-Mode-Info ::= CHOICE {
    fDD     FDD-Info,
    tDD     TDD-Info,
    ...
}

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)),
    ...
}

EncryptionAlgorithms ::= BIT STRING (SIZE (16, ...))

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

E-RAB-ID ::= INTEGER (0..15, ...)

E-RAB-Level-QoS-Parameters ::= SEQUENCE {
    qCI                             QCI,
    allocationAndRetentionPriority  AllocationAndRetentionPriority,
    gbrQosInformation               GBR-QosInformation                                                  OPTIONAL,
    iE-Extensions                   ProtocolExtensionContainer { { E-RAB-Level-QoS-Parameters-ExtIEs} }  OPTIONAL,
    ...
}

E-RAB-Level-QoS-Parameters-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

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

E-RAB-ItemIEs   X2AP-PROTOCOL-IES ::= {
    { ID id-E-RAB-Item   CRITICALITY ignore     TYPE E-RAB-Item     PRESENCE mandatory },
    ...
}
```

```
E-RAB-Item ::= SEQUENCE {
    e-RAB-ID                E-RAB-ID,
    cause                       Cause,
    iE-Extensions               ProtocolExtensionContainer { {E-RAB-Item-ExtIEs} } OPTIONAL,
    ...
}

E-RAB-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

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

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


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


-- F

ForbiddenInterRATs ::= ENUMERATED {
    all,
    geran,
    utran,
    cdma2000,
    ...,
    geranandutran,
    cdma2000andutran

}

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

ForbiddenTAs-Item ::= SEQUENCE {
    pLMN-Identity       PLMN-Identity,
    forbiddenTACs       ForbiddenTACs,
    iE-Extensions       ProtocolExtensionContainer { {ForbiddenTAs-Item-ExtIEs} } OPTIONAL,
    ...
}

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

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

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

ForbiddenLAs-Item ::= SEQUENCE {
```

```
    pLMN-Identity       PLMN-Identity,
    forbiddenLACs       ForbiddenLACs,
    iE-Extensions       ProtocolExtensionContainer { {ForbiddenLAs-Item-ExtIEs} } OPTIONAL,
    ...
}

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

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

Fourframes ::= BIT STRING (SIZE (24))

FreqBandIndicator ::= INTEGER (1..64)

-- G

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

GBR-QosInformation-ExtIEs 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,
    mME-Code            MME-Code,
    iE-Extensions                   ProtocolExtensionContainer { {GUMMEI-ExtIEs} } OPTIONAL,
    ...
}

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



-- H

HandoverReportType  ::= ENUMERATED {
    hoTooEarly,
    hoToWrongCell,
    ...,
    interRATpingpong
}

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)
```

```
HWLoadIndicator ::= SEQUENCE {
    dLHWLoadIndicator           LoadIndicator,
    uLHWLoadIndicator           LoadIndicator,
    iE-Extensions               ProtocolExtensionContainer { { HWLoadIndicator-ExtIEs} } OPTIONAL,
    ...
}

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


-- I

InvokeIndication ::= ENUMERATED{
    abs-information,
    ...
}

IntegrityProtectionAlgorithms ::= BIT STRING (SIZE (16, ...))

InterfacesToTrace ::= BIT STRING (SIZE (8))
-- J
-- K


Key-eNodeB-Star  ::= BIT STRING (SIZE(256))

-- L


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

LastVisitedCell-Item ::= CHOICE {
    e-UTRAN-Cell                    LastVisitedEUTRANCellInformation,
    uTRAN-Cell                      LastVisitedUTRANCellInformation,
    gERAN-Cell                      LastVisitedGERANCellInformation,
    ...
}

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

LastVisitedEUTRANCellInformation-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
-- Extension for Rel-11 to support enhanced granularity for time UE stayed in cell --
    { ID id-Time-UE-StayedInCell-EnhancedGranularity    CRITICALITY ignore  EXTENSION Time-UE-StayedInCell-EnhancedGranularity  PRESENCE optional}|
    { ID id-HO-cause                                    CRITICALITY ignore  EXTENSION Cause                                  PRESENCE optional},
    ...
```

```
}

LastVisitedUTRANCellInformation ::= OCTET STRING

LastVisitedGERANCellInformation ::= CHOICE {
    undefined                       NULL,
    ...
}


LoadIndicator ::= ENUMERATED {
    lowLoad,
    mediumLoad,
    highLoad,
    overLoad,
    ...
}



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

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

-- M

MDT-Activation      ::= ENUMERATED {
    immediate-MDT-only,
    immediate-MDT-and-Trace,
    ...
}

MDT-Configuration ::= SEQUENCE {
    mdt-Activation              MDT-Activation,
    areaScopeOfMDT              AreaScopeOfMDT,
    measurementsToActivate      MeasurementsToActivate,
    reportingTriggerMDT         ReportingTriggerMDT,
    thresholdeventA2            ThresholdEventA2            OPTIONAL,
-- Included in case of event-triggered reporting for measurement M1
    periodicReportingMDT        PeriodicReportingMDT        OPTIONAL,
-- Included in case of periodic reporting
    iE-Extensions               ProtocolExtensionContainer { { MDT-Configuration-ExtIEs} } OPTIONAL,
    ...
}

MDT-Configuration-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
```

```
}

MeasurementsToActivate::= BIT STRING (SIZE (8))

MeasurementThresholdA2 ::= CHOICE {
    threshold-RSRP              Threshold-RSRP,
    threshold-RSRQ              Threshold-RSRQ,
    ...
}

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

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

Measurement-ID  ::= INTEGER (1..4095, ...)

MBMS-Service-Area-Identity-List ::= SEQUENCE (SIZE(1.. maxnoofMBMSServiceAreaIdentities)) OF MBMS-Service-Area-Identity

MBMS-Service-Area-Identity ::= OCTET STRING (SIZE (2))

MBSFN-Subframe-Infolist::= SEQUENCE (SIZE(1.. maxnoofMBSFN)) OF MBSFN-Subframe-Info

MBSFN-Subframe-Info ::= SEQUENCE {
    radioframeAllocationPeriod      RadioframeAllocationPeriod,
    radioframeAllocationOffset      RadioframeAllocationOffset,
    subframeAllocation              SubframeAllocation,
    iE-Extensions           ProtocolExtensionContainer { { MBSFN-Subframe-Info-ExtIEs } }   OPTIONAL,
    ...
}

MBSFN-Subframe-Info-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

ManagementBasedMDTallowed ::= ENUMERATED {allowed, ...}

MobilityParametersModificationRange ::= SEQUENCE {
    handoverTriggerChangeLowerLimit     INTEGER (-20..20),
    handoverTriggerChangeUpperLimit     INTEGER (-20..20),
    ...
}

MobilityParametersInformation ::= SEQUENCE {
    handoverTriggerChange           INTEGER (-20..20),
    ...
}

MultibandInfoList ::= SEQUENCE (SIZE(1..maxnoofBands)) OF BandInfo


BandInfo    ::= SEQUENCE {
    freqBandIndicator       FreqBandIndicator,
    iE-Extensions           ProtocolExtensionContainer { { BandInfo-ExtIEs } }  OPTIONAL,
    ...
```

```
}

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

-- N

Neighbour-Information ::= SEQUENCE (SIZE (0..maxnoofNeighbours)) OF SEQUENCE {
    eCGI                        ECGI,
    pCI                     PCI,
    eARFCN                      EARFCN,
    iE-Extensions       ProtocolExtensionContainer { {Neighbour-Information-ExtIEs} } OPTIONAL,
    ...
}

Neighbour-Information-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    { ID id-NeighbourTAC        CRITICALITY ignore      EXTENSION TAC       PRESENCE optional},
    ...
}

NextHopChainingCount ::= INTEGER (0..7)

Number-of-Antennaports ::= ENUMERATED {
        an1,
        an2,
        an4,
        ...
}

-- O

Oneframe ::= BIT STRING (SIZE (6))

-- P

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

PCI ::= INTEGER (0..503, ...)

PeriodicReportingMDT ::= SEQUENCE {
    reportInterval              ReportIntervalMDT,
    reportAmount                ReportAmountMDT,
    iE-Extensions               ProtocolExtensionContainer { { PeriodicReportingMDT-ExtIEs} } OPTIONAL,
    ...
}

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

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

PRACH-Configuration  ::= SEQUENCE {
```

```
    rootSequenceIndex                       INTEGER (0..837),
    zeroCorrelationIndex                    INTEGER (0..15),
    highSpeedFlag                           BOOLEAN,
    prach-FreqOffset                        INTEGER (0..94),
    prach-ConfigIndex                       INTEGER (0..63)        OPTIONAL,  -- present for TDD --
    iE-Extensions                           ProtocolExtensionContainer { {PRACH-Configuration-ExtIEs} }  OPTIONAL,
    ...
}

PRACH-Configuration-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

Pre-emptionCapability ::= ENUMERATED {
    shall-not-trigger-pre-emption,
    may-trigger-pre-emption
}

Pre-emptionVulnerability ::= ENUMERATED {
    not-pre-emptable,
    pre-emptable
}

PriorityLevel               ::= INTEGER { spare (0), highest (1), lowest (14), no-priority (15) } (0..15)

-- Q

QCI ::= INTEGER (0..255)

-- R

RadioframeAllocationOffset ::= INTEGER (0..7, ...)

RadioframeAllocationPeriod ::= ENUMERATED{
    n1,
    n2,
    n4,
    n8,
    n16,
    n32,
    ...
}


RadioResourceStatus ::= SEQUENCE {
    dL-GBR-PRB-usage                            DL-GBR-PRB-usage,
    uL-GBR-PRB-usage                            UL-GBR-PRB-usage,
    dL-non-GBR-PRB-usage                        DL-non-GBR-PRB-usage,
    uL-non-GBR-PRB-usage                        UL-non-GBR-PRB-usage,
    dL-Total-PRB-usage                          DL-Total-PRB-usage,
    uL-Total-PRB-usage                          UL-Total-PRB-usage,
    iE-Extensions                               ProtocolExtensionContainer { {RadioResourceStatus-ExtIEs} } OPTIONAL,
    ...
}
```

```
RadioResourceStatus-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

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 ::= {
    ...
}

ReportAmountMDT ::= ENUMERATED{r1, r2, r4, r8, r16, r32, r64, rinfinity}

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

ReportIntervalMDT ::= ENUMERATED {ms120, ms240, ms480, ms640, ms1024, ms2048, ms5120, ms10240, min1, min6, min12, min30, min60}

ReportCharacteristics   ::= BIT STRING (SIZE (32))

ReportingTriggerMDT::= ENUMERATED{
    periodic,
    a2eventtriggered,
    ...
}

RNTP-Threshold ::= ENUMERATED {
    minusInfinity,
    minusEleven,
    minusTen,
    minusNine,
    minusEight,
    minusSeven,
    minusSix,
    minusFive,
```

```
    minusFour,
    minusThree,
    minusTwo,
    minusOne,
    zero,
    one,
    two,
    three,
    ...
}

RRC-Context ::= OCTET STRING

RRCConnReestabIndicator ::= ENUMERATED {
    reconfigurationFailure, handoverFailure, otherFailure, ...
}
-- The values correspond to the values of ReestablishmentCause reported from the UE in the RRCConnectionReestablishmentRequest, as defined in TS
36.331 [9]

RRCConnSetupIndicator::= ENUMERATED {
    rrcConnSetup,
    ...
}

-- S

S1TNLLoadIndicator ::= SEQUENCE {
    dLS1TNLLoadIndicator            LoadIndicator,
    uLS1TNLLoadIndicator            LoadIndicator,
    iE-Extensions                   ProtocolExtensionContainer { { S1TNLLoadIndicator-ExtIEs} } OPTIONAL,
    ...
}

S1TNLLoadIndicator-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}




ServedCells ::= SEQUENCE (SIZE (1.. maxCellineNB)) OF SEQUENCE {
    servedCellInfo                  ServedCell-Information,
    neighbour-Info                  Neighbour-Information           OPTIONAL,
    iE-Extensions                   ProtocolExtensionContainer { {ServedCell-ExtIEs} } OPTIONAL,
    ...
}

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

ServedCell-Information ::= SEQUENCE {
    pCI                 PCI,
    cellId              ECGI,
```

```
    tAC                 TAC,
    broadcastPLMNs      BroadcastPLMNs-Item,
    eUTRA-Mode-Info     EUTRA-Mode-Info,
    iE-Extensions       ProtocolExtensionContainer { {ServedCell-Information-ExtIEs} } OPTIONAL,
    ...
}

ServedCell-Information-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    { ID id-Number-of-Antennaports      CRITICALITY ignore  EXTENSION Number-of-Antennaports             PRESENCE optional }|
    { ID id-PRACH-Configuration         CRITICALITY ignore  EXTENSION PRACH-Configuration                PRESENCE optional }|
    { ID id-MBSFN-Subframe-Info         CRITICALITY ignore  EXTENSION MBSFN-Subframe-Infolist            PRESENCE optional }|
    { ID id-CSG-Id                      CRITICALITY ignore  EXTENSION CSG-Id                             PRESENCE optional }|
    { ID id-MBMS-Service-Area-List      CRITICALITY ignore  EXTENSION MBMS-Service-Area-Identity-List    PRESENCE optional }|
    { ID id-MultibandInfoList           CRITICALITY ignore  EXTENSION MultibandInfoList                  PRESENCE optional },
    ...
}

ShortMAC-I ::= BIT STRING (SIZE(16))

SRVCCOperationPossible ::= ENUMERATED {
    possible,
    ...
}

SubframeAssignment ::= ENUMERATED {
    sa0,
    sa1,
    sa2,
    sa3,
    sa4,
    sa5,
    sa6,
    ...
}

SpecialSubframe-Info ::=        SEQUENCE {
    specialSubframePatterns     SpecialSubframePatterns,
    cyclicPrefixDL              CyclicPrefixDL,
    cyclicPrefixUL              CyclicPrefixUL,
    iE-Extensions               ProtocolExtensionContainer { { SpecialSubframe-Info-ExtIEs} } OPTIONAL,
    ...
}

SpecialSubframe-Info-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}


SpecialSubframePatterns ::= ENUMERATED {
    ssp0,
    ssp1,
    ssp2,
    ssp3,
    ssp4,
```

```
    ssp5,
    ssp6,
    ssp7,
    ssp8,
    ...,
    ssp9
}

SubscriberProfileIDforRFP ::= INTEGER (1..256)

SubframeAllocation ::= CHOICE {
    oneframe                        Oneframe,
    fourframes                      Fourframes,
    ...
}

-- T

TAC ::= OCTET STRING (SIZE (2))

TABasedMDT:= SEQUENCE {
    tAListforMDT        TAListforMDT,
    iE-Extensions       ProtocolExtensionContainer { {TABasedMDT-ExtIEs} } OPTIONAL,
    ...
}

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

TAListforMDT ::= SEQUENCE (SIZE(1..maxnoofTAforMDT)) OF TAC

TargetCellInUTRAN ::= OCTET STRING -- This IE is to be encoded according to the UTRAN Cell ID in the Last Visited UTRAN Cell Information IE in TS
25.413 [24]

ThresholdEventA2 ::= SEQUENCE {
    measurementThreshold        MeasurementThresholdA2,
    iE-Extensions               ProtocolExtensionContainer { { ThresholdEventA2-ExtIEs} } OPTIONAL,
    ...
}

ThresholdEventA2-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

TargeteNBtoSource-eNBTransparentContainer   ::= OCTET STRING

Threshold-RSRP ::=  INTEGER(0..97)

Threshold-RSRQ ::=  INTEGER(0..34)

TimeToWait ::= ENUMERATED {
    v1s,
    v2s,
```

```
    v5s,
    v10s,
    v20s,
    v60s,
    ...
}

Time-UE-StayedInCell ::= INTEGER (0..4095)

Time-UE-StayedInCell-EnhancedGranularity ::= INTEGER (0..40950)


TraceActivation ::= SEQUENCE {
    eUTRANTraceID                   EUTRANTraceID,
    interfacesToTrace               InterfacesToTrace,
    traceDepth                      TraceDepth,
    traceCollectionEntityIPAddress  TraceCollectionEntityIPAddress,
    iE-Extensions                   ProtocolExtensionContainer { {TraceActivation-ExtIEs} } OPTIONAL,
    ...
}

TraceActivation-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    { ID id-MDTConfiguration    CRITICALITY ignore  EXTENSION MDT-Configuration     PRESENCE optional},
    ...
}

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

TraceDepth      ::= ENUMERATED {
    minimum,
    medium,
    maximum,
    minimumWithoutVendorSpecificExtension,
    mediumWithoutVendorSpecificExtension,
    maximumWithoutVendorSpecificExtension,
    ...
}



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

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)

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

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

UESecurityCapabilities ::= SEQUENCE {
    encryptionAlgorithms                EncryptionAlgorithms,
    integrityProtectionAlgorithms       IntegrityProtectionAlgorithms,
    iE-Extensions                       ProtocolExtensionContainer { { UESecurityCapabilities-ExtIEs} }         OPTIONAL,
...
}

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

UL-GBR-PRB-usage::= INTEGER (0..100)

UL-non-GBR-PRB-usage::= INTEGER (0..100)

UL-Total-PRB-usage::= INTEGER (0..100)

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

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

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

UE-RLF-Report-Container::= OCTET STRING
-- This IE is a transparent container and shall be encoded as the rlfReport field contained in the UEInformationResponse message as defined in TS
36.331 [9]

UsableABSInformation ::= CHOICE {
    fdd                 UsableABSInformationFDD,
    tdd                 UsableABSInformationTDD,
    ...
}

UsableABSInformationFDD ::= SEQUENCE {
    usable-abs-pattern-info             BIT STRING (SIZE(40)),
    iE-Extensions                       ProtocolExtensionContainer { { UsableABSInformationFDD-ExtIEs} } OPTIONAL,
    ...
}

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

UsableABSInformationTDD ::= SEQUENCE {
    usaable-abs-pattern-info            BIT STRING (SIZE(1..70, ...)),
    iE-Extensions                       ProtocolExtensionContainer { { UsableABSInformationTDD-ExtIEs} } OPTIONAL,
    ...
}

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

-- 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-resourceStatusReportingInitiation                    ProcedureCode ::= 9
id-resourceStatusReporting                              ProcedureCode ::= 10
id-privateMessage                                       ProcedureCode ::= 11
id-mobilitySettingsChange                               ProcedureCode ::= 12
id-rLFIndication                                        ProcedureCode ::= 13
id-handoverReport                                       ProcedureCode ::= 14
id-cellActivation                                       ProcedureCode ::= 15



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

maxEARFCN                               INTEGER ::= 65535
```

```
maxInterfaces                               INTEGER ::= 16
maxCellineNB                                INTEGER ::= 256
maxnoofBands                                INTEGER ::= 16
maxnoofBearers                              INTEGER ::= 256
maxNrOfErrors                               INTEGER ::= 256
maxnoofPDCP-SN                              INTEGER ::= 16
maxnoofEPLMNs                               INTEGER ::= 15
maxnoofEPLMNsPlusOne                        INTEGER ::= 16
maxnoofForbLACs                             INTEGER ::= 4096
maxnoofForbTACs                             INTEGER ::= 4096
maxnoofBPLMNs                               INTEGER ::= 6
maxnoofNeighbours                           INTEGER ::= 512
maxnoofPRBs                                 INTEGER ::= 110
maxPools                                    INTEGER ::= 16
maxnoofCells                                INTEGER ::= 16
maxnoofMBSFN                                INTEGER ::= 8
maxFailedMeasObjects                        INTEGER ::= 32
maxnoofCellIDforMDT                         INTEGER ::= 32
maxnoofTAforMDT                             INTEGER ::= 8
maxnoofMBMSServiceAreaIdentities            INTEGER ::= 256


-- ************************************************************
--
-- IEs
--
-- ************************************************************

id-E-RABs-Admitted-Item                                                 ProtocolIE-ID ::= 0
id-E-RABs-Admitted-List                                                 ProtocolIE-ID ::= 1
id-E-RAB-Item                                                           ProtocolIE-ID ::= 2
id-E-RABs-NotAdmitted-List                                              ProtocolIE-ID ::= 3
id-E-RABs-ToBeSetup-Item                                                ProtocolIE-ID ::= 4
id-Cause                                                                ProtocolIE-ID ::= 5
id-CellInformation                                                      ProtocolIE-ID ::= 6
id-CellInformation-Item                                                 ProtocolIE-ID ::= 7
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-E-RABs-SubjectToStatusTransfer-List                                  ProtocolIE-ID ::= 18
id-E-RABs-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-GUGroupIDToAddList                                   ProtocolIE-ID ::= 34
id-GUGroupIDToDeleteList                                ProtocolIE-ID ::= 35
id-SRVCCOperationPossible                               ProtocolIE-ID ::= 36
id-Measurement-ID                                       ProtocolIE-ID ::= 37
id-ReportCharacteristics                                ProtocolIE-ID ::= 38
id-ENB1-Measurement-ID                                  ProtocolIE-ID ::= 39
id-ENB2-Measurement-ID                                  ProtocolIE-ID ::= 40
id-Number-of-Antennaports                               ProtocolIE-ID ::= 41
id-CompositeAvailableCapacityGroup                      ProtocolIE-ID ::= 42
id-ENB1-Cell-ID                                         ProtocolIE-ID ::= 43
id-ENB2-Cell-ID                                         ProtocolIE-ID ::= 44
id-ENB2-Proposed-Mobility-Parameters                    ProtocolIE-ID ::= 45
id-ENB1-Mobility-Parameters                             ProtocolIE-ID ::= 46
id-ENB2-Mobility-Parameters-Modification-Range          ProtocolIE-ID ::= 47
id-FailureCellPCI                                       ProtocolIE-ID ::= 48
id-Re-establishmentCellECGI                             ProtocolIE-ID ::= 49
id-FailureCellCRNTI                                     ProtocolIE-ID ::= 50
id-ShortMAC-I                                           ProtocolIE-ID ::= 51
id-SourceCellECGI                                       ProtocolIE-ID ::= 52
id-FailureCellECGI                                      ProtocolIE-ID ::= 53
id-HandoverReportType                                   ProtocolIE-ID ::= 54
id-PRACH-Configuration                                  ProtocolIE-ID ::= 55
id-MBSFN-Subframe-Info                                  ProtocolIE-ID ::= 56
id-ServedCellsToActivate                                ProtocolIE-ID ::= 57
id-ActivatedCellList                                    ProtocolIE-ID ::= 58
id-DeactivationIndication                               ProtocolIE-ID ::= 59
id-UE-RLF-Report-Container                              ProtocolIE-ID ::= 60
id-ABSInformation                                       ProtocolIE-ID ::= 61
id-InvokeIndication                                     ProtocolIE-ID ::= 62
id-ABS-Status                                           ProtocolIE-ID ::= 63
id-PartialSuccessIndicator                              ProtocolIE-ID ::= 64
id-MeasurementInitiationResult-List                     ProtocolIE-ID ::= 65
id-MeasurementInitiationResult-Item                     ProtocolIE-ID ::= 66
id-MeasurementFailureCause-Item                         ProtocolIE-ID ::= 67
id-CompleteFailureCauseInformation-List                 ProtocolIE-ID ::= 68
id-CompleteFailureCauseInformation-Item                 ProtocolIE-ID ::= 69
id-CSG-Id                                               ProtocolIE-ID ::= 70
id-CSGMembershipStatus                                  ProtocolIE-ID ::= 71
id-MDTConfiguration                                     ProtocolIE-ID ::= 72
id-ManagementBasedMDTallowed                            ProtocolIE-ID ::= 74
id-RRCConnSetupIndicator                                ProtocolIE-ID ::= 75
id-NeighbourTAC                                         ProtocolIE-ID ::= 76
id-Time-UE-StayedInCell-EnhancedGranularity             ProtocolIE-ID ::= 77
id-RRCConnReestabIndicator                              ProtocolIE-ID ::= 78
id-MBMS-Service-Area-List                               ProtocolIE-ID ::= 79
id-HO-cause                                             ProtocolIE-ID ::= 80
id-TargetCellInUTRAN                                    ProtocolIE-ID ::= 81
```

```
id-MultibandInfoList                                    ProtocolIE-ID ::= 84

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. ITU-T Rec. X.691 [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 TS 36.413 [4] is applicable for the purposes of the present document.

Annex A (informative): Change History

TSG #	TSG Doc.	CR	Rev	Subject/Comment	New
09/2009				Rel-9 version is created based on v.8.7.0	9.0.0

45	RP-090787	0296	1	Handling of Emergency Calls in Limited Service Mode	9.0.0
45	RP-090787	0297	1	Emergency Calls Mobility Handling	9.0.0
46	RP-091192	0307		Introduction of signalling support for Composite Available Capacity with relative units	9.1.0
46	RP-091192	0308	2	Configuration adaptation for MLB on X2	9.1.0
46	RP-091183	0310	1	Clarification on operational use of updated configuration data	9.1.0
46	RP-091192	0317	2	Automatic PRACH information exchange over X2 for SON	9.1.0
46	RP-091192	0333	1	Introduction of Radio Link Failure Indication procedure	9.1.0
46	RP-091192	0334	1	Introduction of Handover Report procedure	9.1.0
46	RP-091192	0335		Introduction of signalling support for Composite Available Capacity with relative units	9.1.0
47	RP-100213	0337		Correction to the Resource Status Reporting Initiation procedure	9.2.0
47	RP-100229	0341	2	Addition of MBSFN information on X2 interface	9.2.0
47	RP-100228	0344	4	Cell pair identification for Mobility Settings Change procedure	9.2.0
47	RP-100213	0352		Addition of cause value for not admitted E-RAB	9.2.0
47	RP-100229	0355	1	Rapporteur"s update of X2AP protocol	9.2.0
47	RP-100230	0356	3	RNL-based energy saving solution	9.2.0
47	RP-100228	0358	1	Inclusion of UE RLF Report in RLF INDICATION message	9.2.0
48	RP-100599	0363	1	Correction of RLF INDICATION message	9.3.0
48	RP-100599	0364	1	Missing error cause for Not supported QCI on Handover	9.3.0
48	RP-100599	0370	1	Introduction of PLMN-related abnormal conditions during X2 handover in network sharing scenarios.	9.3.0
48	RP-100599	0372	1	Outcome of RAN3#68 review of X2AP	9.3.0
48	RP-100599	0373	1	Correction of forbidden inter-RAT	9.3.0
49	RP-100908	0376	1	Explicit PLMN coding in Trace IEs	9.4.0
49	RP-100906	0380	2	The corrections for Last Visited Cell Information	9.4.0
49	RP-100906	0383	1	Handover Restriction List	9.4.0
49	RP-100908	0384	1	Complete list of served cells to be provided in X2 SETUP and eNB Configuration Update messages	9.4.0
50	RP-101271	0385		Clarification on Handover Restriction List	9.5.0
50	RP-101270	0403	3	Correction of semantics description	9.5.0
12/2010				Rel-10 version created based in v. 9.5.0	10.0.0
50	RP-101304	0393	2	Introduction of partial failure in Resource Status Reporting Initiation procedure including detailed reporting of failure cause	10.0.0
50	RP-101279	0407	4	X2 handover support	10.0.0
SP-49	SP-100629			Clarification on the use of References (TS 21.801 CR#0030)	10.1.0
51	RP-110231	0408		Conditions for Enhanced X2 mobility	10.1.0
51	RP-110237	0409		Introduction of X2 signalling support for eICIC	10.1.0
51	RP-110222	0411	1	Correction of the usage of optional ShortMAC-I IE in RLF INDICATION message	10.1.0
51	RP-110230	0413	2	Support for MDT	10.1.0
51	RP-110226	0419	2	Clarification on TEID value range for X2AP	10.1.0
51	RP-110231	0420		Clarify X2 Handover Scenarios	10.1.0
51	RP-110237	0427	1	Enabling reporting of ABS resource status for eICIC purposes	10.1.0
52	RP-110695	0435	1	MDT correction for TAI	10.2.0
52	RP-110698	0436	1	Clarification on Radio Resource Status	10.2.0
52	RP-110700	0443	4	X2 support of RLF Report extension for SON MRO defined in R10	10.2.0
52	RP-110695	0447	3	Support for MDT user consent	10.2.0
52	RP-110686	0451	2	Rapporteur"s proposal following review of TS 36.423	10.2.0
52	RP-110689	0452	1	Correction of the partial success mechanism in Resource Status Reporting	10.2.0
52	RP-110695	0453	2	MDT amendments	10.2.0
52	RP-110685	0454		Reference review outcome in TS 36.423	10.2.0
52	RP-110695	0456		Correction of trace function and trace session	10.2.0
53	RP-111196	0464	2	Clarification of procedures defined for MLB purposes	10.3.0
53	RP-111196	0469	1	ASN.1 definition conforms to ITU-T Recommendations	10.3.0
53	RP-111194	0476	2	Updates of reported quantities for eICIC	10.3.0
53	RP-111195	0478	1	Definition of value of bit in Measurements to Activate	10.3.0
53	RP-111197	0479		Clarification on PLMN Identity	10.3.0
54	RP-111648	0480	2	Correction on ABS Information	10.4.0
55	RP-120234	0491	1	Correct of reset	10.5.0
03/2012				Rel-11 version created based in v. 10.5.0	11.0.0
55	RP-120236	0487	1	Addition of TAC to the neighbour information of a served cell for X2 setup and eNB update procedures	11.0.0

56	RP-120751	0496	-	Introduction of the Security Algorithm (ZUC)	11.1.0
56	RP-120751	0498	2	Clarification on TAC in X2 Setup	11.1.0
56	RP-120751	0501	3	Adding RRC re-establishment cause to RLF indication	11.1.0
56	RP-120752	0513	1	Correction on Emergency ARP Value	11.1.0
56	RP-120752	0516	1	Improved granularity for the time UE stayed in cell	11.1.0
57	RP-121137	0520	2	Support of MBMS Service Continuity	11.2.0
57	RP-121140	0527	3	Multiband support per cell	11.2.0
57	RP-121135	0540	1	Enhancement of HO REPORT to enable inter-RAT ping-pong detection and addition of HO cause value to the UE history information	11.2.0
57	RP-121139	0546		Support for new special subframe configurations	11.2.0

History

Document history		
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