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TECHNICAL SPECIFICATION

**LTE;
Evolved Universal Terrestrial
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X2 Application Protocol (X2AP)
(3GPP TS 36.423 version 12.4.2 Release 12)**

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Contents

Foreword

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

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1   Scope

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

[30]   3GPP TR 25.921 (version.7.0.0): "Guidelines and principles for protocol description and error handling".

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].

Dual Connectivity: as defined in TS 36.300 [15].

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

Master eNB: as defined in TS 36.300 [15].

Secondary Cell Group: as defined in TS 36.300 [15].

Secondary eNB: 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
CoMP	Coordinated Multi Point
DC	Dual Connectivity
DL	Downlink
EARFCN	E-UTRA Absolute Radio Frequency Channel Number
E-CID	Enhanced Cell-ID (positioning method)
eNB	E-UTRAN NodeB
EP	Elementary Procedure
EPC	Evolved Packet Core
E-RAB	E-UTRAN Radio Access Bearer
E-UTRAN	Evolved UTRAN
GNSS	Global Navigation Satellite System
GUMMEI	Globally Unique MME Identifier
HFN	Hyper Frame Number
IE	Information Element
L-GW	Local GateWay
MCG	Master Cell Group
MDT	Minimization of Drive Tests
MeNB	Master eNB
MME	Mobility Management Entity
NAICS	Network-Assisted Interference Cancellation and Suppression
PDCP	Packet Data Convergence Protocol
PLMN	Public Land Mobile Network
SCG	Secondary Cell Group
S-GW	Serving Gateway
SeNB	Secondary eNB
SIPTO	Selected IP Traffic Offload
SIPTO@LN	Selected IP Traffic Offload at the Local Network
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 or request another eNB to provide radio resources for a certain UE while keeping responsibility for that UE. 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.

- X2 Release. This function allows an eNB to be aware that the signalling connection to a peer eNB is unavailable.

- Message transfer. This function allows indirect transport of X2AP messages to a peer eNB.

- Registration. This function allows registration of eNB in case indirect transport of X2AP messages is supported.

- Removing the X2. This function allows removing the signaling connection between two eNBs in a controlled manner.

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
Dual Connectivity	a) SeNB Addition Preparation b) SeNB Reconfiguration Completion c) MeNB initiated SeNB Modification Preparation d) SeNB initiated SeNB Modification e) MeNB initiated SeNB Release f) SeNB initiated SeNB Release g) SeNB Counter Check
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
X2 Release	X2 Release
Message transfer Registration	X2AP Message Transfer
Removing the X2	X2 Removal

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 Response message	Unsuccessful Outcome 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
SeNB Addition Preparation	SENB ADDITION REQUEST	SENB ADDITION ACKNOWLEDGE	SENB ADDITION REJECT
MeNB initiated SeNB Modification Preparation	SENB MODIFICATION REQUEST	SENB MODIFICATION REQUEST ACKNOWLEDGE	SENB MODIFICATION REQUEST REJECT
SeNB initiated SeNB Modification	SENB MODIFICATION REQUIRED	SENB MODIFICATION CONFIRM	SENB MODIFICATION REFUSE
SeNB initiated SeNB Release	SENB RELEASE REQUIRED	SENB RELEASE CONFIRM	
X2 Removal	X2 REMOVAL REQUEST	X2 REMOVAL RESPONSE	X2 REMOVAL 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
X2 Release	X2 RELEASE
X2AP Message Transfer	X2AP MESSAGE TRANSFER
SeNB Reconfiguration Completion	SENB RECONFIGURATION COMPLETE
MeNB initiated SeNB Release	SENB RELEASE REQUEST
SeNB Counter Check	SENB COUNTER CHECK REQUEST

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
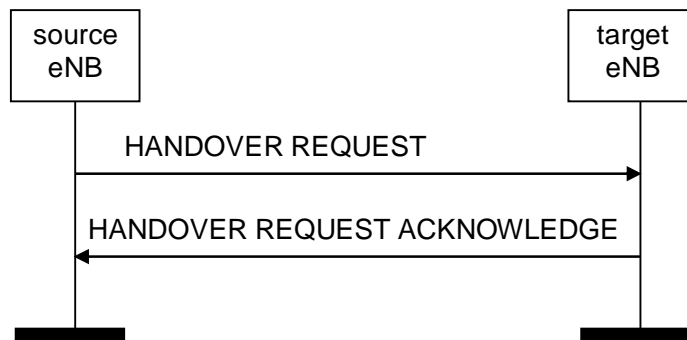
Figure 8.2.1.2-1: Handover Preparation, successful operation

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 *Trace Activation* IE includes the *MDT Location Information* IE, within the *MDT Configuration* IE, store this information and take it into account in the requested MDT session;

- if the *Trace Activation* IE includes the *Signalling based MDT PLMN List* IE, within the *MDT Configuration* IE, the eNB may use it to propagate the MDT Configuration as described in TS 37.320 [31].

If the *Management Based MDT Allowed* IE only or the *Management Based MDT Allowed* IE and the *Management Based MDT PLMN List* 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].

If the *Masked IMEISV* IE is contained in the HANDOVER REQUEST message the target eNB shall, if supported, use it to determine the characteristics of the UE for subsequent handling.

The source eNB shall, if supported and available in the UE context, include the *Management Based MDT Allowed* IE and the *Management Based MDT PLMN List* IE in the HANDOVER REQUEST message, except if the source eNB selects a serving PLMN in the target eNB which is not included in the Management Based MDT PLMN List. If the *Management Based MDT PLMN List* IE is not present, 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;

  - 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;

  - use this information to select a proper SCG during dual connectivity operation.

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

Upon reception of the *UE History Information from the UE* IE in the HANDOVER REQUEST message, the target eNB shall, if supported, store the collected information to be used for future handover preparations.

If the *Mobility Information* IE is provided in the HANDOVER REQUEST message, the target eNB shall, if supported, store this information and use it as defined in TS 36.300 [15]. The target eNB shall, if supported, store the C-RNTI of the source cell received in the HANDOVER REQUEST message.

If the *Expected UE Behaviour* IE is provided in the HANDOVER REQUEST message, the target eNB shall, if supported, store this information and may use it to determine the RRC connection time.

8.2.1.3 Unsuccessful Operation
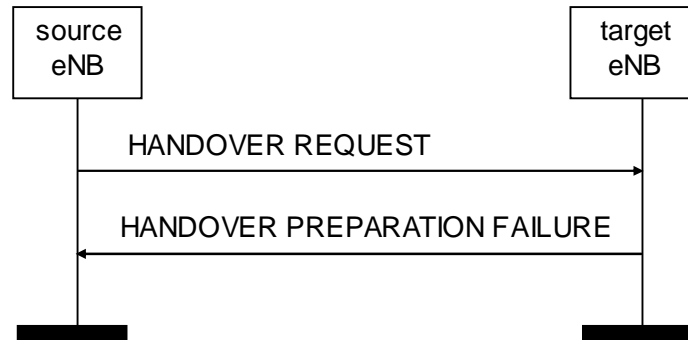
Figure 8.2.1.3-1: Handover Preparation, unsuccessful operation

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 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 target cell is a CSG cell with a different CSG from the source 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 either, from the source to the target eNB during an X2 handover, or between the eNBs involved in dual connectivity, for each respective E-RAB for which PDCP SN and HFN status preservation applies.

If the SN Status Transfer procedure is applied in the course of dual connectivity, in the subsequent specification text

- the behaviour of the eNB from which the E-RAB context is transferred, i.e., the eNB involved in dual connectivity from which data forwarding, is specified by the behaviour of the "source eNB",

- the behaviour of the eNB to which the E-RAB context is transferred, i.e., the eNB involved in dual connectivity to which data is forwarded, is specified by the behaviour of the "target eNB".

The procedure uses UE-associated signalling.

8.2.2.2   Successful Operation
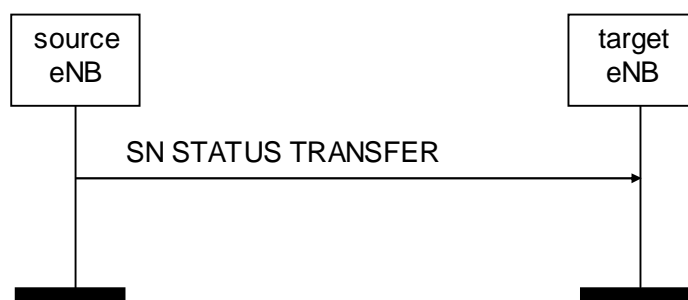
Figure 8.2.2.2-1: SN Status Transfer, successful operation

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 target eNB using Full Configuration for this handover as per TS 36.300 [15] shall ignore the information received in this message.

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 or *Receive Status Of UL PDCP SDUs Extended* 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. If the *DL COUNT Value Extended* IE is included in the *E-RABs Subject To Status Transfer Item* IE, the target eNB shall, if supported, use the value contained in the *PDCP-SN Extended* IE of the *DL COUNT Value Extended* IE instead of the value contained in the *PDCP-SN* IE of the *DL COUNT Value* IE.

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. If the *UL COUNT Value Extended* IE is included in the *E-RABs Subject To Status Transfer Item* IE, the target eNB shall, if supported, use the value contained in the *PDCP-SN Extended* IE of the *UL COUNT Value Extended* IE instead of the value contained in the *PDCP-SN* IE of the *UL COUNT Value* 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

For handover, 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.

For dual connectivity, UE Context Release procedure is initiated by the MeNB to finally release the UE context at the SeNB.

The procedure uses UE-associated signalling.

8.2.3.2 Successful Operation

Figure 8.2.3.2-1: UE Context Release, successful operation for handover

Figure 8.2.3.2-2: UE Context Release, successful operation for dual connectivity

Handover

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). When the eNB supporting L-GW function for SIPTO@LN operation releases radio and control plane related resources associated to the UE context, it shall also request using intra-node signalling the collocated L-GW to release the SIPTO@LN PDN connection as defined in TS 23.401 [12].

Dual Connectivity

The UE Context Release procedure is initiated by the MeNB. By sending the UE CONTEXT RELEASE message the MeNB informs the SeNB that the UE Context can be removed.

Upon reception of the UE CONTEXT RELEASE message, the SeNB may release radio and control plane related resources associated to the UE context. For E-RABs for which data forwarding has been performed, the SeNB should continue forwarding of U-plane data as long as packets are received at the SeNB from the EPC or the SeNB 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, and additionally between eNBs controlling inter-frequency neighboring cells for TDD.

The procedure uses non UE-associated signalling.

8.3.1.2 Successful Operation
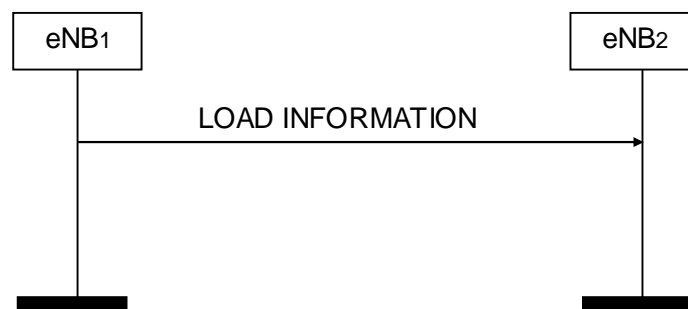
Figure 8.3.1.2-1: Load Indication, successful operation

An eNB_1 initiates the procedure by sending LOAD INFORMATION message to a peer eNB_2.

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. If the *Extended UL Interference Overload Info* IE is received in the LOAD INFORMATION message, the *UL Interference Overload Indication* IE indicates the interference level experienced by the indicated cell ignoring the UL subframe(s) represented as value "1" in the *Associated Subframes* IE. 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. If the *Invoke Indication* IE is set to "Start NAICS Information", it indicates the sending eNB would like the receiving eNB to initiate the Load Indication procedure with the LOAD INFORMATION message containing the *Dynamic DL transmission information* IE. The first time the *Dynamic DL transmission information* IE is signalled after receiving the *Invoke Indication* IE set to "Start NAICS Information", all the NAICS parameters in the *NAICS Information* IE shall be included. If the *Invoke Indication* IE is set to "Stop NAICS Information", it indicates the sending eNB does not need NAICS information and therefore the receiving eNB should stop signalling NAICS parameters for the concerned cell.

If the *NAICS Information* IE is set to "NAICS Active", the receiving eNB may use it for the configuration of DL interference mitigation assistance information towards the UE. Information included in the *NAICS Information* IE shall replace corresponding NAICS information existing at the receiver. If the *NAICS Information* IE is set to "NAICS Inactive", the receiving eNB shall consider the existing NAICS information as invalid.

If the *Intended UL-DL Configuration* IE is included in the LOAD INFORMATION message, it indicates the UL-DL configuration intended to be used by the indicated cell. The receiving eNB may take such information into account when setting its scheduling policy and shall consider the received *Intended UL-DL Configuration* IE value valid until reception of a new LOAD INFORMATION message carrying an update of the same IE.

If the *Extended UL Interference Overload Info* IE is received in the LOAD INFORMATION message, the *Extended UL Interference Overload Indication* IE indicates the interference level experienced by the indicated cell on all resource blocks, per PRB, in the UL subframe(s) which is represented as value "1" in the *Associated Subframes* IE. The receiving eNB may take such information into account when setting its scheduling policy and shall consider the received *Extended UL Interference Overload Info* IE value valid until reception of a new LOAD INFORMATION message carrying an update of the same IE.

If the *CoMP Information* IE is received in the LOAD INFORMATION message, the receiving eNB may take the IE into account for RRM. The receiving eNB shall consider the *CoMP Information* IE valid starting in the subframe indicated by the *Start SFN* IE and *Start Subframe Number* IE, if present. If the *Start SFN* IE and *Start Subframe Number* IE are not present, then the receiving eNB shall consider the *CoMP Information* IE as immediately valid. The receiving eNB shall consider the *CoMP Information* IE valid until an update of the same IE, received in a new LOAD INFORMATION message, is considered valid.

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

- in the course of handover signalling the *Old eNB UE X2AP ID* IE, which is the AP ID allocated by the source eNB, and the *New eNB UE X2AP ID* IE, which is the AP ID allocated by the target eNB

- in the course of signalling for dual connectivity, the *Old eNB UE X2AP ID* IE, which is the AP ID allocated by the SeNB, and the *New eNB UE X2AP ID* IE, which is the AP ID allocated by the MeNB

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
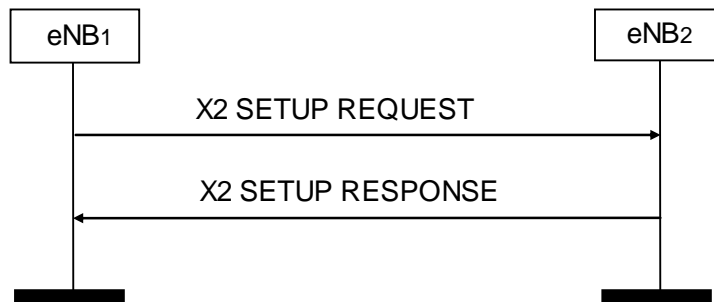
Figure 8.3.3.2-1: X2 Setup, successful operation

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. A direct neighbour of one cell of a given eNB may be any cell belonging to an eNB that is a neighbour of that given eNB cell e.g. even if the cell has not been reported by a UE. The initiating eNB$_1$ may include the *TAC* IE with the *Neighbour Information* IE in the X2 SETUP REQUEST message. The candidate eNB$_2$ 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 eNB$_1$ may include the *MBMS Service Area Identity List* IE in the X2 SETUP REQUEST message. The candidate eNB$_2$ 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 eNB$_1$ the X2 SETUP REQUEST message may contain the *MultibandInfoList* IE. For cell served by the candidate eNB$_2$ 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
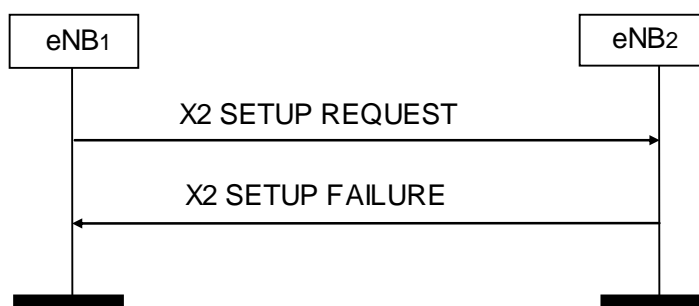
Figure 8.3.3.3-1: X2 Setup, unsuccessful operation

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 message 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
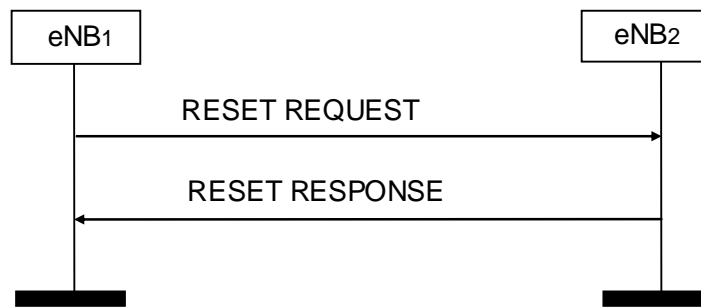
Figure 8.3.4.2-1: Reset, successful operation

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
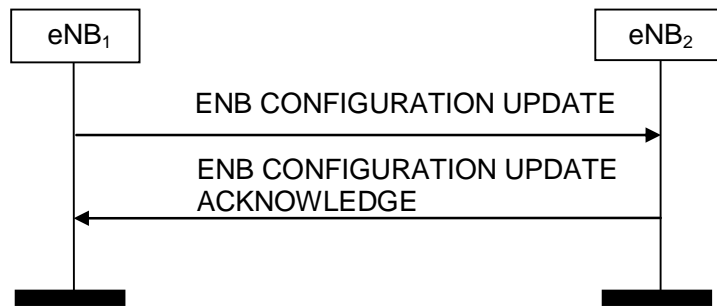
Figure 8.3.5.2-1: eNB Configuration Update, successful operation

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 a given eNB may be any cell belonging to an eNB that is a neighbour of that given eNB 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
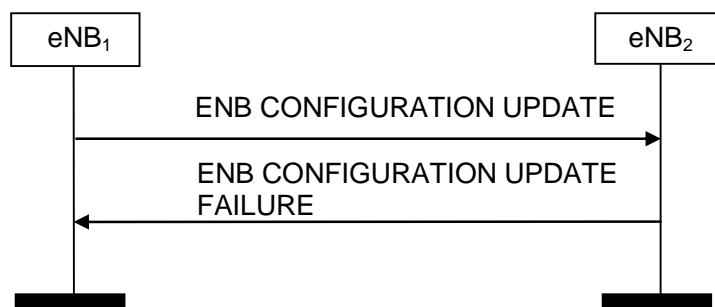
Figure 8.3.5.3-1: eNB Configuration Update, unsuccessful operation

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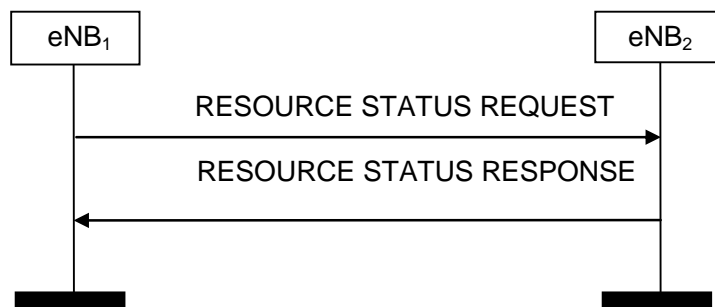
Figure 8.3.6.2-1: Resource Status Reporting Initiation, successful operation

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$_2$;

- the *RSRP Measurement Report List* IE, if the sixth bit, "RSRP Measurement Report Periodic" of the *Report Characteristics* IE included in the RESOURCE STATUS REQUEST message is set to 1..

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 RESOURCE STATUS REQUEST messages that include the *Radio Resource Status* IE, *S1 TNL Load Indicator* IE, *Hardware Load Indicator* IE, *Composite Available Capacity Group* IE, or *ABS Status* IE.

If the *Reporting Periodicity of RSRP Measurement Report* IE is included in the RESOURCE STATUS REQUEST message, eNB$_2$ shall use its value as the minimum time interval between two subsequent RESOURCE STATUS REQUEST messages that include the *RSRP Measurement Report List* IE.

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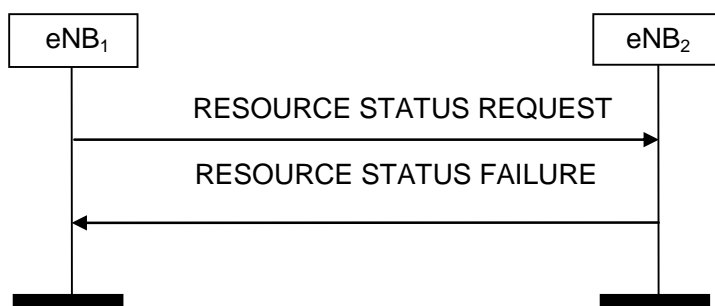
Figure 8.3.6.3-1: Resource Status Reporting Initiation, unsuccessful operation

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, other than the sixth bit, 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 *Reporting Periodicity of RSRP Measurement Report* IE value is not specified when the sixth bit of the *Report Characteristics* IE is set to 1, then eNB$_2$ shall initiate the RESOURCE STATUS FAILURE message and 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
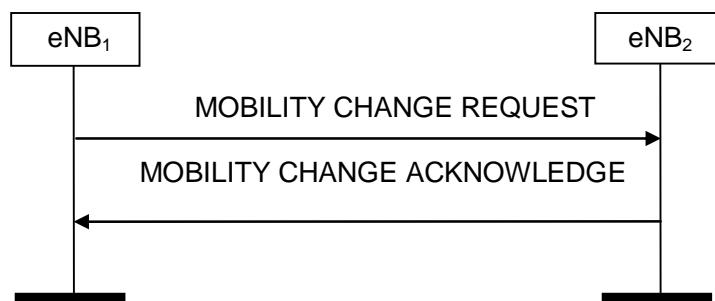
Figure 8.3.8.2-1: Mobility Settings Change, successful operation

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
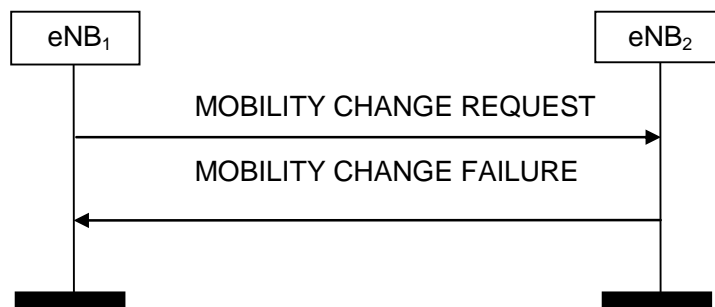
Figure 8.3.8.3-1: Mobility Settings Change, unsuccessful operation

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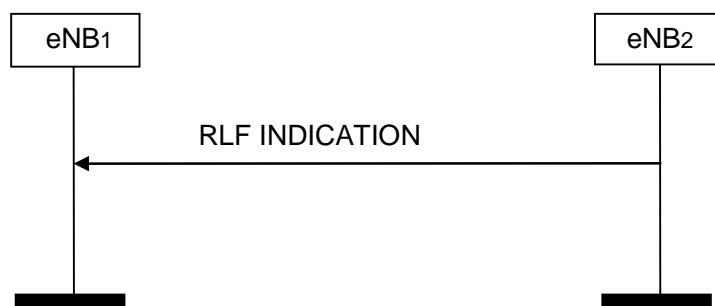
Figure 8.3.9.2-1: Radio Link Failure Indication, successful operation

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 and optionally also the *UE RLF Report Container for extended bands* IE in the RLF INDICATION message, which may be used by the eNB$_1$ to determine the nature of the failure. If the *UE RLF Report Container* IE is included in the RLF INDICATION message sent after successful re-establishment,

the eNB$_2$ shall use the *Re-establishment Cell ECGI* IE in the RLF INDICATION message to indicate the ECGI of the cell where the re-establishment was successful.

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 or an incoming successful handover.

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.

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. 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 UE-related information is available in eNB$_1$, the eNB$_1$ should include in HANDOVER REPORT message:

- the *Mobility Information* IE, if the *Mobility Information* IE was sent for this handover from eNB$_2$;

- the *Source cell C-RNTI* IE.

If received, the eNB$_2$ uses the above information according to TS 36.300 [15].

If the UE RLF Report received from the eNB sending the RLF INDICATION message, as described in TS 36.300 [15], is available, the eNB$_1$ may also include it in the HANDOVER REPORT as *UE RLF Report Container* IE and optionally also *UE RLF Report Container for extended bands* IE.

If the *Handover Report Type* IE is set to "InterRAT ping-pong", then the eNB$_1$ indicates to eNB$_2$ that a completed 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
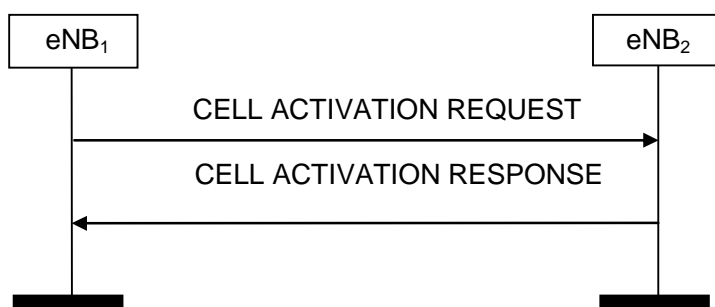
Figure 8.3.11.2-1: Cell Activation, successful operation

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
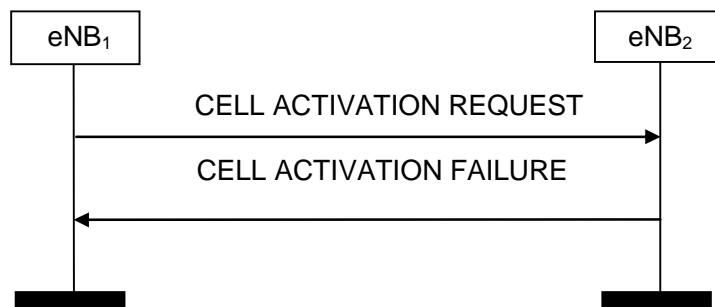
Figure 8.3.11.3-1: Cell Activation, unsuccessful operation

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.

8.3.12 X2 Removal

8.3.12.1 General

The purpose of the X2 Removal procedure is to remove the signaling connection between two eNBs in a controlled manner. If successful, this procedure erases any existing application level configuration data in the two nodes.

The procedure uses non UE-associated signaling.

8.3.12.2 Successful Operation
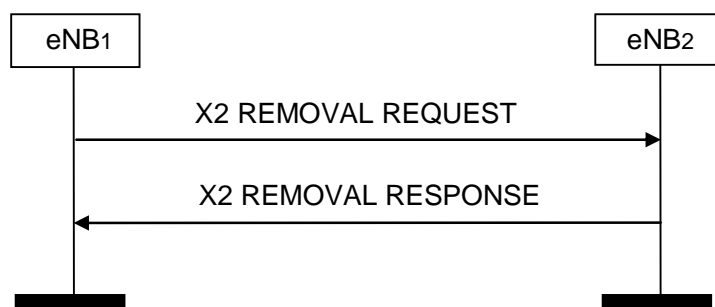
Figure 8.3.12.2-1: X2 Removal, successful operation

An eNB$_1$ initiates the procedure by sending the X2 REMOVAL REQUEST message to a candidate eNB$_2$. Upon reception of the X2 REMOVAL REQUEST message the candidate eNB$_2$ shall reply with the X2 REMOVAL RESPONSE message. After receiving the X2 REMOVAL RESPONSE message, the initiating eNB$_1$ shall initiate removal of the TNL association towards eNB$_2$ and may remove all resources associated with that signaling connection. The candidate eNB$_2$ may then remove all resources associated with that signaling connection.

8.3.12.3 Unsuccessful Operation
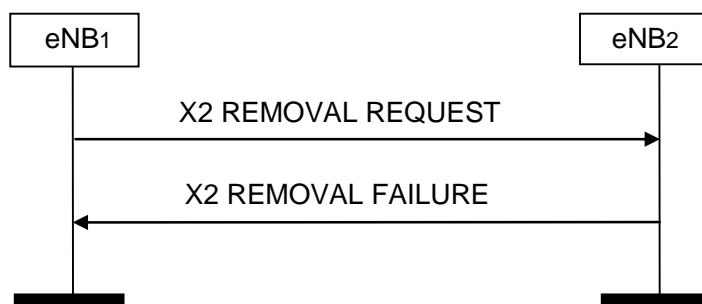
Figure 8.3.12.3-1: X2 Removal, unsuccessful operation

If the candidate eNB$_2$ cannot accept to remove the signaling connection with eNB$_1$ it shall respond with an X2 REMOVAL FAILURE message with an appropriate cause value.

8.3.12.4 Abnormal Conditions

Void.

8.4 X2 Release

8.4.1 General

The purpose of the X2 Release procedure is to inform an eNB that the signalling (i.e. SCTP) connection to a peer eNB is unavailable.

8.4.2 Successful Operation

Figure 8.4.2-1: X2AP Release, successful operation

eNB$_1$ initiates the procedure by sending the X2 RELEASE message to eNB$_2$. Upon the reception of X2 RELEASE message, eNB$_2$ shall consider that the signalling connection to an eNB indicated by the *eNB ID* IE is unavailable. eNB$_2$ may delete all the context information related to the indicated eNB.

8.4.3 Unsuccessful Operation

Not Applicable

8.4.4 Abnormal Condition

Not Applicable.

8.5 X2AP Message Transfer

8.5.1 General

The purpose of the X2AP Message Transfer procedure is to allow indirect transport of an X2AP message (except the X2AP MESSAGE TRANSFER message) between two eNBs and to allow an eNB to perform registration.

8.5.2 Successful Operation

Figure 8.5.2-1: X2AP Message Transfer, successful operation

eNB$_1$ initiates the procedure by sending the X2AP MESSAGE TRANSFER message to eNB$_2$.

Upon the reception of X2 MESSAGE TRANSFER message the target eNB may:

- Retrieve the X2AP message included in the *X2AP Message* IE;

- Consider the target eNB ID contained in the *Target eNB ID* IE, included in the *RNL Header* IE, as the destination for the X2AP message signaled in the *X2AP Message* IE;

- Consider the source eNB ID contained in the *Source eNB ID* IE, included in the *RNL Header* IE, as the source of the X2AP message signaled in the *X2AP Message* IE.

In case the included RNL Header IE does not contain the Target eNB ID IE, the receiving eNB shall consider the eNB ID included in the Source eNB ID IE as the eNB ID corresponding to the TNL address(es) of the sender and update its internal information.

8.5.3 Unsuccessful Operation

Not Applicable.

8.5.4 Abnormal Condition

Not Applicable.

8.6 Procedures for Dual Connectivity

8.6.1 SeNB Addition Preparation

8.6.1.1 General

The purpose of the SeNB Addition Preparation procedure is to request the SeNB to allocate resources for dual connectivity operation for a specific UE. The procedure uses UE-associated signalling.

8.6.1.2 Successful Operation
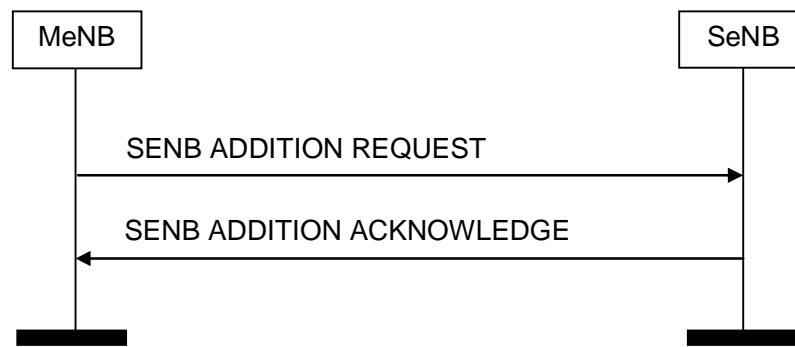
Figure 8.6.1.2-1: SeNB Addition Preparation, successful operation

The MeNB initiates the procedure by sending the SENB ADDITION REQUEST message to the SeNB. When the MeNB sends the SENB ADDITION REQUEST message, it shall start the timer T_{DCprep}.

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].

If the SENB ADDITION REQUEST message contains the *Serving PLMN* IE, the SeNB may use it for RRM purposes.

The SeNB shall report to the MeNB, in the SENB ADDITION ACKNOWLEDGE message, the result for all the requested E-RABs in the following way:

- A list of E-RABs which are successfully established shall be included in the *E-RABs Admitted To Be Added List* IE

- A list of E-RABs which failed to be established shall be included in the *E-RABs Not Admitted To Be Added List* IE.

For each E-RAB configured with the SCG bearer option

- the SeNB shall store the SeNB UE Aggregate Maximum Bit Rate in the UE context, and use the received SeNB UE Aggregate Maximum Bit Rate for non-GBR Bearers for the concerned UE as defined in TS 36.300 [15].

- the SeNB shall choose the ciphering algorithm based on the information in the *UE Security Capabilities* IE and locally configured priority list of AS encryption algorithms and apply the key indicated in the *SeNB Security Key* IE as specified in the TS 33.401 [18].

- the MeNB may propose to apply forwarding of downlink data by including the *DL Forwarding* IE within the *E-RABs To be Added Item* IE of the SENB ADDITION REQUEST message. For each E-RAB that it has decided to admit, the SeNB may include the *DL Forwarding GTP Tunnel Endpoint* IE within the *E-RABs Admitted To Be Added Item* IE of the SENB ADDITION 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 *DL GTP TEID* IE in the *E-RAB To Be Modified in Downlink List* IE of the E-RAB MODIFY INDICATION message (see TS 36.413 [4]) depending on implementation choice.

- the SeNB may include for each bearer in the *E-RABs Admitted To Be Added List* IE the *UL Forwarding GTP Tunnel Endpoint* IE to indicate that it requests data forwarding of uplink packets to be performed for that bearer.

Upon reception of the SENB ADDITION ACKNOWLEDGE message the MeNB shall stop the timer T_{DCprep}.

Interactions with the SeNB Reconfiguration Completion procedure:

If the SeNB admits at least one E-RAB, the SeNB shall start the timer $T_{DCoverall}$ when sending the SENB ADDITION ACKNOWLEDGE message to the MeNB. The reception of the SENB RECONFIGURATION COMPLETE message shall stop the timer $T_{DCoverall}$.

8.6.1.3   Unsuccessful Operation
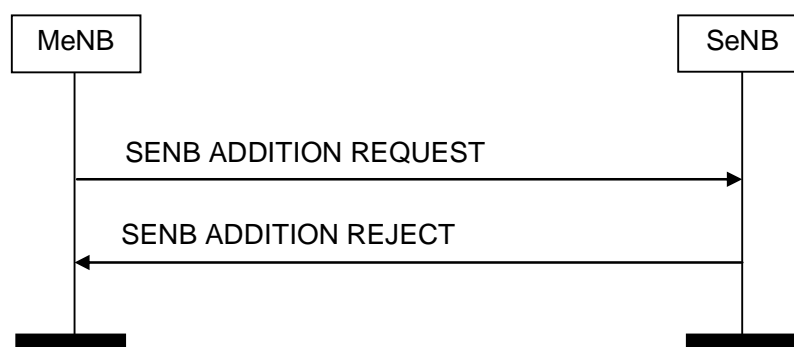
Figure 8.6.1.3-1: SeNB Addition Preparation, unsuccessful operation

If the SeNB is not able to accept any of the bearers or a failure occurs during the SeNB Addition Preparation, the SeNB sends the SENB ADDITION REJECT message with an appropriate cause value to the MeNB.

8.6.1.4   Abnormal Conditions

If the SeNB receives a SENB ADDITION REQUEST message containing multiple *E-RAB ID* IEs (in the *E-RABs To Be Added List* IE) set to the same value, the SeNB shall consider the establishment of the corresponding E-RAB as failed.

If the SeNB receives a SENB ADDITION 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 SeNB shall consider the establishment of the corresponding E-RAB as failed.

If the supported algorithms for encryption defined in the *Encryption Algorithms* IE in the *UE Security Capabilities* IE, plus the mandated support of EEA0 in all UEs (TS 33.401 [18]), do not match any algorithms defined in the configured list of allowed encryption algorithms in the SeNB (TS 33.401 [18]), the SeNB shall reject the procedure using the SENB ADDITION REJECT message.

Interactions with the SeNB Reconfiguration Completion and SeNB initiated SeNB Release procedure:

If the timer $T_{DCoverall}$ expires before the SeNB has received the SENB RECONFIGURATION COMPLETE or the SENB RELEASE REQUEST message, the SeNB shall regard the requested RRC connection reconfiguration as being not applied by the UE and shall trigger the SeNB initiated SeNB Release procedure.

Interactions with the MeNB initiated SeNB Release procedure:

If the timer T_{DCprep} expires before the MeNB has received the SENB ADDITION ACKNOWLEDGE message, the MeNB shall regard the SeNB Addition Preparation procedure as being failed and shall trigger the MeNB initiated SeNB Release procedure.

8.6.2   SeNB Reconfiguration Completion

8.6.2.1   General

The purpose of the SeNB Reconfiguration Completion procedure is to provide information to the SeNB whether the requested configuration was successfully applied by the UE.

The procedure uses UE-associated signalling.

8.6.2.2   Successful Operation

Figure 8.6.2.2-1: SeNB Reconfiguration Complete procedure, successful operation.

The MeNB initiates the procedure by sending the SENB RECONFIGURATION COMPLETE message to the SeNB.

The SENB RECONFIGURATION COMPLETE message may contain information that

- either the UE has successfully applied the configuration requested by the SeNB. The MeNB may also provide configuration information in the *MeNB to SeNB Container* IE.

- or the MeNB has not triggered configuration requested by the SeNB. The MeNB shall provide information with sufficient precision in the included *Cause* IE to enable the SeNB to know the reason for an unsuccessful reconfiguration. The MeNB may also provide configuration information in the *MeNB to SeNB Container* IE.

Upon reception of the SENB RECONFIGURATION COMPLETE message the SeNB shall stop the timer $T_{DCoverall}$.

8.6.2.3 Abnormal Conditions

Void.

8.6.3 MeNB initiated SeNB Modification Preparation

8.6.3.1 General

This procedure is used to enable an MeNB to request an SeNB to modify UE context at the SeNB.

The procedure uses UE-associated signalling.

### 8.6.3.2 Successful Operation
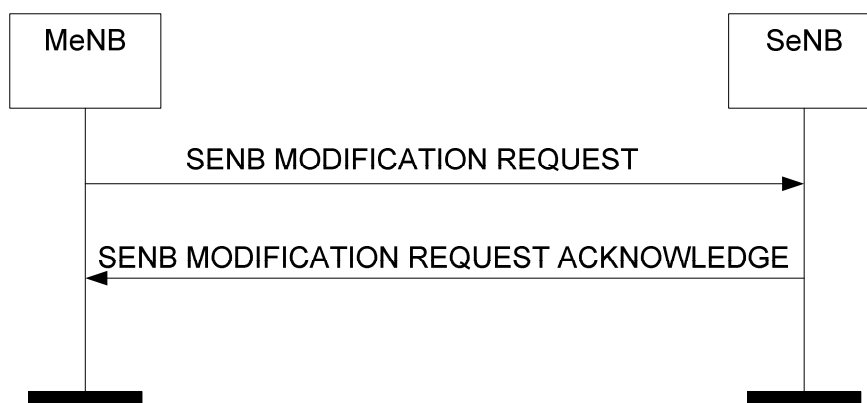
Figure 8.6.3.2-1: MeNB initiated SeNB Modification Preparation, successful operation

The MeNB initiates the procedure by sending the SENB MODIFICATION REQUEST message to the SeNB. When the MeNB sends the SENB MODIFICATION REQUEST message, it shall start the timer T_{DCprep}.

The SENB MODIFICATION REQUEST message may contain

- within the *UE Context Information* IE;

  - E-RABs to be added within the *E-RABs To Be Added Item* IE;

  - E-RABs to be modified within the *E-RABs To Be Modified Item* IE;

  - E-RABs to be released within the *E-RABs To Be Released Item* IE;

  - the *SeNB UE Aggregate Maximum Bit Rate* IE;

- the *MeNB to SeNB Container* IE;

- the *SCG Change Indication* IE.

If the SENB MODIFICATION REQUEST message contains the *Serving PLMN* IE, the SeNB may use it for RRM purposes.

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].

If at least one of the requested modifications is admitted by the SeNB, the SeNB shall modify the related part of the UE context accordingly and send the SENB MODIFICATION REQUEST ACKNOWLEDGE message back to the MeNB.

The SeNB shall include the E-RABs for which resources have been either added or modified or released at the SeNB either in the *E-RABs Admitted To Be Added List* IE or the *E-RABs Admitted To Be Modified List* IE or the *E-RABs Admitted To Be Released List* IE. The SeNB shall include the E-RABs that have not been admitted in the *E-RABs Not Admitted List* IE with an appropriate cause value.

For each E-RAB configured with the SCG bearer option to be added or modified

- the SeNB shall, if included, choose the ciphering algorithm based on the information in the *UE Security Capabilities* IE and locally configured priority list of AS encryption algorithms and apply the key indicated in the *SeNB Security Key* IE as specified in the TS 33.401 [18].

- if applicable, the MeNB may propose to apply forwarding of downlink data by including the *DL Forwarding* IE within the *E-RABs To Be Added Item* IE of the SENB MODIFICATION REQUEST message. For each E-RAB that it has decided to admit, the SeNB may include the *DL Forwarding GTP Tunnel Endpoint* IE within the *E-RABs Admitted To Be Added Item* IE of the SENB MODIFICATION REQUEST ACKNOWLEDGE message to indicate that it accepts the proposed forwarding of downlink data for this bearer. The MeNB may also provide for an applicable E-RAB to be released the *DL Forwarding GTP Tunnel Endpoint* IE and the *UL Forwarding GTP Tunnel Endpoint* IE within the *E-RABs To Be Released Item* IE of the SENB MODIFICATION REQUEST message.

- if applicable, the SeNB may include for each bearer in the *E-RABs Admitted To Be Added List* IE in the SENB MODIFICATION REQUEST ACKNOWLEDGE message the *DL Forwarding GTP Tunnel Endpoint* IE and the *UL Forwarding GTP Tunnel Endpoint* IE to indicate that it requests data forwarding of uplink packets to be performed for that bearer.

For each E-RAB configured with the split bearer option to be modified (released)

- if applicable, the MeNB may provide for an applicable E-RAB to be released the *DL Forwarding GTP Tunnel Endpoint* IE within the *E-RABs To Be Released Item* IE of the SENB MODIFICATION REQUEST message.

If the *SCG Change Indication* IE is included in the SENB MODIFICATION REQUEST message, the SeNB shall act as specified in TS 36.300 [15].

Upon reception of the SENB MODIFICATION REQUEST ACKNOWLEDGE message the MeNB shall stop the timer T_{DCprep}. If the SENB MODIFICATION REQUEST ACKNOWLEDGE message has included the *SeNB to MeNB Container* IE the MeNB is then defined to have a Prepared SeNB Modification for that X2 UE-associated signalling.

Interactions with the SeNB Reconfiguration Completion procedure:

If the SeNB admits a modification of the UE context requiring the MeNB to report about the success of the RRC connection reconfiguration procedure, the SeNB shall start the timer $T_{DCoverall}$ when sending the SENB MODIFICATION REQUEST ACKNOWLEDGE message to the MeNB. The reception of the SeNB RECONFIGURATION COMPLETE message shall stop the timer $T_{DCoverall}$.

8.6.3.3   Unsuccessful Operation
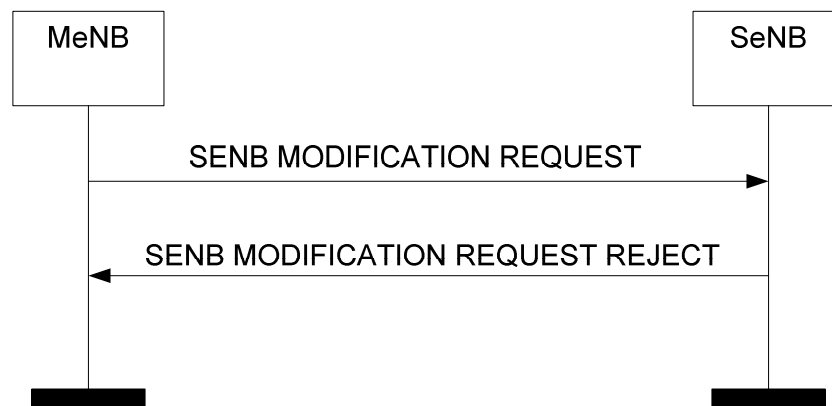
Figure 8.6.3.3-1: MeNB initiated SeNB Modification Preparation, unsuccessful operation

If the SeNB does not admit any modification requested by the MeNB, or a failure occurs during the MeNB initiated SeNB Modfication Preparation, the SeNB shall send the SENB MODIFICATION REQUEST REJECT message to the MeNB. The message shall contain the *Cause* IE with an appropriate value.

If the SeNB receives a SENB MODIFICATION REQUEST message containing the *MeNB to SeNB Container* IE that does not include required information as specified in TS 36.331 [9], the SeNB shall send the SENB MODIFICATION REQUEST REJECT message to the MeNB.

8.6.3.4   Abnormal Conditions

If the SeNB receives a SENB MODIFICATION REQUEST message containing multiple *E-RAB ID* IEs (in the *E-RABs To Be Added List* IE and/or the *E-RABs To Be Modified List* IE) set to the same value, the SeNB shall not admit the action requested for the corresponding E-RABs.

If the SeNB receives an SENB MODIFICATION REQUEST message containing multiple *E-RAB ID* IEs (in the *E-RAB To Be Released List* IE) set to the same value, the SeNB shall initiate the release of one corresponding E-RAB and ignore the duplication of the instances of the selected corresponding E-RABs.

If the SeNB receives a SENB MODIFICATION 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 SeNB 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 SeNB (TS 33.401 [18]), the SeNB shall reject the procedure using the SENB MODIFICATION REQUEST REJECT message.

If the timer T_{DCprep} expires before the MeNB has received the SENB MODIFICATION REQUEST ACKNOWLEDGE message, the MeNB shall regard the MeNB initiated SeNB Modification Preparation procedure as being failed and shall release the UE Context at the SeNB.

Interactions with the SeNB Reconfiguration Completion and SeNB initiated SeNB Release procedure:

If the timer $T_{DCoverall}$ expires before the SeNB has received the SENB RECONFIGURATION COMPLETE or the SENB RELEASE REQUEST message, the SeNB shall regard the requested modification RRC connection reconfiguration as being not applied by the UE and shall trigger the SeNB initiated SeNB Release procedure.**Interaction with the SeNB initiated SeNB Modification Preparation procedure:**

If the MeNB, after having initiated the MeNB initiated SeNB Modification procedure, receives the SENB MODIFICATION REQUIRED message, the MeNB shall refuse the SeNB initiated SeNB Modification procedure with an appropriate cause value in the *Cause* IE.

If the MeNB has a Prepared SeNB Modification and receives the SENB MODIFICATION REQUIRED message, the MeNB shall respond with the SENB MODIFICATION REFUSE message to the SeNB with an appropriate cause value in the *Cause* IE.

8.6.4 SeNB initiated SeNB Modification

8.6.4.1 General

This procedure is used by the SeNB to modify the UE context in the MeNB.

The procedure uses UE-associated signalling.

8.6.4.2 Successful Operation
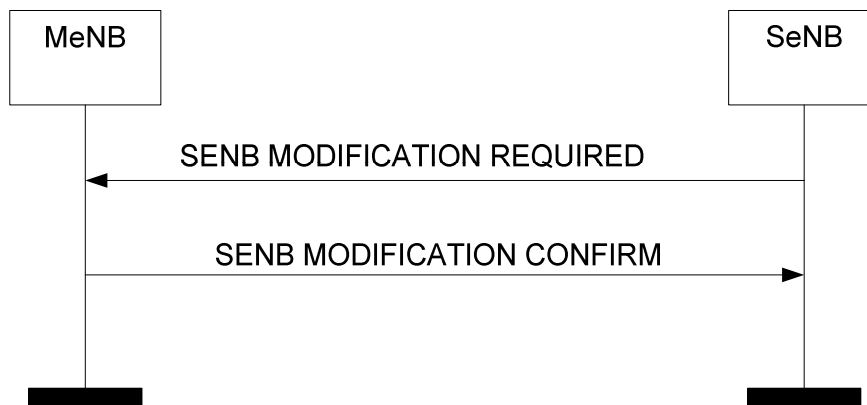
Figure 8.6.4.2-1: SeNB initiated SeNB Modification, successful operation.

The SeNB initiates the procedure by sending the SENB MODIFICATION REQUIRED message to the MeNB. When the SeNB sends the SENB MODIFICATION REQUIRED message, it shall start the timer $T_{DCoverall.}$

The SENB MODIFICATION REQUIRED message may contain

- the *SeNB to MeNB Container* IE.

- E-RABs to be released within the *E-RABs To Be Released Item* IE;

- the *SCG Change Indication* IE.

If the MeNB receives a SENB MODIFICATION REQUIRED message containing the *SCG Change Indication* IE, the MeNB shall act as specified in TS 36.300 [15].

If the MeNB is able to perform the modifications requested by the SeNB, the MeNB shall send the SENB MODIFICATION CONFIRM message to the SeNB. The SENB MODIFICATION CONFIRM message may contain the *MeNB to SeNB Container* IE.

Upon reception of the SENB MODIFICATION CONFIRM message the SeNB shall stop the timer $T_{DCoverall.}$

Interaction with the MeNB initiated SeNB Modification Preparation procedure:

If applicable, as specified in TS 36.300 [15], the SeNB may receive, after having initiated the SeNB initiated SeNB Modification procedure, the SENB MODIFICATION REQUEST message including the *DL Forwarding GTP Tunnel Endpoint* IE and the *UL Forwarding GTP Tunnel Endpoint* IE within the *E-RABs To Be Released List* IE.

If applicable, as specified in TS 36.300 [15], the SeNB may receive, after having initiated the SeNB initiated SeNB Modification procedure, the SENB MODIFICATION REQUEST message including the *SeNB Security Key* IE within the *UE Context Information* IE.

If the SeNB has initiated the SeNB initiated SeNB Modification procedure with the SENB MODIFICATION REQUIRED message including the *E-RABs To Be Released Item* IE, it may receive the SENB MODIFICATION REQUEST message including the *SCG Change Indication* IE, upon which the SeNB shall provide respective information in the *SeNB to MeNB Container* IE within the SENB MODIFICATION REQUEST ACKNOWLEDGMENT message, as specified in TS 36.300 [15].

8.6.4.3   Unsuccessful Operation
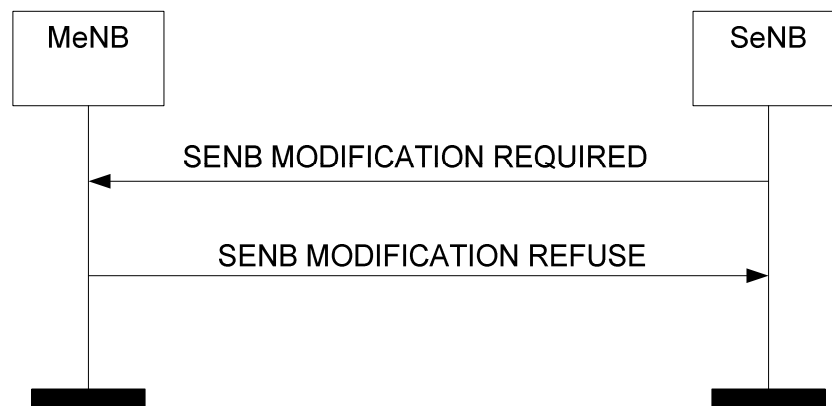
Figure 8.6.4.3-1: SeNB initiated SeNB Modification, unsuccessful operation.

In case the request modification cannot be performed successfully the MeNB shall respond with the SENB MODIFICATION REFUSE message to the SeNB with an appropriate cause value in the *Cause* IE.

The MeNB may also provide configuration information in the *MeNB to SeNB Container* IE.

8.6.4.4   Abnormal Conditions

If the timer $T_{DCoverall}$ expires before the SeNB has received the SENB MODIFICATION CONFIRM or the SENB MODIFICATION REFUSE message, the SeNB shall regard the requested modification as failed and may take further actions like triggering the SeNB initiated SeNB Release procedure to release all SeNB resources allocated for the UE.

If the MeNB is aware that the SeNB didn't receive the latest configuration information concerning the MCG, the MeNB may respond with the SENB MODIFICATION REFUSE message to the SeNB with an appropriate cause value in the *Cause* IE.

If the value received in the *E-RAB ID* IE of any of the *E-RABs To Be Released Items* IE is not known at the MeNB, the MeNB shall regard the procedure as failed and may take appropriate actions like triggering the MeNB initiated SeNB Release procedure.

Interaction with the MeNB initiated SeNB Modification Preparation procedure:

If the SeNB, after having initiated the SeNB initiated SeNB Modification procedure, receives the SENB MODIFICATION REQUEST message including other IEs than an applicable *SeNB Security Key* IE and/or applicable forwarding addresses and/or the *SCG Change Indication* IE the SeNB shall

- regard the SeNB initiated SeNB Modification Procedure as being failed,

- stop the $T_{DCoverall}$, which was started to supervise the SeNB initiated SeNB Modification procedure,

- be prepared to receive the SENB MODIFICATION REFUSE message from the MeNB and

- continue with the MeNB initiated SeNB Modification Preparation procedure as specified in section 8.6.3.

8.6.5   MeNB initiated SeNB Release

8.6.5.1   General

The MeNB initiated SeNB Release procedure is triggered by the MeNB to initiate the release of the resources for a specific UE.

The procedure uses UE-associated signalling.

8.6.5.2 Successful Operation

Figure 8.6.5.2-1: MeNB initiated SeNB Release, successful operation

The MeNB initiates the procedure by sending the SENB RELEASE REQUEST message. Upon reception of the SENB RELEASE REQUEST message the SeNB shall stop providing user data to the UE. The *SeNB UE X2AP ID* IE shall be included if it has been obtained from the SeNB. The MeNB may provide appropriate information within the *Cause* IE.

If the bearer context in the SeNB was configured with the SCG bearer option, for each SCG bearer for which the MeNB requests forwarding of uplink/downlink data, the MeNB includes the *UL Forwarding GTP Tunnel Endpoint/ DL Forwarding GTP Tunnel Endpoint* IE within the *E-RABs To Be Released Item* IE of the SENB RELEASE REQUEST message to indicate that the SeNB should perform data forwarding of uplink/downlink packets for that SCG bearer.

If the bearer context in the SeNB was configured with the split bearer option, for each Split bearer for which the MeNB requests forwarding of downlink data, the MeNB includes the *DL Forwarding GTP Tunnel Endpoint* IE within the *E-RABs To Be Released Item* IE of the SENB RELEASE REQUEST message to indicate that the SeNB should perform data forwarding of downlink packets for that split bearer.

8.6.5.3 Unsuccessful Operation

Not applicable.

8.6.5.4 Abnormal Conditions

Should the SENB RELEASE REQUEST message refer to a context that does not exist, the SeNB shall ignore the message.

When the MeNB has initiated the procedure and did not include the *SeNB UE X2AP ID* IE the MeNB shall regard the resources for the UE at the SeNB as being fully released.

8.6.6 SeNB initiated SeNB Release

8.6.6.1 General

This procedure is triggered by the SeNB to initiate the release of the resources for a specific UE.

The procedure uses UE-associated signalling.

8.6.6.2 Successful Operation
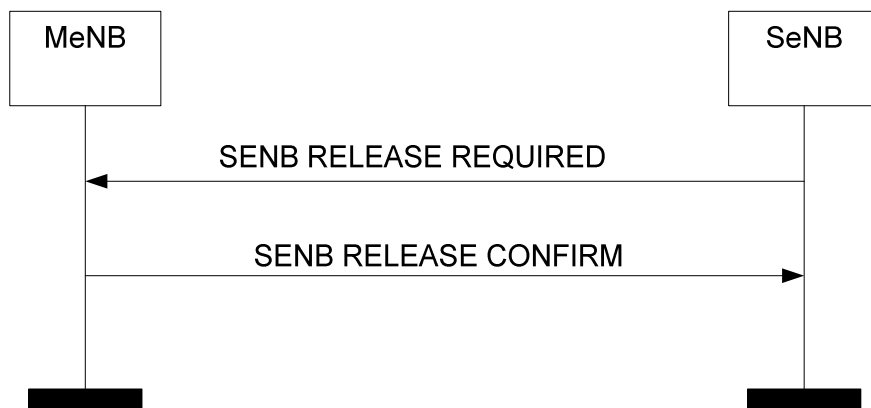
Figure 8.6.6.2-1: SeNB initiated SeNB Release, successful operation.

The SeNB initiates the procedure by sending the SENB RELEASE REQUIRED message to the MeNB.

Upon reception of the SENB RELEASE REQUIRED message, the MeNB replies with the SENB RELEASE CONFIRM message. For each E-RAB configured with the SCG bearer option, the MeNB may include the *DL Forwarding GTP Tunnel Endpoint* IE and the *UL Forwarding GTP Tunnel Endpoint* IE within the *E-RABs To Be Released Item* IE to indicate that it requests data forwarding of uplink and downlink packets to be performed for that bearer. For each E-RAB configured with the split bearer option, the MeNB may include the *DL Forwarding GTP Tunnel Endpoint* IE within the *E-RABs To Be Released Item* IE to indicate that it requests data forwarding of downlink packets to be performed for that bearer.

The SeNB may start data forwarding and stop providing user data to the UE upon reception of the SENB RELEASE CONFIRM message,

8.6.6.3 Unsuccessful Operation

Not applicable.

8.6.6.4 Abnormal Conditions

Void.

8.6.7 SeNB Counter Check

8.6.7.1 General

This procedure is initiated by the SeNB to request the MeNB to execute a counter check procedure to verify the value of the PDCP COUNTs associated with SCG bearers established in the SeNB.

The procedure uses UE-associated signalling.

8.6.7.2   Successful Operation
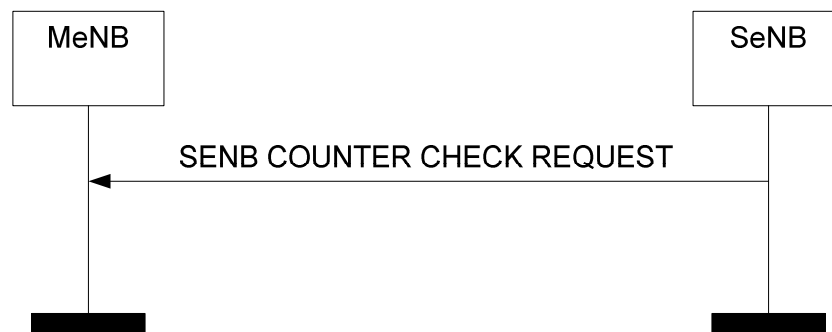
Figure 8.6.7.2-1: SeNB Counter Check procedure, successful operation.

The SeNB initiates the procedure by sending the SENB COUNTER CHECK REQUEST message to the MeNB.

Upon reception of the SENB COUNTER CHECK REQUEST message, the MeNB may perform the RRC counter check procedure as defined in TS 33.401 [18].

8.6.7.3   Unsuccessful Operation

Not applicable.

8.6.7.4   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].

   NOTE: The messages have been defined in accordance to the guidelines specified in TR 25.921 [30].

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
>Management Based MDT PLMN List	O		MDT PLMN List 9.2.64		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
Mobility Information	O		BIT STRING (SIZE (32))	Information related to the handover; the source eNB provides it in order to enable later analysis of the conditions that led to a wrong HO.	YES	ignore
Masked IMEISV	O		9.2.69		YES	ignore
UE History Information from the UE	O		OCTET STRING	VisitedCellInfoList contained in the UEInformationResp	YES	ignore

ETSI

			onse message (TS 36.331 [9])			
Expected UE Behaviour	O		9.2.70		YES	ignore

Range bound	Explanation
maxnoofBearers	Maximum no. of E-RABs. Value is 256
maxnoofMDTPLMNs	PLMNs in the Management Based MDT PLMN list. Value is 16.

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 and 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 (handover), eNB from which the E-RAB context is transferred → eNB to which the E-RAB context is transferred (dual connectivity).

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 for handover at the source eNB and for dual connectivity at the eNB from which the E-RAB context is transferred	YES	reject
New eNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated for handover at the target eNB and for dual connectivity at the eNB to which the E-RAB context is transferred	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 in case of 12 bit long PDCP-SN	–	–
>>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 in case of 12 bit long PDCP-SN	–	–
>>Receive Status Of UL PDCP SDUs Extended	O		BIT STRING (1..16384)	The IE is used in case of 15 bit long PDCP-SN in this release. The first bit indicates the status of the SDU after the First Missing UL PDCP SDU. The Nth bit indicates the status of the UL PDCP SDU in position (N + First Missing SDU Number) modulo (1 + the maximum value of the PDCP-SN). 0: PDCP SDU has not been received. 1: PDCP SDU has been received correctly.	YES	ignore
>>UL COUNT Value Extended	O		COUNT Value Extended 9.2.66	PDCP-SN and Hyper Frame Number of the first missing UL SDU in case of 15 bit long	YES	ignore

				PDCP-SN		
>>DL COUNT Value Extended	O		COUNT Value Extended 9.2.66	PDCP-SN and Hyper Frame Number that the target eNB should assign for the next DL SDU not having an SN yet in case of 15 bit long PDCP-SN	YES	ignore

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 (handover), MeNB → SeNB (dual connectivity).

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 for handover at the source eNB and for dual connectivity at the SeNB	YES	reject
New eNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated for handover at the target eNB and for dual connectivity at the MeNB	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$_1$ → 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
>>Intended UL-DL Configuration	O		ENUMERATED(sa0, sa1, sa2, sa3, sa4, sa5, sa6,…)	One of the UL-DL configurations defined in TS 36.211 [10]. The UL subframe(s) in the indicated configuration is subset of those in SIB1 UL-DL configuration. This IE applies to TDD only.	YES	ignore
>>Extended UL Interference Overload Info	O		9.2.67	This IE applies to TDD only.	YES	ignore
>>CoMP Information	O		9.2.74		YES	ignore
>>Dynamic DL transmission information	O		9.2.77		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 for handover at the source eNB and for dual connectivity at the SeNB	YES	ignore
New eNB UE X2AP ID	O		eNB UE X2AP ID 9.2.24	Allocated for handover at the target eNB and for dual connectivity at the MeNB	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 or EARFCN for TDD	–	–
>>TAC	O		OCTET STRING (2)	Tracking Area Code	YES	ignore
>>EARFCN Extension	O		9.2.65	DL EARFCN for FDD or EARFCN for TDD. If this IE is present, the value signalled in the *EARFCN* IE is ignored.	YES	reject
GU Group Id List		*0 .. <maxfPools>*		List of all the pools to which the eNB belongs	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 or EARFCN for TDD	–	–
>>TAC	O		OCTET STRING (2)	Tracking Area Code	YES	ignore
>>EARFCN Extension	O		9.2.65	DL EARFCN for FDD or EARFCN for TDD. If this IE is present, the value signalled in the *EARFCN* IE is ignored.	YES	reject
GU Group Id List		*0 .. <maxPools>*		List of all the pools to which the eNB belongs	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 or EARFCN for TDD	–	–
>>TAC	O		OCTET STRING (2)	Tracking Area Code	YES	ignore
>>EARFCN Extension	O		9.2.65	DL EARFCN for FDD or EARFCN for TDD. If this IE is present, the value signalled in the *EARFCN* IE is ignored.	YES	reject
Served Cells To Modify		*0 .. <maxCellineNB>*		Complete list of modified cells served by the eNB	GLOBAL	reject
>Old ECGI	M		ECGI 9.2.14	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 or EARFCN for TDD	–	–
>>TAC	O		OCTET STRING (2)	Tracking Area Code	YES	ignore
>>EARFCN Extension	O		9.2.65	DL EARFCN for FDD or EARFCN for TDD. If this IE is present, the value signalled in the *EARFCN* IE is ignored.	YES	reject
>Deactivation Indication	O		ENUMERATED(deactivated, …)	Indicates that the concerned cell is switched off for energy	YES	ignore

				saving reasons		
Served Cells To Delete		*0 ..* *<maxCellineNB>*		Complete list of deleted cells served by the eNB	GLOBAL	reject
>Old ECGI	M		ECGI 9.2.14	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$_2$ → 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$_2$ → 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$_1$ → 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, this bit should be set to 1 if at least one of the First, Second or Third bits is set to 1, Fifth Bit = ABS Status Periodic, Sixth Bit = RSRP Measurement Report 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, …)	Periodicity that can be used for reporting of PRB Periodic, TNL Load Ind Periodic, HW Load Ind Periodic, Composite Available Capacity Periodic or ABS Status Periodic.	YES	ignore
Partial Success Indicator	O		ENUMERATED(partial success allowed, ...)	Included if partial success is allowed	YES	ignore
Reporting Periodicity of RSRP Measurement Report	O		ENUMERATED(120ms, 240ms, 480ms, 640ms, ...)	Periodicity that can be used for the reporting of RSRP Measurement Report Periodic.	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*		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, Sixth Bit = RSRP Measurement Report 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, Sixth Bit = RSRP Measurement Report 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.
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
>>RSRP Measurement Report List	O		9.2.76		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$_2$ → 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
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$_2$ → 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-r*9 IE 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 or an incoming successful handover	YES	reject
RRC Conn Reestab Indicator	O		ENUMERATED(reconfigurationFailure, handoverFailure, otherFailure, ...)	The Reestablishment Cause in RRCConnection Reestablishment Request message(TS 36.331 [9])	YES	ignore
UE RLF Report Container for extended bands	O		OCTET STRING	*RLF-Report-v9e0* IE contained in the UEInformationResponse 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		Cause 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
Source cell C-RNTI	O		BIT STRING (SIZE (16))	C-RNTI allocated at the source eNB (in eNB$_2$) contained in the AS-config (TS 36.331 [9]).	YES	ignore
Mobility Information	O		BIT STRING (SIZE (32))	Information provided in the HANDOVER REQUEST message from eNB$_2$.	YES	ignore
UE RLF Report Container	O		OCTET STRING	The UE RLF Report Container IE received in the RLF INDICATION message.	YES	ignore
UE RLF Report Container for extended bands	O		OCTET STRING	The *UE RLF Report Container for extended bands* IE received in the RLF INDICATION message.	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$_1$ → 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

9.1.2.23 X2 RELEASE

This message is used to indicate that the signalling connection to an eNB is unavailable.

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

9.1.2.24 X2AP MESSAGE TRANSFER

This message is used for indirect transport of an X2AP message (except the X2AP MESSAGE TRANSFER message) between two eNBs, and to allow an eNB to perform registration.

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
RNL Header	M		9.2.68		YES	reject
X2AP Message	O		OCTET STRING	Includes any X2AP message except the X2AP MESSAGE TRANSFER message	YES	reject

9.1.2.25   X2 REMOVAL REQUEST

This message is sent by an eNB to a neighbouring eNB to initiate the removal of the signaling connection.

Direction: eNB$_1$ → 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

9.1.2.26   X2 REMOVAL RESPONSE

This message is sent by an eNB to a neighbouring eNB to acknowledge the initiation of removal of the signaling connection.

Direction: eNB$_2$ → 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
Criticality Diagnostics	O		9.2.7		YES	ignore

9.1.2.27   X2 REMOVAL FAILURE

This message is sent by the eNB to indicate that removing the signaling connection cannot be accepted.

Direction: eNB$_2$ → 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

9.1.3   Messages for Dual Connectivity Procedures

9.1.3.1   SENB ADDITION REQUEST

This message is sent by the MeNB to the SeNB to request the preparation of resources for dual connectivity operation for a specific UE

Direction: MeNB → SeNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
MeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the MeNB	YES	reject
UE Security Capabilities	C-ifSCGBearerOption		9.2.29		YES	reject
SeNB Security Key	C-ifSCGBearerOption		9.2.72	The S-KeNB which is provided by the MeNB, see TS 33.401 [18].	YES	reject
SeNB UE Aggregate Maximum Bit Rate	M		UE Aggregate Maximum Bit Rate 9.2.12	The UE Aggregate Maximum Bit Rate is split into MeNB UE Aggregate Maximum Bit Rate and SeNB UE Aggregate Maximum Bit Rate which are enforced by MeNB and SeNB respectively.	YES	reject
Serving PLMN	O		PLMN Identity 9.2.4	The serving PLMN of the SCG in the SeNB.	YES	ignore
E-RABs To Be Added List		1			YES	reject
>E-RABs To Be Added Item		1 .. *<maxnoof Bearers>*			EACH	reject
>>CHOICE Bearer Option	M					
>>>SCG Bearer						
>>>>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		–	–
>>>>S1 UL GTP Tunnel Endpoint	M		GTP Tunnel Endpoint 9.2.1	SGW endpoint of the S1 transport bearer. For delivery of UL PDUs.	–	–
>>>Split Bearer						
>>>>E-RAB ID	M		9.2.23		–	–
>>>>E-RAB Level QoS Parameters	M		9.2.9	Includes necessary QoS parameters	–	–
>>>>MeNB GTP Tunnel Endpoint	M		GTP Tunnel Endpoint 9.2.1	MeNB endpoint of the X2 transport bearer. For delivery of UL PDUs.	–	–
MeNB to SeNB Container	M		OCTET STRING	Includes the *SCG-ConfigInfo* message as defined in TS 36.331 [9]	YES	reject

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

Condition	Explanation
ifSCGBearerOption	This IE shall be present if the SCG bearer option is configured.

9.1.3.2 SENB ADDITION ACKNOWLEDGE

This message is sent by the SeNB to confirm the MeNB about the SeNB addition preparation.

Direction: SeNB → MeNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
MeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the MeNB	YES	reject
SeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the SeNB	YES	reject
E-RABs Admitted To Be Added List		*1*			YES	ignore
>E-RABs Admitted To Be Added Item		*1 .. <maxnoof Bearers>*			EACH	ignore
>>CHOICE Bearer Option	M					
>>>*SCG Bearer*						
>>>>E-RAB ID	M		9.2.23		–	–
>>>>S1 DL GTP Tunnel Endpoint	M		GTP Tunnel Endpoint 9.2.1	SeNB endpoint of the S1 transport bearer. For delivery of DL PDUs.	–	–
>>>>DL Forwarding GTP Tunnel Endpoint	O		GTP Tunnel Endpoint 9.2.1	Identifies the X2 transport bearer used for forwarding of DL PDUs	–	–
>>>>UL Forwarding GTP Tunnel Endpoint	O		GTP Tunnel Endpoint 9.2.1	Identifies the X2 transport bearer used for forwarding of UL PDUs	–	–
>>>*Split Bearer*						
>>>>E-RAB ID	M		9.2.23		–	–
>>>>SeNB GTP Tunnel Endpoint	M		GTP Tunnel Endpoint 9.2.1	Endpoint of the X2 transport bearer at the SeNB.	–	–
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 and in *E-RABs Not Admitted List* IE.	YES	ignore
SeNB to MeNB Container	M		OCTET STRING	Includes the *SCG-Configuration* message as defined in TS 36.331 [9]	YES	reject
Criticality Diagnostics	O		9.2.7		YES	ignore

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

9.1.3.3 SENB ADDITION REJECT

This message is sent by the SeNB to inform the MeNB that the SeNB Addition Preparation has failed.

Direction: SeNB → MeNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
MeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the MeNB	YES	reject
SeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the SeNB	YES	reject
Cause	M		9.2.6		YES	ignore
Criticality Diagnostics	O		9.2.7		YES	ignore

9.1.3.4 SENB RECONFIGURATION COMPLETE

This message is sent by the MeNB to the SeNB to indicate that configuration requested by the SeNB was applied by the UE.

Direction: MeNB → SeNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	ignore
MeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the MeNB	YES	reject
SeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the SeNB	YES	reject
Response Information	M				YES	ignore
>CHOICE *Response Type*	M					
>>*Configuration successfully applied*						
>>>MeNB to SeNB Container	O		OCTET STRING	Includes the *SCG-ConfigInfo* message as defined in TS 36.331 [9]	-	-
>>*Configuration rejected by the MeNB*						
>>>Cause	M		9.2.6		-	-
>>>MeNB to SeNB Container	O		OCTET STRING	Includes the *SCG-ConfigInfo* message as defined in TS 36.331 [9]	-	-

9.1.3.5 SENB MODIFICATION REQUEST

This message is sent by the MeNB to the SeNB to request the preparation to modify SeNB resources for a specific UE.

Direction: MeNB → SeNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
MeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the MeNB	YES	reject
SeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the SeNB	YES	reject
Cause	M		9.2.6		YES	ignore
SCG Change Indication	O		9.2.73		YES	ignore
Serving PLMN	O		PLMN Identity 9.2.4	The serving PLMN of the SCG in the SeNB.	YES	ignore
UE Context Information		*1*			YES	reject
>UE Security Capabilities	O		9.2.29		–	–
>SeNB Security Key	O		9.2.72		–	–
>SeNB UE Aggregate Maximum Bit Rate	O		UE Aggregate Maximum Bit Rate 9.2.12		–	–
>E-RABs To Be Added List		*0..1*			–	–
>>E-RABs To Be Added Item		*1 .. <maxnoof Bearers>*			EACH	ignore
>>>CHOICE *Bearer Option*	M					
>>>>*SCG Bearer*						
>>>>>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		–	–
>>>>>S1 UL GTP Tunnel Endpoint	M		GTP Tunnel Endpoint 9.2.1	SGW endpoint of the S1 transport bearer. For delivery of UL PDUs.	–	–
>>>>*Split Bearer*						
>>>>>E-RAB ID	M		9.2.23		–	–
>>>>>E-RAB Level QoS Parameters	M		9.2.9	Includes necessary QoS parameters	–	–
>>>>>MeNB GTP Tunnel Endpoint	M		GTP Tunnel Endpoint 9.2.1	MeNB endpoint of the X2 transport bearer. For delivery of UL PDUs.	–	–
>E-RABs To Be Modified List		*0..1*			–	–
>>E-RABs To Be Modified Item		*1 .. <maxnoof Bearers>*			EACH	ignore
>>>CHOICE *Bearer Option*	M					
>>>>*SCG Bearer*						
>>>>>E-RAB ID	M		9.2.23		–	–
>>>>>E-RAB Level QoS Parameters	O		9.2.9	Includes QoS parameters to be modified	–	–
>>>>>S1 UL GTP Tunnel Endpoint	O		GTP Tunnel Endpoint 9.2.1	SGW endpoint of the S1 transport bearer. For delivery of UL PDUs.	–	–
>>>>*Split Bearer*						
>>>>>E-RAB ID	M		9.2.23		–	–
>>>>>E-RAB Level QoS Parameters	O		9.2.9	Includes QoS parameters to be modified	–	–
>>>>>MeNB GTP	O		GTP Tunnel	MeNB endpoint of	–	–

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Tunnel Endpoint			Endpoint 9.2.1	the X2 transport bearer. For delivery of UL PDUs.		
>E-RABs To Be Released List		*0..1*			–	–
>>E-RABs To Be Released Item		*1 .. <maxnoof Bearers>*			EACH	ignore
>>>CHOICE *Bearer Option*	M					
>>>>*SCG Bearer*						
>>>>>E-RAB ID	M		9.2.23		–	–
>>>>>DL Forwarding GTP Tunnel Endpoint	O		GTP Tunnel Endpoint 9.2.1	Identifies the X2 transport bearer used for forwarding of DL PDUs	–	–
>>>>>UL Forwarding GTP Tunnel Endpoint	O		GTP Tunnel Endpoint 9.2.1	Identifies the X2 transport bearer. used for forwarding of UL PDUs	–	–
>>>>*Split Bearer*						
>>>>>E-RAB ID	M		9.2.23		–	–
>>>>>DL Forwarding GTP Tunnel Endpoint	O		GTP Tunnel Endpoint 9.2.1	Identifies the X2 transport bearer used for forwarding of DL PDUs	–	–
MeNB to SeNB Container	O		OCTET STRING	Includes the *SCG-ConfigInfo* message as defined in TS 36.331 [9]	YES	ignore

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

Condition	Explanation
ifSCGBearerOption	This IE shall be present if the SCG bearer option is configured.

9.1.3.6   SENB MODIFICATION REQUEST ACKNOWLEDGE

This message is sent by the SeNB to confirm the MeNB's request to modify the SeNB resources for a specific UE.

Direction: SeNB → MeNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
MeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the MeNB	YES	ignore
SeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the SeNB	YES	ignore
E-RABs Admitted List		*0..1*			YES	ignore
>E-RABs Admitted To Be Added List		*1*			–	–
>>E-RABs Admitted To Be Added Item		*1 .. <maxnoof Bearers>*			EACH	ignore
>>>CHOICE *Bearer Option*	M					
>>>>*SCG Bearer*						
>>>>>E-RAB ID	M		9.2.23		–	–
>>>>>S1 DL GTP Tunnel Endpoint	M		GTP Tunnel Endpoint 9.2.1	SeNB endpoint of the S1 transport bearer. For delivery of DL PDUs.	–	–
>>>>>DL Forwarding GTP Tunnel Endpoint	O		GTP Tunnel Endpoint 9.2.1	Identifies the X2 transport bearer used for forwarding of DL PDUs	–	–
>>>>>UL Forwarding GTP Tunnel Endpoint	O		GTP Tunnel Endpoint 9.2.1	Identifies the X2 transport bearer used for forwarding of UL PDUs	–	–
>>>>*Split Bearer*						
>>>>>E-RAB ID	M		9.2.23		–	–
>>>>>SeNB GTP Tunnel Endpoint	M		GTP Tunnel Endpoint 9.2.1	Endpoint of the X2 transport bearer at the SeNB.	–	–
>E-RABs Admitted To Be Modified List		*0..1*			–	–
>>E-RABs Admitted To Be Modified Item		*1 .. <maxnoof Bearers>*			EACH	ignore
>>>CHOICE *Bearer Option*	M					
>>>>*SCG Bearer*						
>>>>>E-RAB ID	M		9.2.23		–	–
>>>>>S1 DL GTP Tunnel Endpoint	O		GTP Tunnel Endpoint 9.2.1	SeNB endpoint of the S1 transport bearer. For delivery of DL PDUs.	–	–
>>>>*Split Bearer*						
>>>>>E-RAB ID	M		9.2.23		–	–
>>>>>SeNB GTP Tunnel Endpoint	O		GTP Tunnel Endpoint 9.2.1	Endpoint of the X2 transport bearer at the SeNB.	–	–
>E-RABs Admitted To Be		*0..1*			–	–

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Released List						
>>E-RABs Admitted To Be Released Item		*1 .. <maxnoof Bearers>*			EACH	ignore
>>>CHOICE *Bearer Option*	M					
>>>>SCG Bearer						
>>>>>E-RAB ID	M		9.2.23		–	–
>>>>Split Bearer						
>>>>>E-RAB ID	M		9.2.23		–	–
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 and in *E-RABs Not Admitted List* IE.	YES	ignore
SeNB to MeNB Container	O		OCTET STRING	Includes the *SCG-Configuration* message as defined 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

9.1.3.7 SENB MODIFICATION REQUEST REJECT

This message is sent by the SeNB to inform the MeNB that the MeNB initiated SeNB Modification Preparation has failed.

Direction: SeNB → MeNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
MeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the MeNB	YES	ignore
SeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the SeNB	YES	ignore
Cause	M		9.2.6		YES	ignore
Criticality Diagnostics	O		9.2.7		YES	ignore

9.1.3.8 SENB MODIFICATION REQUIRED

This message is sent by the SeNB to the MeNB to request the modification of SeNB resources for a specific UE.

Direction: SeNB → MeNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
MeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the MeNB	YES	reject
SeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the SeNB	YES	reject
Cause	M		9.2.6		YES	ignore
SCG Change Indication	O		9.2.73		YES	ignore
E-RABs To Be Released List		*0..1*			–	–
>E-RABs To Be Released Item		*1 .. <maxnoof Bearers>*			EACH	ignore
>>E-RAB ID	M		9.2.23		–	–
>>Cause	M		9.2.6		–	–
SeNB to MeNB Container	O		OCTET STRING	Includes the *SCG-Configuration* message as defined in TS 36.331 [9]	YES	ignore

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

9.1.3.9   SENB MODIFICATION CONFIRM

This message is sent by the MeNB to inform the SeNB about the successful modification.

Direction: MeNB → SeNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
MeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the MeNB	YES	ignore
SeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the SeNB	YES	ignore
MeNB to SeNB Container	O		OCTET STRING	Includes the *SCG-ConfigInfo* message as defined 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

9.1.3.10   SENB MODIFICATION REFUSE

This message is sent by the MeNB to inform the SeNB that the SeNB initiated SeNB Modification has failed.

Direction: MeNB → SeNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
MeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the MeNB	YES	ignore
SeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the SeNB	YES	ignore
Cause	M		9.2.6		YES	ignore
MeNB to SeNB Container	O		OCTET STRING	Includes the *SCG-ConfigInfo* message as defined in TS 36.331 [9]	YES	ignore
Criticality Diagnostics	O		9.2.7		YES	ignore

9.1.3.11 SENB RELEASE REQUEST

This message is sent by the MeNB to the SeNB to request the release of resources.

Direction: MeNB → SeNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	ignore
MeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the MeNB	YES	reject
SeNB UE X2AP ID	O		eNB UE X2AP ID 9.2.24	Allocated at the SeNB	YES	reject
Cause	O		9.2.6		YES	ignore
E-RABs To Be Released List		*0..1*			–	–
> E-RABs To Be Released Item		*1 .. <maxnoof Bearers>*			EACH	ignore
>>CHOICE *Bearer Option*	M					
>>>*SCG Bearer*						
>>>>E-RAB ID	M		9.2.23		–	–
>>>>UL Forwarding GTP Tunnel Endpoint	O		GTP Tunnel Endpoint 9.2.1	Identifies the X2 transport bearer used for forwarding of UL PDUs	–	–
>>>>DL Forwarding GTP Tunnel Endpoint	O		GTP Tunnel Endpoint 9.2.1	Identifies the X2 transport bearer. used for forwarding of DL PDUs	–	–
>>>*Split Bearer*						
>>>>E-RAB ID	M		9.2.23		–	–
>>>>DL Forwarding GTP Tunnel Endpoint	O		GTP Tunnel Endpoint 9.2.1	Identifies the X2 transport bearer. used for forwarding of DL PDUs	–	–

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

9.1.3.12   SENB RELEASE REQUIRED

This message is sent by the SeNB to request the release of all resources for a specific UE at the SeNB.

Direction: SeNB → MeNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
MeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the MeNB	YES	reject
SeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the SeNB	YES	reject
Cause	M		9.2.6		YES	ignore

9.1.3.13   SENB RELEASE CONFIRM

This message is sent by the MeNB to confirm the release of all resources for a specific UE at the SeNB.

Direction: MeNB → SeNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
MeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the MeNB	YES	ignore
SeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the SeNB	YES	ignore
E-RABs to be Released List		*0..1*			YES	ignore
>E-RABs To Be Released Item		*1 .. <maxnoof Bearers>*			–	–
>>CHOICE *Bearer Option*	M					
>>>*SCG Bearer*						
>>>>E-RAB ID	M		9.2.23		–	–
>>>>DL Forwarding GTP Tunnel Endpoint	O		GTP Tunnel Endpoint 9.2.1	Identifies the X2 transport bearer used for forwarding of DL PDUs	–	–
>>>>UL Forwarding GTP Tunnel Endpoint	O		GTP Tunnel Endpoint 9.2.1	Identifies the X2 transport bearer used for forwarding of UL PDUs	–	–
>>>*SCG Bearer*						
>>>>E-RAB ID	M		9.2.23		–	–
>>>>DL Forwarding GTP Tunnel Endpoint	O		GTP Tunnel Endpoint 9.2.1	Identifies the X2 transport bearer used for forwarding of DL PDUs	–	–
Criticality Diagnostics	O		9.2.7		YES	ignore

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

9.1.3.14 SENB COUNTER CHECK REQUEST

This message is sent by the SeNB to request the verification of the value of the PDCP COUNTs associated with SCG bearers established in the SeNB.

Direction: SeNB → MeNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
MeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the MeNB	YES	ignore
SeNB UE X2AP ID	M		eNB UE X2AP ID 9.2.24	Allocated at the SeNB	YES	ignore
E-RABs Subject to Counter Check List		1			YES	ignore
>E-RABs Subject to Counter Check Item		1 .. <maxnoof Bearers>			EACH	ignore
>>E-RAB ID	M		9.2.23		-	-
>>UL COUNT	M	INTEGER(0.. 4294967295)		Indicates the value of uplink COUNT associated to this E-RAB.	-	-
>>DL COUNT	M	INTEGER(0.. 4294967295)		Indicates the value of downlink COUNT associated to this E-RAB.	-	-

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

9.2 Information Element definitions

9.2.0 General

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

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

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

- When importing bit strings from other specifications, the first bit of the bit string contains the first bit of the concerned information.

9.2.1 GTP Tunnel Endpoint

The *GTP Tunnel Endpoint* IE 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 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 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 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, or for SCG selection during dual connectivity operation.

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]. This list is part of the roaming restriction information. Roaming restrictions apply to PLMNs other than the serving PLMN and Equivalent PLMNs.	–	–
>PLMN Identity	M		9.2.4		–	–
Forbidden TAs		*0..<maxnoof EPLMNsPlu sOne>*		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 EPLMNsPlu sOne>*		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,T$_{DCoverall}$ Expiry, T$_{DCprep}$ Expiry)	
>*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 in serving cell needs to be reduced. When applied to handover preparation, it indicates the handover is triggered due to load balancing.
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.
$T_{DCoverall}$ Expiry	The reason for the action is expiry of timer $T_{DCoverall}$.
T_{DCprep} Expiry	The reason for the action is expiry of timer T_{DCprep}.

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 of TS 36.413 [4]).
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 of TS 36.413 [4]).
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 of TS 36.413 [4]).
Message not Compatible with Receiver State	The received message was not compatible with the receiver state (see sub clause 10.4 of TS 36.413 [4]).
Semantic Error	The received message included a semantic error (see sub clause 10.4 of TS 36.413 [4]).
Transfer Syntax Error	The received message included a transfer syntax error (see sub clause 10.2 of TS 36.413 [4]).
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 TS 36.104 [16] for E-UTRA operating bands for which it is defined; ignored for E-UTRA operating bands for which N_{UL} is not defined	–	–
>>>DL EARFCN	M		EARFCN 9.2.26	Corresponds to N_{DL} in TS 36.104 [16]	–	–
>>>UL Transmission Bandwidth	M		Transmission Bandwidth 9.2.27	Same as DL Transmission Bandwidth in this release; ignored in case UL EARFCN value is ignored	–	–
>>>DL Transmission Bandwidth	M		Transmission Bandwidth 9.2.27		–	–
>>>UL EARFCN Extension	O		EARFCN Extension 9.2.65	If this IE is present, the value signalled in the *UL EARFCN* IE is ignored.	YES	reject
>>>DL EARFCN Extension	O		EARFCN Extension 9.2.65	If this IE is present, the value signalled in the *DL EARFCN* IE is ignored.	YES	reject
>*TDD*					–	–
>>TDD Info		1			–	–
>>>EARFCN	M		9.2.26	Corresponds to N_{DL}/N_{UL} in 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 configuration information defined in TS 36.211 [10]	–	–
>>>Special Subframe Info		1		Special subframe	–	–

				configuration information defined in TS 36.211 [10]		
>>>>Special Subframe Patterns	M		ENUMERATED (ssp0, ssp1, ssp2, ssp3, ssp4, ssp5, ssp6, ssp7, ssp8, …)		–	–
>>>>Cyclic Prefix DL	M		ENUMERATED (Normal, Extended,…)		–	–
>>>>Cyclic Prefix UL	M		ENUMERATED (Normal, Extended,…)		–	–
>>>Additional Special Subframe Info	O			Special subframe configuration information defined in TS 36.211 [10]. Only for newly defined configuration of special subframe from Release 11.	GLOBAL	ignore
>>>>Additional 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,…)		–	–
>>>EARFCN Extension	O		9.2.65	If this IE is present, the value signalled in the *EARFCN* IE is ignored.	YES	reject
Number of Antenna Ports	O		9.2.43		YES	ignore
PRACH Configuration	O		PRACH Configuration 9.2.50		YES	ignore
MBSFN Subframe Info		0..<maxnoof MBSFN>		MBSFN subframe defined in TS 36.331 [9]	GLOBAL	ignore
>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..<maxnoof MBMSServic eAreaIdentiti es >		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 [29]		

ETSI

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. In Dual Connectivity, UE Aggregate Maximum Bit Rate is split into MeNB UE Aggregate Maximum Bit Rate and SeNB UE Aggregate Maximum Bit Rate which are enforced by MeNB and SeNB respectively. For the split bearer option, the SeNB ignores the UE Aggregate Maximum Bit Rate Downlink in the *SeNB UE Aggregate Maximum Bit Rate* IE and ignores the UE Aggregate Maximum Bit Rate Uplink in the *SeNB UE Aggregate Maximum Bit Rate* IE if the SeNB is not configured to serve the uplink for the split bearer. 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 "16" = X2 Release "17" = X2AP Message Transfer
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		PLMN Identity 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 " N_{RB} " 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)	KeNB* defined in TS 33.401 [18]. If the target cell belongs to multiple frequency bands, the source eNB selects the DL-EARFCN for KeNB* calculation as specified in section 10.3 of 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		Load Indicator 9.2.36	
UL Hardware Load Indicator	M		Load Indicator 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		Load Indicator 9.2.36	
UL S1TNL Load Indicator	M		Load Indicator 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		Cause 9.2.6	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 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 a 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 should be measured and reported so that the minimum E-UTRAN resource usage of existing services is reserved according to implementation. 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 subframe. Value "1" indicates 'ABS' and value "0" indicates 'non ABS' which is applicable only in positions corresponding to the DL direction. 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

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				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, …, Start NAICS Information, Stop NAICS Information)	–

9.2.56   MDT Configuration

The IE defines the MDT configuration parameters.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
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..<*maxno ofCellIDfor MDT*>			–	–
>>>ECGI	M		9.2.14		–	–
>*TA Based*					–	–
>>**TA List for MDT**		1..<*maxno ofTAforM DT*>			–	–
>>>TAC	M		OCTET STRING (2)	Tracking Area Code. The TAI is derived using the current serving PLMN.	–	–
>*PLMN Wide*			NULL		–	–
>*TAI based*					–	–
>>**TAI List for MDT**		1..<*maxno ofTAforM DT*>			–	–
>>>TAC	M		OCTET STRING (2)	Tracking Area Code	–	–
>>>PLMN Identity	M		9.2.4		–	–
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, Third Bit = M3, Fourth Bit = M4, Fifth Bit = M5, Sixth Bit = logging of M1 from event triggered measurement reports according to existing RRM configuration. Other bits are reserved for future use and are ignored if received. Value "1" indicates "activate" and value "0" indicates "do not activate".	–	–
M1 Reporting Trigger	M		ENUMERATED (periodic, A2event-triggered, …, A2event-triggered periodic)	This IE shall be ignored if the *Measurements to Activate* IE has the first bit set to "0".	–	–
M1 Threshold Event A2	C-ifM1A2trigger			Included in case of event-triggered or event-triggered periodic 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].	–	–
M1 Periodic reporting	C-			Included in case of	–	–

	ifperiodic MDT			periodic or event-triggered periodic reporting for measurement M1		
>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	–	–
M3 Configuration	C-ifM3		9.2.61		YES	ignore
M4 Configuration	C-ifM4		9.2.62		YES	ignore
M5 Configuration	C-ifM5		9.2.63		YES	ignore
MDT Location Information	O		BITSTRING(SIZE(8))	Each position in the bitmap represents requested location information as defined in TS 37.320 [31]. First Bit = GNSS Second Bit = E-CID information. Other bits are reserved for future use and are ignored if received. Value "1" indicates "activate" and value "0" indicates "do not activate". The eNB shall ignore the first bit unless the *Measurements to Activate* IE has the first bit or the sixth bit set to "1".	YES	ignore
Signalling based MDT PLMN List	O		MDT PLMN List 9.2.64		YES	ignore

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 *M1 Reporting Trigger* IE is set to "A2event-triggered" or to "A2event-triggered periodic".
ifperiodicMDT	This IE shall be present if the *M1 Reporting Trigger* IE is set to "periodic" or to "A2event-triggered periodic".
ifM3	This IE shall be present if the *Measurements to Activate* IE has the third bit set to "1".
ifM4	This IE shall be present if the *Measurements to Activate* IE has the fourth bit set to "1".
ifM5	This IE shall be present if the *Measurements to Activate* IE has the fifth bit set to "1".

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 DL traffic 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 the additional frequency band indicators that a cell belongs to listed in decreasing order of preference, see TS 36.331 [9].

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
BandInfo		*1..<maxnoofBands>*			–	–
>FrequencyBandIndicator	M		INTEGER (1.. 256, ...)	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. The value is 16.

9.2.61   M3 Configuration

This IE defines the parameters for M3 measurement collection.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
M3 Collection Period	M		ENUMERATED (ms100, ms1000, ms10000, …)	

9.2.62   M4 Configuration

This IE defines the parameters for M4 measurement collection.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
M4 Collection Period	M		ENUMERATED (ms1024, ms2048, ms5120, ms10240, min1, …)	
M4 Links to log	M		ENUMERATED(uplink, downlink, both-uplink-and-downlink, …)	

9.2.63   M5 Configuration

This IE defines the parameters for M5 measurement collection.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
M5 Collection Period	M		ENUMERATED (ms1024, ms2048, ms5120, ms10240, min1, …)	
M5 Links to log	M		ENUMERATED(uplink, downlink, both-uplink-and-downlink, …)	

9.2.64   MDT PLMN List

The purpose of the *MDT PLMN List* IE is to provide the list of PLMNs allowed for MDT.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
MDT PLMN List		*1..<maxnoof MDTPLMNs >*		
>PLMN Identity	M		9.2.4	

Range bound	Explanation
maxnoofMDTPLMNs	Maximum no. of PLMNs in the MDT PLMN list. Value is 16.

9.2.65   EARFCN Extension

The E-UTRA Absolute Radio Frequency Channel Number Extension 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 Extension	M		INTEGER (maxEARFCN+1 .. newmaxEARFCN, ...)	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.
newmaxEARFCN	New maximum value of EARFCNs. Value is 262143.

9.2.66   COUNT Value Extended

This information element indicates the 15 bit long PDCP SN and the corresponding 17 bit long Hyper Frame Number.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
PDCP-SN Extended	M		INTEGER (0..32767)		–	–
HFN Modified	M		INTEGER (0..131071)		–	–

9.2.67   Extended UL Interference Overload Info

This IE provides report on interference overload for the set of subframes that are subject to UL-DL subframe reconfiguration. This IE applies to TDD only.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Associated Subframes	M		BITSTRING (SIZE(5))	The set of subframe(s) to which the Extended UL interference overload indication is applicable. The bitmap from the least significant bit position to the most significant bit position represents subframes #{3, 4, 7, 8, 9} in a radio frame. Value "1" in a bit position indicates that the Extended UL interference overload indication is applicable to the corresponding subframe; and value "0" indicates otherwise.
Extended UL Interference Overload Indication	M		UL Interference Overload Indication 9.2.17	

9.2.68   RNL Header

The *RNL Header* IE indicates the target eNB ID and source eNB ID.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Source eNB ID	M		Global eNB ID 9.2.22		-	-
Target eNB ID	O		Global eNB ID 9.2.22		-	-

9.2.69   Masked IMEISV

This information element contains the IMEISV value with a mask, to identify a terminal model without identifying an individual Mobile Equipment.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Masked IMEISV	M		BIT STRING (SIZE(64))	Coded as the International Mobile station Equipment Identity and Software Version Number (IMEISV) defined in TS 23.003 [29] with the last 4 digits of the SNR masked by setting the corresponding bits to 1.

9.2.70 Expected UE Behaviour

This IE defines the behaviour of a UE with predictable activity and/or mobility behaviour, to assist the eNB in determining the optimum RRC connection time.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Expected UE Activity Behaviour	M		9.2.71	
Expected HO Interval	O		ENUMERATED (sec15, sec30, sec60, sec90, sec120, sec180, long-time, …)	Indicates the expected time interval between inter-eNB handovers. If "long-time" is included, the interval between inter-eNB handovers is expected to be longer than 180 seconds.

9.2.71 Expected UE Activity Behaviour

Indicates information about the expected "UE activity behaviour" as defined in TS 23.401 [12].

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Expected Activity Period	O		INTEGER (1..30|40|50|60|80| 100|120|150|180| 181, ...)	If this IE is set to "181" the expected activity time is longer than 180 seconds. The remaining values indicate the expected activity time in [seconds].
Expected Idle Period	O		INTEGER (1..30|40|50|60|80| 100|120|150|180| 181, ...)	If this IE is set to "181" the expected idle time is longer than 180 seconds. The remaining values indicate the expected idle time in [seconds].
Source of UE Activity Behaviour Information	O		ENUMERATED (subscription information, statistics, ...)	If "subscription information" is indicated, the information contained in the *Expected Activity Period* IE and the *Expected Idle Period* IE, if present, is derived from subscription information. If "statistics" is indicated, the information contained in the *Expected Activity Period* IE and the *Expected Idle Period* IE, if present, is derived from statistical information.

9.2.72 SeNB Security Key

The *SeNB Security Key* IE is used to apply security in the SeNB as defined in TS 33.401 [18].

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
SeNB Security Key	M		BIT STRING (SIZE(256))	The S-KeNB which is provided by the MeNB, see TS 33.401 [18].

9.2.73 SCG Change Indication

The *SCG Change Indication* IE is either used to request the SeNB to prepare the SCG Change in the SeNB or to request the MeNB to initiate the SCG Change towards the UE (see TS 36.300 [15]).

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
SCG Change Indication	M		ENUMERATED (PDCPCountWrapAround, PSCellChange, other, …)	

9.2.74 CoMP Information

This IE provides the list of CoMP hypothesis sets, where each CoMP hypothesis set is the collection of CoMP hypothesis(es) of one or multiple cells and each CoMP hypothesis set is associated with a benefit metric.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CoMP Information Item		*1 .. <maxnoofCoMPHypothesisSet>*		
>CoMP Hypothesis Set	M		9.2.75	
>Benefit Metric	M		INTEGER (-101..100, …)	Value -100 indicates the maximum cost, and 100 indicates the maximum benefit. Value -101 indicates unknown benefit. Values from -100 to 100 should be calculated on a linear scale.
CoMP Information Start Time		*0..1*		
>Start SFN	M		INTEGER (0..1023, …)	SFN of the radio frame containing the first subframe when the *CoMP Information* IE is valid.
>Start Subframe Number	M		INTEGER (0..9, …)	Subframe number, within the radio frame indicated by the *Start SFN* IE, of the first subframe when the *CoMP Information* IE is valid.

Range bound	Explanation
maxnoofCoMPHypothesisSet	Maximum number of CoMP Hypothesis sets. The value is 256.

9.2.75 CoMP Hypothesis Set

This IE provides a set of CoMP hypotheses. A CoMP hypothesis is hypothetical PRB-specific resource allocation information for a cell.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CoMP Hypothesis Set Item		*1..<maxnoofCoMPCells>*		
>Cell ID	M		ECGI 9.2.14	ID of the cell for which the *CoMP Hypothesis* IE is applied.
>CoMP Hypothesis	M		BIT STRING (6..4400, …)	Each position in the bitmap represents a PRB in a subframe, for which value "1" indicates 'interference protected resource' and value "0" indicates 'resource with no utilization constraints,' which is applicable only in positions corresponding to the DL direction. The first bit corresponds to PRB 0 of the first subframe for which the IE is valid, the second bit corresponds to PRB 1 of the first subframe for which the IE is valid, and so on. The bit string may span across multiple contiguous subframes. The length of the bit string is an integer (maximum 40) multiple of $N_{\mathrm{RB}}^{\mathrm{DL}}$. $N_{\mathrm{RB}}^{\mathrm{DL}}$ is defined in TS 36.211 [10]. The CoMP hypothesis pattern is continuously repeated.

Range bound	Explanation
maxnoofCoMPCells	Maximum number of cells in a CoMP hypothesis set. Value is 32.

9.2.76 RSRP Measurement Report List

This IE provides RSRP measurement reports of UEs served by the sending eNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
RSRP Measurement Report Item		*1 .. <maxUEReport>*		
>RSRP Measurement Result		*1 .. <maxCellReport>*		
>>RSRP Cell ID	M		ECGI 9.2.14	ID of the cell on which the RSRP is measured.
>>RSRP Measured	M		INTEGER (0..97, ...)	Measured RSRP. Defined in TS 36.331 [9].

Range bound	Explanation
maxUEReport	Maximum number of UE measurement reports. Value is 128.
maxCellReport	Maximum number of reported cells. The value is 9.

9.2.77 Dynamic DL transmission information

This IE contains assistance information for DL interference mitigation.

IE/Group Name	Presence	Range	IE type and reference	Semantics description
CHOICE *NAICS Information*	M			
>*NAICS Active*				
>>Transmission Modes	O		BIT STRING (SIZE(8))	The set bits indicate some or all transmission modes: 1, 2, 3, 4, 6, 8, 9, 10, as defined in TS 36.213 [23, 7.1]. The first/ leftmost bit is for transmission mode 1, the second bit is for transmission mode 2, and so on.
>>P_B	O		INTEGER (0..3)	See TS 36.213 [23, Table 5.2-1]
>>P_A_list		*0 .. <maxnoofPA>*		
>>>P_A	M		ENUMERATED (dB-6, dB-4dot77, dB-3, dB-1dot77, dB0, dB1, dB2, dB3,...)	See P_A TS 36.213 [23, 5.2]. Value dB-6 corresponds to -6 dB, dB-4dot77 corresponds to -4.77 dB etc.
>*NAICS Inactive*			NULL	

Range bound	Explanation
maxnoofPA	Maximum no of P_A values that can be configured. Value is 3.

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 an 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 an 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,
```

ETSI

```
    X2Release,
    X2MessageTransfer,
    SeNBAdditionRequest,
    SeNBAdditionAcknowledge,
    SeNBAdditionReject,
    SeNBReconfigurationComplete,
    SeNBModificationRequest,
    SeNBModificationRequestAcknowledge,
    SeNBModificationRequestReject,
    SeNBModificationRequired,
    SeNBModificationConfirm,
    SeNBModificationRefuse,
    SeNBReleaseRequest,
    SeNBReleaseRequired,
    SeNBReleaseConfirm,
    SeNBCounterCheckRequest,
    X2RemovalFailure,
    X2RemovalRequest,
    X2RemovalResponse

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,
    id-x2Release,
    id-x2MessageTransfer,
    id-seNBAdditionPreparation,
    id-seNBReconfigurationCompletion,
    id-meNBinitiatedSeNBModificationPreparation,
    id-seNBinitiatedSeNBModification,
    id-meNBinitiatedSeNBRelease,
    id-seNBinitiatedSeNBRelease,
    id-seNBCounterCheck,
    id-x2Removal

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                                      |
    seNBAdditionPreparation                             |
    meNBinitiatedSeNBModificationPreparation            |
    seNBinitiatedSeNBModification                       |
    seNBinitiatedSeNBRelease                            |
    x2Removal                                           ,
    ...
}

X2AP-ELEMENTARY-PROCEDURES-CLASS-2 X2AP-ELEMENTARY-PROCEDURE ::= {
    snStatusTransfer                    |
    uEContextRelease                    |
    handoverCancel                      |
    errorIndication                     |
    resourceStatusReporting             |
    loadIndication                      |
    privateMessage                      |
    rLFIndication                       |
    handoverReport                      |
    x2Release                           |
    x2MessageTransfer                   |
    seNBReconfigurationCompletion       |
    meNBinitiatedSeNBRelease            |
    seNBCounterCheck,
    ...

}

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

x2Release X2AP-ELEMENTARY-PROCEDURE ::= {
```

ETSI

```
    INITIATING MESSAGE      X2Release
    PROCEDURE CODE          id-x2Release
    CRITICALITY             reject
}

x2MessageTransfer X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      X2MessageTransfer
    PROCEDURE CODE          id-x2MessageTransfer
    CRITICALITY             reject
}

seNBAdditionPreparation X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      SeNBAdditionRequest
    SUCCESSFUL OUTCOME      SeNBAdditionAcknowledge
    UNSUCCESSFUL OUTCOME    SeNBAdditionReject
    PROCEDURE CODE          id-seNBAdditionPreparation
    CRITICALITY             reject
}

seNBReconfigurationCompletion   X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      SeNBReconfigurationComplete
    PROCEDURE CODE          id-seNBReconfigurationCompletion
    CRITICALITY             reject
}

meNBinitiatedSeNBModificationPreparation    X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      SeNBModificationRequest
    SUCCESSFUL OUTCOME      SeNBModificationRequestAcknowledge
    UNSUCCESSFUL OUTCOME    SeNBModificationRequestReject
    PROCEDURE CODE          id-meNBinitiatedSeNBModificationPreparation
    CRITICALITY             reject
}

seNBinitiatedSeNBModification   X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      SeNBModificationRequired
    SUCCESSFUL OUTCOME      SeNBModificationConfirm
    UNSUCCESSFUL OUTCOME    SeNBModificationRefuse
    PROCEDURE CODE          id-seNBinitiatedSeNBModification
    CRITICALITY             reject
}

meNBinitiatedSeNBRelease    X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      SeNBReleaseRequest
    PROCEDURE CODE          id-meNBinitiatedSeNBRelease
    CRITICALITY             reject
}

seNBinitiatedSeNBRelease    X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      SeNBReleaseRequired
    SUCCESSFUL OUTCOME      SeNBReleaseConfirm
    PROCEDURE CODE          id-seNBinitiatedSeNBRelease
    CRITICALITY             reject
}
```

```
seNBCounterCheck    X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      SeNBCounterCheckRequest
    PROCEDURE CODE          id-seNBCounterCheck
    CRITICALITY             reject
}

x2Removal   X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE      X2RemovalRequest
    SUCCESSFUL OUTCOME      X2RemovalResponse
    UNSUCCESSFUL OUTCOME    X2RemovalFailure
    PROCEDURE CODE          id-x2Removal
    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,
    DynamicDLTransmissionInformation,
    ECGI,
```

```
        E-RAB-ID,
        E-RAB-Level-QoS-Parameters,
        E-RAB-List,
        EUTRANTraceID,
        GlobalENB-ID,
        GTPtunnelEndpoint,
        GUGroupIDList,
        GUMMEI,
        HandoverReportType,
        HandoverRestrictionList,
        Masked-IMEISV,
        InvokeIndication,
        LocationReportingInformation,
        MDT-Configuration,
        ManagementBasedMDTallowed,
        MDTPLMNList,
        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-HistoryInformationFromTheUE,
        UE-S1AP-ID,
        UESecurityCapabilities,
        UE-X2AP-ID,
        UL-HighInterferenceIndicationInfo,
        UL-InterferenceOverloadIndication,
        HWLoadIndicator,
        S1TNLLoadIndicator,
        Measurement-ID,
        ReportCharacteristics,
        MobilityParametersInformation,
        MobilityParametersModificationRange,
        ReceiveStatusOfULPDCPSDUsExtended,
```

ETSI

```
    COUNTValueExtended,
    SubframeAssignment,
    ExtendedULInterferenceOverloadInfo,
    ExpectedUEBehaviour,
    SeNBSecurityKey,
    MeNBtoSeNBContainer,
    SeNBtoMeNBContainer,
    SCGChangeIndication,
    CoMPInformation,
    ReportingPeriodicityRSRPMR,
    RSRPMRList,
    UE-RLF-Report-Container-for-extended-bands
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-DynamicDLTransmissionInformation,
    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-Masked-IMEISV,
    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,
    id-MobilityInformation,
    id-SourceCellCRNTI,
    id-ManagementBasedMDTPLMNList,
    id-ReceiveStatusOfULPDCPSDUsExtended,
    id-ULCOUNTValueExtended,
    id-DLCOUNTValueExtended,
    id-IntendedULDLConfiguration,
```

```
        id-ExtendedULInterferenceOverloadInfo,
        id-RNL-Header,
        id-x2APMessage,
        id-UE-HistoryInformationFromTheUE,
        id-ExpectedUEBehaviour,
        id-MeNB-UE-X2AP-ID,
        id-SeNB-UE-X2AP-ID,
        id-UE-SecurityCapabilities,
        id-SeNBSecurityKey,
        id-UEAggregateMaximumBitRate,
        id-ServingPLMN,
        id-E-RABs-ToBeAdded-List,
        id-E-RABs-ToBeAdded-Item,
        id-MeNBtoSeNBContainer,
        id-E-RABs-Admitted-ToBeAdded-List,
        id-E-RABs-Admitted-ToBeAdded-Item,
        id-SeNBtoMeNBContainer,
        id-ResponseInformationSeNBReconfComp,
        id-UE-ContextInformationSeNBModReq,
        id-E-RABs-ToBeAdded-ModReqItem,
        id-E-RABs-ToBeModified-ModReqItem,
        id-E-RABs-ToBeReleased-ModReqItem,
        id-E-RABs-Admitted-ToBeAdded-ModAckList,
        id-E-RABs-Admitted-ToBeModified-ModAckList,
        id-E-RABs-Admitted-ToBeReleased-ModAckList,
        id-E-RABs-Admitted-ToBeAdded-ModAckItem,
        id-E-RABs-Admitted-ToBeModified-ModAckItem,
        id-E-RABs-Admitted-ToBeReleased-ModAckItem,
        id-SCGChangeIndication,
        id-E-RABs-ToBeReleased-ModReqd,
        id-E-RABs-ToBeReleased-ModReqdItem,
        id-E-RABs-ToBeReleased-List-RelReq,
        id-E-RABs-ToBeReleased-RelReqItem,
        id-E-RABs-ToBeReleased-List-RelConf,
        id-E-RABs-ToBeReleased-RelConfItem,
        id-E-RABs-SubjectToCounterCheck-List,
        id-E-RABs-SubjectToCounterCheckItem,
        id-CoMPInformation,
        id-ReportingPeriodicityRSRPMR,
        id-RSRPMRList,
        id-UE-RLF-Report-Container-for-extended-bands,

        maxCellineNB,
        maxnoofBearers,
        maxnoofPDCP-SN,
        maxFailedMeasObjects,
        maxnoofCellIDforMDT,
        maxnoofTAforMDT
FROM X2AP-Constants;

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

ETSI

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

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}|
    { ID id-MobilityInformation              CRITICALITY ignore  TYPE MobilityInformation           PRESENCE optional}|
    { ID id-Masked-IMEISV                    CRITICALITY ignore  TYPE Masked-IMEISV                 PRESENCE optional}|
    { ID id-UE-HistoryInformationFromTheUE   CRITICALITY ignore  TYPE UE-HistoryInformationFromTheUE PRESENCE optional}|
    { ID id-ExpectedUEBehaviour              CRITICALITY ignore  TYPE ExpectedUEBehaviour           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 }|
{ ID id-ManagementBasedMDTPLMNList  CRITICALITY ignore  EXTENSION MDTPLMNList                   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 ::= {
    ...
}

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

-- *************************************************************
--
-- 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" --|
    { ID id-SourceCellCRNTI                           CRITICALITY ignore  TYPE CRNTI                                     PRESENCE optional}|
    { ID id-MobilityInformation                       CRITICALITY ignore  TYPE MobilityInformation                       PRESENCE optional}|
    { ID id-UE-RLF-Report-Container                   CRITICALITY ignore  TYPE UE-RLF-Report-Container                   PRESENCE optional}|
    { ID id-UE-RLF-Report-Container-for-extended-bands  CRITICALITY ignore  TYPE UE-RLF-Report-Container-for-extended-bands PRESENCE optional},
    ...
}

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

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

```
SNStatusTransfer-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-Old-eNB-UE-X2AP-ID                      CRITICALITY reject  TYPE UE-X2AP-ID                 PRESENCE mandatory} |
    { ID id-New-eNB-UE-X2AP-ID                      CRITICALITY reject  TYPE UE-X2AP-ID                 PRESENCE mandatory} |
    { ID id-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 ::= {
    { ID id-ReceiveStatusOfULPDCPSDUsExtended   CRITICALITY ignore  EXTENSION ReceiveStatusOfULPDCPSDUsExtended     PRESENCE optional}|
    { ID id-ULCOUNTValueExtended                CRITICALITY ignore  EXTENSION COUNTValueExtended                    PRESENCE optional}|
    { ID id-DLCOUNTValueExtended                CRITICALITY ignore  EXTENSION COUNTValueExtended                    PRESENCE optional},
    ...
}

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

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

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 }|
{ ID id-IntendedULDLConfiguration               CRITICALITY ignore  EXTENSION SubframeAssignment                    PRESENCE optional }|
{ ID id-ExtendedULInterferenceOverloadInfo      CRITICALITY ignore  EXTENSION ExtendedULInterferenceOverloadInfo    PRESENCE optional }|
```

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```
{ ID id-CoMPInformation                    CRITICALITY ignore  EXTENSION CoMPInformation                   PRESENCE optional }|
{ ID id-DynamicDLTransmissionInformation   CRITICALITY ignore  EXTENSION DynamicDLTransmissionInformation  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}|
    { ID id-ReportingPeriodicityRSRPMR CRITICALITY ignore  TYPE ReportingPeriodicityRSRPMR 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}|
    { ID id-RSRPMRList                      CRITICALITY ignore  EXTENSION RSRPMRList                           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}|
    { ID id-UE-RLF-Report-Container-for-extended-bands  CRITICALITY ignore  TYPE UE-RLF-Report-Container-for-extended-bands    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 },
    ...
}

-- *************************************************************
--
-- X2 RELEASE
--
-- *************************************************************

X2Release ::= SEQUENCE {
    protocolIEs     ProtocolIE-Container    {{X2Release-IEs}},
    ...
}

X2Release-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-GlobalENB-ID             CRITICALITY reject  TYPE GlobalENB-ID        PRESENCE mandatory},
...
}

-- *************************************************************
--
-- X2 Message Transfer
--
-- *************************************************************

X2MessageTransfer ::= SEQUENCE {
    protocolIEs     ProtocolIE-Container    {{X2MessageTransfer-IEs}},
    ...
}

X2MessageTransfer-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-RNL-Header  CRITICALITY reject  TYPE RNL-Header          PRESENCE mandatory}|
    { ID id-x2APMessage CRITICALITY reject  TYPE X2AP-Message        PRESENCE optional},
    ...
}

RNL-Header ::= SEQUENCE {
    target-GlobalENB-ID GlobalENB-ID    OPTIONAL,
    source-GlobalENB-ID GlobalENB-ID,
    iE-Extensions                       ProtocolExtensionContainer { { RNL-Header-Item-ExtIEs} } OPTIONAL,
    ...
}

RNL-Header-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

X2AP-Message ::= OCTET STRING

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

```
--
-- SENB ADDITION REQUEST
--
-- ****************************************************************

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

SeNBAdditionRequest-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-MeNB-UE-X2AP-ID                CRITICALITY reject  TYPE UE-X2AP-ID                    PRESENCE mandatory}|
    { ID id-UE-SecurityCapabilities        CRITICALITY reject  TYPE UESecurityCapabilities        PRESENCE conditional}|
    { ID id-SeNBSecurityKey                CRITICALITY reject  TYPE SeNBSecurityKey               PRESENCE conditional}|
    { ID id-UEAggregateMaximumBitRate      CRITICALITY reject  TYPE UEAggregateMaximumBitRate     PRESENCE mandatory}|
    { ID id-ServingPLMN                    CRITICALITY ignore  TYPE PLMN-Identity                 PRESENCE optional}|
    { ID id-E-RABs-ToBeAdded-List          CRITICALITY reject  TYPE E-RABs-ToBeAdded-List         PRESENCE mandatory}|
    { ID id-MeNBtoSeNBContainer            CRITICALITY reject  TYPE MeNBtoSeNBContainer           PRESENCE mandatory},
    ...
}

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

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

E-RABs-ToBeAdded-Item ::= CHOICE {
    sCG-Bearer       E-RABs-ToBeAdded-Item-SCG-Bearer,
    split-Bearer     E-RABs-ToBeAdded-Item-Split-Bearer,
    ...
}

E-RABs-ToBeAdded-Item-SCG-Bearer ::= SEQUENCE {
    e-RAB-ID                      E-RAB-ID,
    e-RAB-Level-QoS-Parameters    E-RAB-Level-QoS-Parameters,
    dL-Forwarding                 DL-Forwarding                                            OPTIONAL,
    s1-UL-GTPtunnelEndpoint       GTPtunnelEndpoint,
    iE-Extensions                 ProtocolExtensionContainer { {E-RABs-ToBeAdded-Item-SCG-BearerExtIEs} }  OPTIONAL,
    ...
}

E-RABs-ToBeAdded-Item-SCG-BearerExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

E-RABs-ToBeAdded-Item-Split-Bearer ::= SEQUENCE {
    e-RAB-ID                      E-RAB-ID,
    e-RAB-Level-QoS-Parameters    E-RAB-Level-QoS-Parameters,
    meNB-GTPtunnelEndpoint        GTPtunnelEndpoint,
    iE-Extensions                 ProtocolExtensionContainer { {E-RABs-ToBeAdded-Item-Split-BearerExtIEs} } OPTIONAL,
    ...
}
```

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```
E-RABs-ToBeAdded-Item-Split-BearerExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

-- **************************************************************
--
-- SENB ADDITION ACKNOWLEDGE
--
-- **************************************************************

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

SeNBAdditionAcknowledge-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-MeNB-UE-X2AP-ID                    CRITICALITY reject  TYPE UE-X2AP-ID                  PRESENCE mandatory}|
    { ID id-SeNB-UE-X2AP-ID                    CRITICALITY reject  TYPE UE-X2AP-ID                  PRESENCE mandatory}|
    { ID id-E-RABs-Admitted-ToBeAdded-List     CRITICALITY ignore  TYPE E-RABs-Admitted-ToBeAdded-List PRESENCE mandatory}|
    { ID id-E-RABs-NotAdmitted-List            CRITICALITY ignore  TYPE E-RAB-List                  PRESENCE optional}|
    { ID id-SeNBtoMeNBContainer                CRITICALITY reject  TYPE SeNBtoMeNBContainer         PRESENCE mandatory}|
    { ID id-CriticalityDiagnostics             CRITICALITY ignore  TYPE CriticalityDiagnostics      PRESENCE optional},
    ...
}

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

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

E-RABs-Admitted-ToBeAdded-Item ::= CHOICE {
    sCG-Bearer      E-RABs-Admitted-ToBeAdded-Item-SCG-Bearer,
    split-Bearer    E-RABs-Admitted-ToBeAdded-Item-Split-Bearer,
    ...
}

E-RABs-Admitted-ToBeAdded-Item-SCG-Bearer ::= SEQUENCE {
    e-RAB-ID                            E-RAB-ID,
    s1-DL-GTPtunnelEndpoint             GTPtunnelEndpoint,
    dL-Forwarding-GTPtunnelEndpoint     GTPtunnelEndpoint                                                OPTIONAL,
    uL-Forwarding-GTPtunnelEndpoint     GTPtunnelEndpoint                                                OPTIONAL,
    iE-Extensions                       ProtocolExtensionContainer { {E-RABs-Admitted-ToBeAdded-Item-SCG-BearerExtIEs} }  OPTIONAL,
    ...
}

E-RABs-Admitted-ToBeAdded-Item-SCG-BearerExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

E-RABs-Admitted-ToBeAdded-Item-Split-Bearer ::= SEQUENCE {
    e-RAB-ID                    E-RAB-ID,
    seNB-GTPtunnelEndpoint      GTPtunnelEndpoint,
```

```
    iE-Extensions                     ProtocolExtensionContainer { {E-RABs-Admitted-ToBeAdded-Item-Split-BearerExtIEs} } OPTIONAL,
    ...
}

E-RABs-Admitted-ToBeAdded-Item-Split-BearerExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

-- ************************************************************
--
-- SENB ADDITION REJECT
--
-- ************************************************************

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

SeNBAdditionReject-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-MeNB-UE-X2AP-ID              CRITICALITY reject  TYPE UE-X2AP-ID            PRESENCE mandatory}|
    { ID id-SeNB-UE-X2AP-ID              CRITICALITY reject  TYPE UE-X2AP-ID            PRESENCE mandatory}|
    { ID id-Cause                       CRITICALITY ignore  TYPE Cause                 PRESENCE mandatory}|
    { ID id-CriticalityDiagnostics      CRITICALITY ignore  TYPE CriticalityDiagnostics    PRESENCE optional},
    ...
}

-- ************************************************************
--
-- SENB RECONFIGURATION COMPLETE
--
-- ************************************************************

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

SeNBReconfigurationComplete-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-MeNB-UE-X2AP-ID                       CRITICALITY reject  TYPE UE-X2AP-ID                           PRESENCE mandatory}|
    { ID id-SeNB-UE-X2AP-ID                       CRITICALITY reject  TYPE UE-X2AP-ID                           PRESENCE mandatory}|
    { ID id-ResponseInformationSeNBReconfComp     CRITICALITY ignore  TYPE ResponseInformationSeNBReconfComp   PRESENCE mandatory},
    ...
}

ResponseInformationSeNBReconfComp ::= CHOICE {
    success             ResponseInformationSeNBReconfComp-SuccessItem,
    reject-by-MeNB      ResponseInformationSeNBReconfComp-RejectByMeNBItem,
    ...
}

ResponseInformationSeNBReconfComp-SuccessItem ::= SEQUENCE {
    meNBtoSeNBContainer         MeNBtoSeNBContainer OPTIONAL,
    iE-Extensions               ProtocolExtensionContainer { {ResponseInformationSeNBReconfComp-SuccessItemExtIEs} } OPTIONAL,
```

```
    ...
}

ResponseInformationSeNBReconfComp-SuccessItemExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

ResponseInformationSeNBReconfComp-RejectByMeNBItem ::= SEQUENCE {
    cause                          Cause,
    meNBtoSeNBContainer            MeNBtoSeNBContainer                                                         OPTIONAL,
    iE-Extensions                  ProtocolExtensionContainer { { ResponseInformationSeNBReconfComp-RejectByMeNBItemExtIEs} } OPTIONAL,
    ...
}

ResponseInformationSeNBReconfComp-RejectByMeNBItemExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

-- ************************************************************
--
-- SENB MODIFICATION REQUEST
--
-- ************************************************************

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

SeNBModificationRequest-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-MeNB-UE-X2AP-ID              CRITICALITY reject  TYPE UE-X2AP-ID                      PRESENCE mandatory}|
    { ID id-SeNB-UE-X2AP-ID              CRITICALITY reject  TYPE UE-X2AP-ID                      PRESENCE mandatory}|
    { ID id-Cause                        CRITICALITY ignore  TYPE Cause                           PRESENCE mandatory}|
    { ID id-SCGChangeIndication          CRITICALITY ignore  TYPE SCGChangeIndication             PRESENCE optional}|
    { ID id-ServingPLMN                  CRITICALITY ignore  TYPE PLMN-Identity                    PRESENCE optional}|
    { ID id-UE-ContextInformationSeNBModReq  CRITICALITY reject  TYPE UE-ContextInformationSeNBModReq  PRESENCE mandatory}|
    { ID id-MeNBtoSeNBContainer          CRITICALITY ignore  TYPE MeNBtoSeNBContainer             PRESENCE optional},
    ...
}

UE-ContextInformationSeNBModReq ::= SEQUENCE {
    uE-SecurityCapabilities        UESecurityCapabilities                                         OPTIONAL,
    seNB-SecurityKey               SeNBSecurityKey                                                OPTIONAL,
    uEAggregateMaximumBitRate      UEAggregateMaximumBitRate                                      OPTIONAL,
    e-RABs-ToBeAdded               E-RABs-ToBeAdded-List-ModReq                                   OPTIONAL,
    e-RABs-ToBeModified            E-RABs-ToBeModified-List-ModReq                                OPTIONAL,
    e-RABs-ToBeReleased            E-RABs-ToBeReleased-List-ModReq                                OPTIONAL,
    iE-Extensions                  ProtocolExtensionContainer { { UE-ContextInformationSeNBModReqExtIEs} }  OPTIONAL,
    ...
}

UE-ContextInformationSeNBModReqExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}
```

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

E-RABs-ToBeAdded-ModReqItemIEs X2AP-PROTOCOL-IES ::= {
    { ID id-E-RABs-ToBeAdded-ModReqItem CRITICALITY ignore  TYPE E-RABs-ToBeAdded-ModReqItem    PRESENCE mandatory},
    ...
}

E-RABs-ToBeAdded-ModReqItem ::= CHOICE {
    sCG-Bearer      E-RABs-ToBeAdded-ModReqItem-SCG-Bearer,
    split-Bearer    E-RABs-ToBeAdded-ModReqItem-Split-Bearer,
    ...
}

E-RABs-ToBeAdded-ModReqItem-SCG-Bearer ::= SEQUENCE {
    e-RAB-ID                      E-RAB-ID,
    e-RAB-Level-QoS-Parameters    E-RAB-Level-QoS-Parameters,
    dL-Forwarding                 DL-Forwarding                                               OPTIONAL,
    s1-UL-GTPtunnelEndpoint       GTPtunnelEndpoint,
    iE-Extensions                 ProtocolExtensionContainer { {E-RABs-ToBeAdded-ModReqItem-SCG-BearerExtIEs} } OPTIONAL,
    ...
}

E-RABs-ToBeAdded-ModReqItem-SCG-BearerExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

E-RABs-ToBeAdded-ModReqItem-Split-Bearer ::= SEQUENCE {
    e-RAB-ID                      E-RAB-ID,
    e-RAB-Level-QoS-Parameters    E-RAB-Level-QoS-Parameters,
    meNB-GTPtunnelEndpoint        GTPtunnelEndpoint,
    iE-Extensions           ProtocolExtensionContainer { {E-RABs-ToBeAdded-ModReqItem-Split-BearerExtIEs} } OPTIONAL,
    ...
}

E-RABs-ToBeAdded-ModReqItem-Split-BearerExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

E-RABs-ToBeModified-List-ModReq ::= SEQUENCE (SIZE(1..maxnoofBearers)) OF ProtocolIE-Single-Container { {E-RABs-ToBeModified-ModReqItemIEs} }

E-RABs-ToBeModified-ModReqItemIEs X2AP-PROTOCOL-IES ::= {
    { ID id-E-RABs-ToBeModified-ModReqItem  CRITICALITY ignore  TYPE E-RABs-ToBeModified-ModReqItem     PRESENCE mandatory},
    ...
}


E-RABs-ToBeModified-ModReqItem ::= CHOICE {
    sCG-Bearer      E-RABs-ToBeModified-ModReqItem-SCG-Bearer,
    split-Bearer    E-RABs-ToBeModified-ModReqItem-Split-Bearer,
    ...
}

E-RABs-ToBeModified-ModReqItem-SCG-Bearer ::= SEQUENCE {
```

```
    e-RAB-ID                         E-RAB-ID,
    e-RAB-Level-QoS-Parameters       E-RAB-Level-QoS-Parameters                                        OPTIONAL,
    s1-UL-GTPtunnelEndpoint          GTPtunnelEndpoint                                                 OPTIONAL,
    iE-Extensions                    ProtocolExtensionContainer { {E-RABs-ToBeModified-ModReqItem-SCG-BearerExtIEs} } OPTIONAL,
    ...
}

E-RABs-ToBeModified-ModReqItem-SCG-BearerExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

E-RABs-ToBeModified-ModReqItem-Split-Bearer ::= SEQUENCE {
    e-RAB-ID                         E-RAB-ID,
    e-RAB-Level-QoS-Parameters       E-RAB-Level-QoS-Parameters                                        OPTIONAL,
    meNB-GTPtunnelEndpoint           GTPtunnelEndpoint                                                 OPTIONAL,
    iE-Extensions                    ProtocolExtensionContainer { {E-RABs-ToBeModified-ModReqItem-Split-BearerExtIEs} } OPTIONAL,
    ...
}

E-RABs-ToBeModified-ModReqItem-Split-BearerExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

E-RABs-ToBeReleased-List-ModReq ::= SEQUENCE (SIZE(1..maxnoofBearers)) OF ProtocolIE-Single-Container { {E-RABs-ToBeReleased-ModReqItemIEs} }

E-RABs-ToBeReleased-ModReqItemIEs X2AP-PROTOCOL-IES ::= {
    { ID id-E-RABs-ToBeReleased-ModReqItem  CRITICALITY ignore  TYPE E-RABs-ToBeReleased-ModReqItem    PRESENCE mandatory},
    ...
}

E-RABs-ToBeReleased-ModReqItem ::= CHOICE {
    sCG-Bearer      E-RABs-ToBeReleased-ModReqItem-SCG-Bearer,
    split-Bearer    E-RABs-ToBeReleased-ModReqItem-Split-Bearer,
    ...
}

E-RABs-ToBeReleased-ModReqItem-SCG-Bearer ::= SEQUENCE {
    e-RAB-ID                         E-RAB-ID,
    dL-GTPtunnelEndpoint             GTPtunnelEndpoint                                                 OPTIONAL,
    uL-GTPtunnelEndpoint             GTPtunnelEndpoint                                                 OPTIONAL,
    iE-Extensions                    ProtocolExtensionContainer { {E-RABs-ToBeReleased-ModReqItem-SCG-BearerExtIEs} } OPTIONAL,
    ...
}

E-RABs-ToBeReleased-ModReqItem-SCG-BearerExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

E-RABs-ToBeReleased-ModReqItem-Split-Bearer ::= SEQUENCE {
    e-RAB-ID                         E-RAB-ID,
    dL-GTPtunnelEndpoint             GTPtunnelEndpoint                                                 OPTIONAL,
    iE-Extensions                    ProtocolExtensionContainer { {E-RABs-ToBeReleased-ModReqItem-Split-BearerExtIEs} } OPTIONAL,
    ...
}
```

```
E-RABs-ToBeReleased-ModReqItem-Split-BearerExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

-- *************************************************************
--
-- SENB MODIFICATION REQUEST ACKNOWLEDGE
--
-- *************************************************************

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

SeNBModificationRequestAcknowledge-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-MeNB-UE-X2AP-ID                          CRITICALITY ignore  TYPE UE-X2AP-ID                                PRESENCE mandatory}|
    { ID id-SeNB-UE-X2AP-ID                          CRITICALITY ignore  TYPE UE-X2AP-ID                                PRESENCE mandatory}|
    { ID id-E-RABs-Admitted-ToBeAdded-ModAckList     CRITICALITY ignore  TYPE E-RABs-Admitted-ToBeAdded-ModAckList      PRESENCE optional}|
    { ID id-E-RABs-Admitted-ToBeModified-ModAckList  CRITICALITY ignore  TYPE E-RABs-Admitted-ToBeModified-ModAckList   PRESENCE optional}|
    { ID id-E-RABs-Admitted-ToBeReleased-ModAckList  CRITICALITY ignore  TYPE E-RABs-Admitted-ToBeReleased-ModAckList   PRESENCE optional}|
    { ID id-E-RABs-NotAdmitted-List                  CRITICALITY ignore  TYPE E-RAB-List                                PRESENCE optional}|
    { ID id-SeNBtoMeNBContainer                      CRITICALITY ignore  TYPE SeNBtoMeNBContainer                       PRESENCE optional}|
    { ID id-CriticalityDiagnostics                   CRITICALITY ignore  TYPE CriticalityDiagnostics                   PRESENCE optional},
    ...
}

E-RABs-Admitted-ToBeAdded-ModAckList ::= SEQUENCE (SIZE (1..maxnoofBearers)) OF ProtocolIE-Single-Container { {E-RABs-Admitted-ToBeAdded-
ModAckItemIEs} }

E-RABs-Admitted-ToBeAdded-ModAckItemIEs X2AP-PROTOCOL-IES ::= {
    { ID id-E-RABs-Admitted-ToBeAdded-ModAckItem    CRITICALITY ignore  TYPE E-RABs-Admitted-ToBeAdded-ModAckItem      PRESENCE mandatory}
}

E-RABs-Admitted-ToBeAdded-ModAckItem ::= CHOICE {
    sCG-Bearer       E-RABs-Admitted-ToBeAdded-ModAckItem-SCG-Bearer,
    split-Bearer     E-RABs-Admitted-ToBeAdded-ModAckItem-Split-Bearer,
    ...
}

E-RABs-Admitted-ToBeAdded-ModAckItem-SCG-Bearer ::= SEQUENCE {
    e-RAB-ID                          E-RAB-ID,
    s1-DL-GTPtunnelEndpoint           GTPtunnelEndpoint,
    dL-Forwarding-GTPtunnelEndpoint   GTPtunnelEndpoint                                                    OPTIONAL,
    uL-Forwarding-GTPtunnelEndpoint   GTPtunnelEndpoint                                                    OPTIONAL,
    iE-Extensions                     ProtocolExtensionContainer { {E-RABs-Admitted-ToBeAdded-ModAckItem-SCG-BearerExtIEs} }  OPTIONAL,
    ...
}

E-RABs-Admitted-ToBeAdded-ModAckItem-SCG-BearerExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}
```

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```
E-RABs-Admitted-ToBeAdded-ModAckItem-Split-Bearer ::= SEQUENCE {
    e-RAB-ID                        E-RAB-ID,
    seNB-GTPtunnelEndpoint          GTPtunnelEndpoint,
    iE-Extensions                   ProtocolExtensionContainer { {E-RABs-Admitted-ToBeAdded-ModAckItem-Split-BearerExtIEs} } OPTIONAL,
    ...
}

E-RABs-Admitted-ToBeAdded-ModAckItem-Split-BearerExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}
E-RABs-Admitted-ToBeModified-ModAckList ::= SEQUENCE (SIZE (1..maxnoofBearers)) OF ProtocolIE-Single-Container { {E-RABs-Admitted-ToBeModified-
ModAckItemIEs} }

E-RABs-Admitted-ToBeModified-ModAckItemIEs X2AP-PROTOCOL-IES ::= {
    { ID id-E-RABs-Admitted-ToBeModified-ModAckItem    CRITICALITY ignore  TYPE E-RABs-Admitted-ToBeModified-ModAckItem PRESENCE mandatory}
}

E-RABs-Admitted-ToBeModified-ModAckItem ::= CHOICE {
    sCG-Bearer      E-RABs-Admitted-ToBeModified-ModAckItem-SCG-Bearer,
    split-Bearer    E-RABs-Admitted-ToBeModified-ModAckItem-Split-Bearer,
    ...
}

E-RABs-Admitted-ToBeModified-ModAckItem-SCG-Bearer ::= SEQUENCE {
    e-RAB-ID                        E-RAB-ID,
    s1-DL-GTPtunnelEndpoint         GTPtunnelEndpoint                                                         OPTIONAL,
    iE-Extensions                   ProtocolExtensionContainer { {E-RABs-Admitted-ToBeModified-ModAckItem-SCG-BearerExtIEs} } OPTIONAL,
    ...
}

E-RABs-Admitted-ToBeModified-ModAckItem-SCG-BearerExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

E-RABs-Admitted-ToBeModified-ModAckItem-Split-Bearer ::= SEQUENCE {
    e-RAB-ID                        E-RAB-ID,
    seNB-GTPtunnelEndpoint          GTPtunnelEndpoint                                                    OPTIONAL,
    iE-Extensions                   ProtocolExtensionContainer { {E-RABs-Admitted-ToBeModified-ModAckItem-Split-BearerExtIEs} } OPTIONAL,
    ...
}

E-RABs-Admitted-ToBeModified-ModAckItem-Split-BearerExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

E-RABs-Admitted-ToBeReleased-ModAckList ::= SEQUENCE (SIZE (1..maxnoofBearers)) OF ProtocolIE-Single-Container { {E-RABs-Admitted-ToBeReleased-
ModAckItemIEs} }

E-RABs-Admitted-ToBeReleased-ModAckItemIEs X2AP-PROTOCOL-IES ::= {
    { ID id-E-RABs-Admitted-ToBeReleased-ModAckItem    CRITICALITY ignore  TYPE E-RABs-Admitted-ToReleased-ModAckItem    PRESENCE mandatory}
}

E-RABs-Admitted-ToReleased-ModAckItem ::= CHOICE {
    sCG-Bearer      E-RABs-Admitted-ToBeReleased-ModAckItem-SCG-Bearer,
```

```
    split-Bearer    E-RABs-Admitted-ToBeReleased-ModAckItem-Split-Bearer,
    ...
}

E-RABs-Admitted-ToBeReleased-ModAckItem-SCG-Bearer ::= SEQUENCE {
    e-RAB-ID                    E-RAB-ID,
    iE-Extensions               ProtocolExtensionContainer { {E-RABs-Admitted-ToBeReleased-ModAckItem-SCG-BearerExtIEs} }OPTIONAL,
    ...
}

E-RABs-Admitted-ToBeReleased-ModAckItem-SCG-BearerExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

E-RABs-Admitted-ToBeReleased-ModAckItem-Split-Bearer ::= SEQUENCE {
    e-RAB-ID                    E-RAB-ID,
    iE-Extensions               ProtocolExtensionContainer { {E-RABs-Admitted-ToBeReleased-ModAckItem-Split-BearerExtIEs} } OPTIONAL,
    ...
}

E-RABs-Admitted-ToBeReleased-ModAckItem-Split-BearerExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

-- ************************************************************
--
-- SENB MODIFICATION REQUEST REJECT
--
-- ************************************************************

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

SeNBModificationRequestReject-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-MeNB-UE-X2AP-ID                  CRITICALITY ignore  TYPE UE-X2AP-ID             PRESENCE mandatory}|
    { ID id-SeNB-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},
    ...
}

-- ************************************************************
--
-- SENB MODIFICATION REQUIRED
--
-- ************************************************************

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

```
SeNBModificationRequired-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-MeNB-UE-X2AP-ID                    CRITICALITY reject  TYPE UE-X2AP-ID                    PRESENCE mandatory}|
    { ID id-SeNB-UE-X2AP-ID                    CRITICALITY reject  TYPE UE-X2AP-ID                    PRESENCE mandatory}|
    { ID id-Cause                              CRITICALITY ignore  TYPE Cause                         PRESENCE mandatory}|
    { ID id-SCGChangeIndication                CRITICALITY ignore  TYPE SCGChangeIndication           PRESENCE optional}|
    { ID id-E-RABs-ToBeReleased-ModReqd        CRITICALITY ignore  TYPE E-RABs-ToBeReleased-ModReqd   PRESENCE optional}|
    { ID id-SeNBtoMeNBContainer                CRITICALITY ignore  TYPE SeNBtoMeNBContainer           PRESENCE optional},
    ...
}


E-RABs-ToBeReleased-ModReqd ::= SEQUENCE (SIZE (1..maxnoofBearers)) OF ProtocolIE-Single-Container { {E-RABs-ToBeReleased-ModReqdItemIEs} }

E-RABs-ToBeReleased-ModReqdItemIEs X2AP-PROTOCOL-IES ::= {
    { ID id-E-RABs-ToBeReleased-ModReqdItem  CRITICALITY ignore    TYPE E-RABs-ToBeReleased-ModReqdItem  PRESENCE mandatory },
    ...
}

E-RABs-ToBeReleased-ModReqdItem ::= SEQUENCE {
    e-RAB-ID                      E-RAB-ID,
    cause                         Cause,
    iE-Extensions                 ProtocolExtensionContainer { {E-RABs-ToBeReleased-ModReqdItemExtIEs} } OPTIONAL,
    ...
}

E-RABs-ToBeReleased-ModReqdItemExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

-- *************************************************************
--
-- SENB MODIFICATION CONFIRM
--
-- *************************************************************

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

SeNBModificationConfirm-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-MeNB-UE-X2AP-ID                    CRITICALITY ignore  TYPE UE-X2AP-ID              PRESENCE mandatory}|
    { ID id-SeNB-UE-X2AP-ID                    CRITICALITY ignore  TYPE UE-X2AP-ID              PRESENCE mandatory}|
    { ID id-MeNBtoSeNBContainer                CRITICALITY ignore  TYPE MeNBtoSeNBContainer     PRESENCE optional}|
    { ID id-CriticalityDiagnostics             CRITICALITY ignore  TYPE CriticalityDiagnostics  PRESENCE optional},
    ...
}

-- *************************************************************
--
-- SENB MODIFICATION REFUSE
--
-- *************************************************************
```

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

SeNBModificationRefuse-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-MeNB-UE-X2AP-ID                     CRITICALITY ignore  TYPE UE-X2AP-ID             PRESENCE mandatory}|
    { ID id-SeNB-UE-X2AP-ID                     CRITICALITY ignore  TYPE UE-X2AP-ID             PRESENCE mandatory}|
    { ID id-Cause                               CRITICALITY ignore  TYPE Cause                  PRESENCE mandatory}|
    { ID id-MeNBtoSeNBContainer                 CRITICALITY ignore  TYPE MeNBtoSeNBContainer    PRESENCE optional}|
    { ID id-CriticalityDiagnostics              CRITICALITY ignore  TYPE CriticalityDiagnostics  PRESENCE optional},
    ...
}

-- **************************************************************
--
-- SENB RELEASE REQUEST
--
-- **************************************************************

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

SeNBReleaseRequest-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-MeNB-UE-X2AP-ID                     CRITICALITY reject  TYPE UE-X2AP-ID                         PRESENCE mandatory}|
    { ID id-SeNB-UE-X2AP-ID                     CRITICALITY reject  TYPE UE-X2AP-ID                         PRESENCE optional}|
    { ID id-Cause                               CRITICALITY ignore  TYPE Cause                              PRESENCE optional}|
    { ID id-E-RABs-ToBeReleased-List-RelReq     CRITICALITY ignore  TYPE E-RABs-ToBeReleased-List-RelReq     PRESENCE optional},
    ...
}
E-RABs-ToBeReleased-List-RelReq ::= SEQUENCE (SIZE(1..maxnoofBearers)) OF ProtocolIE-Single-Container { {E-RABs-ToBeReleased-RelReqItemIEs} }

E-RABs-ToBeReleased-RelReqItemIEs X2AP-PROTOCOL-IES ::= {
    { ID id-E-RABs-ToBeReleased-RelReqItem     CRITICALITY ignore  TYPE E-RABs-ToBeReleased-RelReqItem   PRESENCE mandatory},
    ...
}

E-RABs-ToBeReleased-RelReqItem ::= CHOICE {
    sCG-Bearer      E-RABs-ToBeReleased-RelReqItem-SCG-Bearer,
    split-Bearer    E-RABs-ToBeReleased-RelReqItem-Split-Bearer,
    ...
}

E-RABs-ToBeReleased-RelReqItem-SCG-Bearer ::= SEQUENCE {
    e-RAB-ID                    E-RAB-ID,
    uL-GTPtunnelEndpoint        GTPtunnelEndpoint                                                       OPTIONAL,
    dL-GTPtunnelEndpoint        GTPtunnelEndpoint                                                       OPTIONAL,
    iE-Extensions               ProtocolExtensionContainer { {E-RABs-ToBeReleased-RelReqItem-SCG-BearerExtIEs} } OPTIONAL,
    ...
}

E-RABs-ToBeReleased-RelReqItem-SCG-BearerExtIEs X2AP-PROTOCOL-EXTENSION ::= {
```

```
    ...
}

E-RABs-ToBeReleased-RelReqItem-Split-Bearer ::= SEQUENCE {
    e-RAB-ID                        E-RAB-ID,
    dL-GTPtunnelEndpoint            GTPtunnelEndpoint                                                     OPTIONAL,
    iE-Extensions                   ProtocolExtensionContainer { {E-RABs-ToBeReleased-RelReqItem-Split-BearerExtIEs} } OPTIONAL,
    ...
}

E-RABs-ToBeReleased-RelReqItem-Split-BearerExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

-- **************************************************************
--
-- SENB RELEASE REQUIRED
--
-- **************************************************************

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

SeNBReleaseRequired-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-MeNB-UE-X2AP-ID                     CRITICALITY reject  TYPE UE-X2AP-ID     PRESENCE mandatory}|
    { ID id-SeNB-UE-X2AP-ID                     CRITICALITY reject  TYPE UE-X2AP-ID     PRESENCE mandatory}|
    { ID id-Cause                               CRITICALITY ignore  TYPE Cause          PRESENCE mandatory},
    ...
}

-- **************************************************************
--
-- SENB RELEASE CONFIRM
--
-- **************************************************************

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

SeNBReleaseConfirm-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-MeNB-UE-X2AP-ID                     CRITICALITY ignore  TYPE UE-X2AP-ID                         PRESENCE mandatory}|
    { ID id-SeNB-UE-X2AP-ID                     CRITICALITY ignore  TYPE UE-X2AP-ID                         PRESENCE mandatory}|
    { ID id-E-RABs-ToBeReleased-List-RelConf    CRITICALITY ignore  TYPE E-RABs-ToBeReleased-List-RelConf   PRESENCE optional}|
    { ID id-CriticalityDiagnostics              CRITICALITY ignore  TYPE CriticalityDiagnostics             PRESENCE optional},
    ...
}
E-RABs-ToBeReleased-List-RelConf ::= SEQUENCE (SIZE(1..maxnoofBearers)) OF ProtocolIE-Single-Container { {E-RABs-ToBeReleased-RelConfItemIEs} }

E-RABs-ToBeReleased-RelConfItemIEs X2AP-PROTOCOL-IES ::= {
    { ID id-E-RABs-ToBeReleased-RelConfItem     CRITICALITY ignore      TYPE E-RABs-ToBeReleased-RelConfItem    PRESENCE mandatory},
```

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```
    ...
}

E-RABs-ToBeReleased-RelConfItem ::= CHOICE {
    sCG-Bearer       E-RABs-ToBeReleased-RelConfItem-SCG-Bearer,
    split-Bearer     E-RABs-ToBeReleased-RelConfItem-Split-Bearer,
    ...
}

E-RABs-ToBeReleased-RelConfItem-SCG-Bearer ::= SEQUENCE {
    e-RAB-ID                        E-RAB-ID,
    uL-GTPtunnelEndpoint            GTPtunnelEndpoint                                                        OPTIONAL,
    dL-GTPtunnelEndpoint            GTPtunnelEndpoint                                                        OPTIONAL,
    iE-Extensions                   ProtocolExtensionContainer { {E-RABs-ToBeReleased-RelConfItem-SCG-BearerExtIEs} } OPTIONAL,
    ...
}

E-RABs-ToBeReleased-RelConfItem-SCG-BearerExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

E-RABs-ToBeReleased-RelConfItem-Split-Bearer ::= SEQUENCE {
    e-RAB-ID                        E-RAB-ID,
    dL-GTPtunnelEndpoint            GTPtunnelEndpoint                                        OPTIONAL,
    iE-Extensions                   ProtocolExtensionContainer { {E-RABs-ToBeReleased-RelConfItem-Split-BearerExtIEs} } OPTIONAL,
    ...
}

E-RABs-ToBeReleased-RelConfItem-Split-BearerExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

-- *************************************************************
--
-- SENB COUNTER CHECK REQUEST
--
-- *************************************************************

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

SeNBCounterCheckRequest-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-MeNB-UE-X2AP-ID                          CRITICALITY ignore  TYPE UE-X2AP-ID                          PRESENCE mandatory}|
    { ID id-SeNB-UE-X2AP-ID                          CRITICALITY ignore  TYPE UE-X2AP-ID                          PRESENCE mandatory}|
    { ID id-E-RABs-SubjectToCounterCheck-List        CRITICALITY ignore  TYPE E-RABs-SubjectToCounterCheck-List PRESENCE mandatory},
    ...
}
E-RABs-SubjectToCounterCheck-List ::= SEQUENCE (SIZE(1..maxnoofBearers)) OF ProtocolIE-Single-Container { {E-RABs-SubjectToCounterCheckItemIEs} }

E-RABs-SubjectToCounterCheckItemIEs X2AP-PROTOCOL-IES ::= {
    { ID id-E-RABs-SubjectToCounterCheckItem    CRITICALITY ignore  TYPE E-RABs-SubjectToCounterCheckItem     PRESENCE mandatory},
    ...
```

```
}

E-RABs-SubjectToCounterCheckItem ::= SEQUENCE {
    e-RAB-ID                          E-RAB-ID,
    uL-Count                          INTEGER (0..4294967295),
    dL-Count                          INTEGER (0..4294967295),
    iE-Extensions                     ProtocolExtensionContainer { {E-RABs-SubjectToCounterCheckItemExtIEs} } OPTIONAL,
    ...
}

E-RABs-SubjectToCounterCheckItemExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

-- *************************************************************
--
-- X2 REMOVAL REQUEST
--
-- *************************************************************

X2RemovalRequest ::= SEQUENCE {
    protocolIEs     ProtocolIE-Container    {{X2RemovalRequest-IEs}},
    ...
}

X2RemovalRequest-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-GlobalENB-ID              CRITICALITY reject  TYPE GlobalENB-ID          PRESENCE mandatory},
...
}



-- *************************************************************
--
-- X2 REMOVAL RESPONSE
--
-- *************************************************************

X2RemovalResponse ::= SEQUENCE {
    protocolIEs     ProtocolIE-Container    {{X2RemovalResponse-IEs}},
    ...
}

X2RemovalResponse-IEs X2AP-PROTOCOL-IES ::= {
    { ID id-GlobalENB-ID              CRITICALITY reject  TYPE GlobalENB-ID          PRESENCE mandatory}|
    { ID id-CriticalityDiagnostics    CRITICALITY ignore  TYPE CriticalityDiagnostics    PRESENCE optional},
    ...
}



-- *************************************************************
--
-- X2 REMOVAL FAILURE
```

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

X2RemovalFailure ::= SEQUENCE {
    protocolIEs     ProtocolIE-Container     {{X2RemovalFailure-IEs}},
    ...
}

X2RemovalFailure-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-SignallingBasedMDTPLMNList,
    id-MultibandInfoList,
    id-NeighbourTAC,
    id-Time-UE-StayedInCell-EnhancedGranularity,
    id-MBMS-Service-Area-List,
    id-HO-cause,
    id-eARFCNExtension,
    id-DL-EARFCNExtension,
    id-UL-EARFCNExtension,
    id-M3Configuration,
    id-M4Configuration,
    id-M5Configuration,
    id-MDT-Location-Info,
```

```
    id-AdditionalSpecialSubframe-Info,
    maxnoofBearers,
    maxCellineNB,
    maxEARFCN,
    maxEARFCNPlusOne,
    newmaxEARFCN,
    maxInterfaces,

    maxnoofBands,
    maxnoofBPLMNs,
    maxnoofCells,
    maxnoofEPLMNs,
    maxnoofEPLMNsPlusOne,
    maxnoofForbLACs,
    maxnoofForbTACs,
    maxnoofNeighbours,
    maxnoofPRBs,
    maxNrOfErrors,
    maxPools,
    maxnoofMBSFN,
    maxnoofTAforMDT,
    maxnoofCellIDforMDT,
    maxnoofMBMSServiceAreaIdentities,
    maxnoofMDTPLMNs,
    maxnoofCoMPHypothesisSet,
    maxnoofCoMPCells,
    maxUEReport,
    maxCellReport,
    maxnoofPA

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)

AdditionalSpecialSubframe-Info ::=      SEQUENCE {
    additionalspecialSubframePatterns       AdditionalSpecialSubframePatterns,
    cyclicPrefixDL                          CyclicPrefixDL,
    cyclicPrefixUL                          CyclicPrefixUL,
    iE-Extensions                           ProtocolExtensionContainer { { AdditionalSpecialSubframe-Info-ExtIEs} } OPTIONAL,
    ...
}

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

AdditionalSpecialSubframePatterns ::= ENUMERATED {
    ssp0,
    ssp1,
    ssp2,
    ssp3,
```

```
        ssp4,
        ssp5,
        ssp6,
        ssp7,
        ssp8,
        ssp9,
        ...
}

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,
    ...,
    tAIBased                TAIBasedMDT
}

-- B

BenefitMetric ::= INTEGER (-101..100, ...)

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,
```

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```
    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,
    tDCoverall-expiry,
    tDCprep-expiry

}

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 ::= {
    ...
}

CoMPHypothesisSet ::= SEQUENCE (SIZE(1..maxnoofCoMPCells)) OF CoMPHypothesisSetItem

CoMPHypothesisSetItem ::= SEQUENCE {
    coMPCellID                  ECGI,
    coMPHypothesis              BIT STRING (SIZE(6..4400, ...)),
    iE-Extensions               ProtocolExtensionContainer { { CoMPHypothesisSetItem-ExtIEs} } OPTIONAL,
    ...
}

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

```
CoMPInformation ::= SEQUENCE {
    coMPInformationItem                 CoMPInformationItem,
    coMPInformationStartTime            CoMPInformationStartTime,
    iE-Extensions                       ProtocolExtensionContainer { { CoMPInformation-ExtIEs} } OPTIONAL,
    ...
}

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

CoMPInformationItem ::= SEQUENCE (SIZE(1..maxnoofCoMPHypothesisSet)) OF
    SEQUENCE {
        coMPHypothesisSet               CoMPHypothesisSet,
        benefitMetric                   BenefitMetric,
        iE-Extensions                   ProtocolExtensionContainer { { CoMPInformationItem-ExtIEs} } OPTIONAL,
        ...
    }

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

CoMPInformationStartTime ::= SEQUENCE (SIZE(0..1)) OF
    SEQUENCE {
        startSFN                        INTEGER (0..1023, ...),
        startSubframeNumber             INTEGER (0..9, ...),
        iE-Extensions                   ProtocolExtensionContainer { { CoMPInformationStartTime-ExtIEs} } OPTIONAL,
        ...
    }

CoMPInformationStartTime-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 ::= {
    ...
}

COUNTValueExtended ::= SEQUENCE {
    pDCP-SNExtended         PDCP-SNExtended,
    hFNModified             HFNModified,
    iE-Extensions           ProtocolExtensionContainer { { COUNTValueExtended-ExtIEs} } OPTIONAL,
    ...
}

COUNTValueExtended-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)

DynamicDLTransmissionInformation ::= CHOICE {
    naics-active          DynamicNAICSInformation,
    naics-inactive        NULL,
    ...
}

DynamicNAICSInformation ::= SEQUENCE {
    transmissionModes                    BIT STRING (SIZE(8))                                          OPTIONAL,
    pB-information                       INTEGER(0..3)                                                 OPTIONAL,
    pA-list                              SEQUENCE (SIZE(0..maxnoofPA)) OF PA-Values,
    iE-Extensions                        ProtocolExtensionContainer { {DynamicNAICSInformation-ExtIEs} } OPTIONAL,
    ...
}

DynamicNAICSInformation-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
```

```
    ...
}

-- E

EARFCN ::= INTEGER (0..maxEARFCN)

EARFCNExtension ::= INTEGER(maxEARFCNPlusOne..newmaxEARFCN, ...)

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 ::= {
    { ID id-UL-EARFCNExtension       CRITICALITY reject  EXTENSION EARFCNExtension      PRESENCE optional}|
    { ID id-DL-EARFCNExtension       CRITICALITY reject  EXTENSION EARFCNExtension      PRESENCE optional},
    ...
}

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 ::= {
    { ID id-AdditionalSpecialSubframe-Info  CRITICALITY ignore  EXTENSION AdditionalSpecialSubframe-Info  PRESENCE optional}|
    { ID id-eARFCNExtension                 CRITICALITY reject  EXTENSION EARFCNExtension                 PRESENCE optional},
    ...
}

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 ::= {
    ...
}
```

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```
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,
    ...
}

ExpectedUEBehaviour ::= SEQUENCE {
```

```
    expectedActivity        ExpectedUEActivityBehaviour OPTIONAL,
    expectedHOInterval      ExpectedHOInterval          OPTIONAL,
    iE-Extensions           ProtocolExtensionContainer { { ExpectedUEBehaviour-ExtIEs} } OPTIONAL,
    ...
}

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

ExpectedUEActivityBehaviour ::= SEQUENCE {
    expectedActivityPeriod                  ExpectedActivityPeriod                  OPTIONAL,
    expectedIdlePeriod                      ExpectedIdlePeriod                      OPTIONAL,
    sourceofUEActivityBehaviourInformation  SourceOfUEActivityBehaviourInformation  OPTIONAL,
    iE-Extensions        ProtocolExtensionContainer { { ExpectedUEActivityBehaviour-ExtIEs} } OPTIONAL,
    ...
}

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

ExpectedActivityPeriod ::= INTEGER (1..30|40|50|60|80|100|120|150|180|181,...)

ExpectedIdlePeriod ::= INTEGER (1..30|40|50|60|80|100|120|150|180|181,...)

SourceOfUEActivityBehaviourInformation ::= ENUMERATED {
    subscription-information,
    statistics,
    ...
}

ExpectedHOInterval ::= ENUMERATED {
    sec15, sec30, sec60, sec90, sec120, sec180, long-time,
    ...
}

ExtendedULInterferenceOverloadInfo ::= SEQUENCE {
    associatedSubframes                      BIT STRING (SIZE (5)),
    extended-ul-InterferenceOverloadIndication  UL-InterferenceOverloadIndication,
    iE-Extensions                            ProtocolExtensionContainer { { ExtendedULInterferenceOverloadInfo-ExtIEs} } OPTIONAL,
    ...
}

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

-- F

ForbiddenInterRATs ::= ENUMERATED {
    all,
    geran,
    utran,
```

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```
    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..256, ...)

-- 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)

HFNModified ::= INTEGER (0..131071)

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

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


-- I

Masked-IMEISV ::= BIT STRING (SIZE (64))

InvokeIndication ::= ENUMERATED{
    abs-information,
    ...,
    naics-information-start,
    naics-information-stop
}

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

InterfacesToTrace ::= BIT STRING (SIZE (8))
```

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```
-- 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,
    ...
}


Links-to-log ::= ENUMERATED {uplink, downlink, both-uplink-and-downlink, ...}


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




LocationReportingInformation ::= SEQUENCE {
    eventType       EventType,
```

```
    reportArea        ReportArea,
    iE-Extensions         ProtocolExtensionContainer { {LocationReportingInformation-ExtIEs} } OPTIONAL,
    ...
}

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

-- M

M3Configuration ::= SEQUENCE {
    m3period          M3period,
    iE-Extensions         ProtocolExtensionContainer { { M3Configuration-ExtIEs} } OPTIONAL,
    ...
}

M3Configuration-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

M3period ::= ENUMERATED {ms100, ms1000, ms10000, ... }

M4Configuration ::= SEQUENCE {
    m4period          M4period,
    m4-links-to-log   Links-to-log,
    iE-Extensions         ProtocolExtensionContainer { { M4Configuration-ExtIEs} } OPTIONAL,
    ...
}

M4Configuration-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

M4period ::= ENUMERATED {ms1024, ms2048, ms5120, ms10240, min1, ... }


M5Configuration ::= SEQUENCE {
    m5period          M5period,
    m5-links-to-log   Links-to-log,
    iE-Extensions         ProtocolExtensionContainer { { M5Configuration-ExtIEs} } OPTIONAL,
    ...
}

M5Configuration-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    ...
}

M5period ::= ENUMERATED {ms1024, ms2048, ms5120, ms10240, min1, ... }

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

```
}

MDT-Configuration ::= SEQUENCE {
    mdt-Activation              MDT-Activation,
    areaScopeOfMDT              AreaScopeOfMDT,
    measurementsToActivate      MeasurementsToActivate,
    m1reportingTrigger          M1ReportingTrigger,
    m1thresholdeventA2          M1ThresholdEventA2          OPTIONAL,
-- Included in case of event-triggered, or event-triggered periodic reporting for measurement M1
    m1periodicReporting         M1PeriodicReporting         OPTIONAL,
-- Included in case of periodic, or event-triggered periodic reporting for measurement M1
    iE-Extensions               ProtocolExtensionContainer { { MDT-Configuration-ExtIEs} } OPTIONAL,
    ...
}

MDT-Configuration-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    {ID id-M3Configuration           CRITICALITY ignore  EXTENSION M3Configuration      PRESENCE conditional}|
    {ID id-M4Configuration           CRITICALITY ignore  EXTENSION M4Configuration      PRESENCE conditional}|
    {ID id-M5Configuration           CRITICALITY ignore  EXTENSION M5Configuration      PRESENCE conditional}|
    {ID id-MDT-Location-Info         CRITICALITY ignore  EXTENSION MDT-Location-Info    PRESENCE optional}|
    {ID id-SignallingBasedMDTPLMNList CRITICALITY ignore  EXTENSION MDTPLMNList          PRESENCE optional},
    ...
}

MDTPLMNList ::= SEQUENCE (SIZE(1..maxnoofMDTPLMNs)) OF PLMN-Identity

MDT-Location-Info ::= BIT STRING (SIZE (8))

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

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

MeNBtoSeNBContainer  ::= OCTET STRING

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}|
    { ID id-eARFCNExtension     CRITICALITY reject  EXTENSION EARFCNExtension   PRESENCE optional},
    ...
}

NextHopChainingCount ::= INTEGER (0..7)

Number-of-Antennaports ::= ENUMERATED {
      an1,
```

```
        an2,
        an4,
        ...
}

-- O

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

-- P

PA-Values ::= ENUMERATED {
    dB-6,
    dB-4dot77,
    dB-3,
    dB-1dot77,
    dB0,
    dB1,
    dB2,
    dB3,
    ...
}

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

PDCP-SNExtended ::= INTEGER (0..32767)

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

M1PeriodicReporting ::= SEQUENCE {
    reportInterval              ReportIntervalMDT,
    reportAmount                ReportAmountMDT,
    iE-Extensions               ProtocolExtensionContainer { { M1PeriodicReporting-ExtIEs} } OPTIONAL,
    ...
}

M1PeriodicReporting-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))

ReceiveStatusOfULPDCPSDUsExtended ::= BIT STRING (SIZE(1..16384))

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,
    ...
}

ReportingPeriodicityRSRPMR ::= ENUMERATED {
    one-hundred-20-ms,
    two-hundred-40-ms,
    four-hundred-80-ms,
    six-hundred-40-ms,
...
}

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

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

M1ReportingTrigger::= ENUMERATED{
    periodic,
    a2eventtriggered,
    ...,
    a2eventtriggered-periodic
}

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

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```
        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,
        ...
}

RSRPMeasurementResult ::= SEQUENCE (SIZE(1..maxCellReport)) OF
        SEQUENCE {
            rSRPCellID                    ECGI,
            rSRPMeasured                  INTEGER (0..97, ...),
            iE-Extensions                 ProtocolExtensionContainer { { RSRPMeasurementResult-ExtIEs} } OPTIONAL,
            ...
        }

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

RSRPMRList ::= SEQUENCE (SIZE(1..maxUEReport)) OF
        SEQUENCE {
            rSRPMeasurementResult         RSRPMeasurementResult,
            iE-Extensions                 ProtocolExtensionContainer { { RSRPMRList-ExtIEs} } OPTIONAL,
            ...
        }

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

-- S

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

ETSI

```
}

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

SCGChangeIndication ::= ENUMERATED {pDCPCountWrapAround, pSCellChange, other, ...}

SeNBSecurityKey ::= BIT STRING (SIZE(256))

SeNBtoMeNBContainer ::= OCTET STRING


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,
    ...
}

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

TAIBasedMDT ::= SEQUENCE {
    tAIListforMDT          TAIListforMDT,
    iE-Extensions          ProtocolExtensionContainer { {TAIBasedMDT-ExtIEs} } OPTIONAL,
    ...
}

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

TAIListforMDT ::= SEQUENCE (SIZE(1..maxnoofTAforMDT)) OF TAI-Item

TAI-Item ::= SEQUENCE {
    tAC                TAC,
    pLMN-Identity      PLMN-Identity,
    iE-Extensions      ProtocolExtensionContainer { { TAI-Item-ExtIEs} } OPTIONAL,
    ...
}

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

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]

M1ThresholdEventA2 ::= SEQUENCE {
    measurementThreshold        MeasurementThresholdA2,
    iE-Extensions               ProtocolExtensionContainer { { M1ThresholdEventA2-ExtIEs} } OPTIONAL,
    ...
}

M1ThresholdEventA2-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,
    ...
```

ETSI

```
}

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,
    ...
}
```

ETSI

```
-- U

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

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

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 RLF-Report-r9 field contained in the UEInformationResponse message as defined in
TS 36.331 [9]

UE-RLF-Report-Container-for-extended-bands ::= OCTET STRING
-- This IE is a transparent container and shall be encoded as the RLF-Report-v9e0 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
id-x2Release                                            ProcedureCode ::= 16
id-x2MessageTransfer                                    ProcedureCode ::= 17
id-x2Removal                                            ProcedureCode ::= 18
id-seNBAdditionPreparation                              ProcedureCode ::= 19
id-seNBReconfigurationCompletion                        ProcedureCode ::= 20
id-meNBinitiatedSeNBModificationPreparation             ProcedureCode ::= 21
id-seNBinitiatedSeNBModification                        ProcedureCode ::= 22
id-meNBinitiatedSeNBRelease                             ProcedureCode ::= 23
id-seNBinitiatedSeNBRelease                             ProcedureCode ::= 24
id-seNBCounterCheck                                     ProcedureCode ::= 25
```

```
-- *************************************************************
--
-- Lists
--
-- *************************************************************

maxEARFCN                               INTEGER ::= 65535
maxEARFCNPlusOne                        INTEGER ::= 65536
newmaxEARFCN                            INTEGER ::= 262143
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
maxnoofMDTPLMNs                         INTEGER ::= 16
maxnoofCoMPHypothesisSet                INTEGER ::= 256
maxnoofCoMPCells                        INTEGER ::= 32
maxUEReport                             INTEGER ::= 128
maxCellReport                           INTEGER ::= 9
maxnoofPA                               INTEGER ::= 3


-- *************************************************************
--
-- 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-MobilityInformation                                   ProtocolIE-ID ::= 82
id-SourceCellCRNTI                                       ProtocolIE-ID ::= 83
id-MultibandInfoList                                     ProtocolIE-ID ::= 84
id-M3Configuration                                       ProtocolIE-ID ::= 85
id-M4Configuration                                       ProtocolIE-ID ::= 86
id-M5Configuration                                       ProtocolIE-ID ::= 87
id-MDT-Location-Info                                     ProtocolIE-ID ::= 88
id-ManagementBasedMDTPLMNList                            ProtocolIE-ID ::= 89
id-SignallingBasedMDTPLMNList                            ProtocolIE-ID ::= 90
id-ReceiveStatusOfULPDCPSDUsExtended                     ProtocolIE-ID ::= 91
id-ULCOUNTValueExtended                                  ProtocolIE-ID ::= 92
id-DLCOUNTValueExtended                                  ProtocolIE-ID ::= 93
id-eARFCNExtension                                       ProtocolIE-ID ::= 94
id-UL-EARFCNExtension                                    ProtocolIE-ID ::= 95
id-DL-EARFCNExtension                                    ProtocolIE-ID ::= 96
id-AdditionalSpecialSubframe-Info                        ProtocolIE-ID ::= 97
id-Masked-IMEISV                                         ProtocolIE-ID ::= 98
id-IntendedULDLConfiguration                             ProtocolIE-ID ::= 99
id-ExtendedULInterferenceOverloadInfo                    ProtocolIE-ID ::= 100
id-RNL-Header                                            ProtocolIE-ID ::= 101
id-x2APMessage                                           ProtocolIE-ID ::= 102
id-ExpectedUEBehaviour                                   ProtocolIE-ID ::= 104
id-UE-HistoryInformationFromTheUE                        ProtocolIE-ID ::= 105
id-DynamicDLTransmissionInformation                      ProtocolIE-ID ::= 106
id-UE-RLF-Report-Container-for-extended-bands            ProtocolIE-ID ::= 107
id-CoMPInformation                                       ProtocolIE-ID ::= 108
id-ReportingPeriodicityRSRPMR                            ProtocolIE-ID ::= 109
id-RSRPMRList                                            ProtocolIE-ID ::= 110
id-MeNB-UE-X2AP-ID                                       ProtocolIE-ID ::= 111
id-SeNB-UE-X2AP-ID                                       ProtocolIE-ID ::= 112
id-UE-SecurityCapabilities                               ProtocolIE-ID ::= 113
id-SeNBSecurityKey                                       ProtocolIE-ID ::= 114
id-UEAggregateMaximumBitRate                             ProtocolIE-ID ::= 115
id-ServingPLMN                                           ProtocolIE-ID ::= 116
id-E-RABs-ToBeAdded-List                                 ProtocolIE-ID ::= 117
id-E-RABs-ToBeAdded-Item                                 ProtocolIE-ID ::= 118
id-MeNBtoSeNBContainer                                   ProtocolIE-ID ::= 119
```

```
id-E-RABs-Admitted-ToBeAdded-List                    ProtocolIE-ID ::= 120
id-E-RABs-Admitted-ToBeAdded-Item                    ProtocolIE-ID ::= 121
id-SeNBtoMeNBContainer                               ProtocolIE-ID ::= 122
id-ResponseInformationSeNBReconfComp                 ProtocolIE-ID ::= 123
id-UE-ContextInformationSeNBModReq                   ProtocolIE-ID ::= 124
id-E-RABs-ToBeAdded-ModReqItem                       ProtocolIE-ID ::= 125
id-E-RABs-ToBeModified-ModReqItem                    ProtocolIE-ID ::= 126
id-E-RABs-ToBeReleased-ModReqItem                    ProtocolIE-ID ::= 127
id-E-RABs-Admitted-ToBeAdded-ModAckList              ProtocolIE-ID ::= 128
id-E-RABs-Admitted-ToBeModified-ModAckList           ProtocolIE-ID ::= 129
id-E-RABs-Admitted-ToBeReleased-ModAckList           ProtocolIE-ID ::= 130
id-E-RABs-Admitted-ToBeAdded-ModAckItem              ProtocolIE-ID ::= 131
id-E-RABs-Admitted-ToBeModified-ModAckItem           ProtocolIE-ID ::= 132
id-E-RABs-Admitted-ToBeReleased-ModAckItem           ProtocolIE-ID ::= 133
id-E-RABs-ToBeReleased-ModReqd                       ProtocolIE-ID ::= 134
id-E-RABs-ToBeReleased-ModReqdItem                   ProtocolIE-ID ::= 135
id-SCGChangeIndication                               ProtocolIE-ID ::= 136
id-E-RABs-ToBeReleased-List-RelReq                   ProtocolIE-ID ::= 137
id-E-RABs-ToBeReleased-RelReqItem                    ProtocolIE-ID ::= 138
id-E-RABs-ToBeReleased-List-RelConf                  ProtocolIE-ID ::= 139
id-E-RABs-ToBeReleased-RelConfItem                   ProtocolIE-ID ::= 140
id-E-RABs-SubjectToCounterCheck-List                 ProtocolIE-ID ::= 141
id-E-RABs-SubjectToCounterCheckItem                  ProtocolIE-ID ::= 142

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 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.

T_{DCprep}

- Specifies the maximum time for the SeNB Addition Preparation or MeNB initiated SeNB Modification Preparation procedure in the MeNB.

$T_{DCoverall}$

- Specifies the maximum time in the SeNB for either the SeNB initiated SeNB Modification procedure or the protection of the E-UTRAN actions necessary to configure UE resources at SeNB Addition or MeNB initiated SeNB Modification.

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
58	RP-121731	0548		Addition of Mobility Information	11.3.0
58	RP-121730	0549	3	Introduction of new MDT measurements	11.3.0
58	RP-121732	0550	1	HeNB Mobility enhancement when target is hybrid HeNB	11.3.0
58	RP-121730	0552	2	Multi-PLMN MDT	11.3.0
58	RP-121731	0564		Clarification on successful handover for HO report procedure	11.3.0
58	RP-121737	0569	2	X2AP Rapporteur Update	11.3.0
59	RP-130208	0572	3	Correction on the Special Subframe Pattern	11.4.0
59	RP-130208	0580	2	Support for Downlink-Only Bands	11.4.0
59	RP-130207	0581		Correction on use of Mobility Information	11.4.0
59	RP-130207	0582	1	Correction on MRO procedures	11.4.0
59	RP-130237	0583	2	Extending maxEARFCN	11.4.0
59	RP-130237	0584	1	Extending Maximum Frequency Band Index	11.4.0
59	RP-130211	0585	1	Rapporteur correction of X2AP	11.4.0
59	RP-130207	0586		Clarification on Signalling Based MDT PLMN List	11.4.0
59	RP-130210	0587	1	X2AP modification for PDCP SN extension	11.4.0
60	RP-130643	0588		Correction on the Definition of Direct Neighbours	11.5.0
60	RP-130641	0589	1	Correction for the MDT Location Information IE	11.5.0
60	RP-130640	0590	5	Correction on RLF INDICATION procedure	11.5.0
60	RP-130643	0592	1	Security key generation in case of MFBI	11.5.0
60	RP-130643	0593	2	Correction on the Multiple Frequency Band Indicators	11.5.0
61	RP-131181	0598	1	Correction on Handover Report procedure	11.6.0
61	RP-131179	0602	2	Correction on ABS Information	11.6.0
61	RP-131183	0606	1	Correction of terminology concerning the mobility restriction function	11.6.0
62	RP-131902	0609	3	Correction of Handover Restriction List	11.7.0
62	RP-131902	0611	1	Correction for Load Balancing Related cause value CR for 36423	11.7.0
62	RP-131902	0623	2	Correction for Load Balancing Related IE	12.0.0
62	RP-131909	0607	3	Handling SIPTO@LN during UE Context Release procedure	12.0.0
63	RP-140294	0634		Correction to tabular of Served Cell Information IE	12.1.0
64	RP-140901	0629	4	TDD eIMTA support on X2AP	12.2.0
64	RP-140906	0630	4	Provide IMEISV to eNB to identify UE characteristics	12.2.0
64	RP-140905	0661	1	Correction of SN STATUS TRANSFER	12.2.0
64	RP-140905	0676		Clarification of DL ABS status	12.2.0
64	RP-140897	0641	4	Introduce X2GW procedures in Stage-3	12.2.0
65	RP-141520	0663	3	Introduction of the UE history reported from the UE	12.3.0
65	RP-141518	0690	2	Introduction of an indication of the expected UE behaviour	12.3.0
66	RP-142089	0691	8	Introduction of Dual Connectivity	12.4.0
66	RP-142090	0692	10	Introduction of inter-eNB CoMP signalling	12.4.0
66	RP-142092	0748	5	X2 support for Network Assisted Interference Cancellation	12,4.0
66	RP-142094	0754	2	X2AP Rapporteur Update	12.4.0
66	RP-142094	0759	2	Correction on RLF Report Container	12.4.0
66	RP-142094	0776	2	Setting of Re-establishment Cell ID in RLF Indication message	12.4.0
66	RP-142094	0777	3	X2 Removal Signaling	12.4.0
12/2014				History table corrected	12.4.1
12/2014				ASN.1 correction to make it compilable	12.4.2

History

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