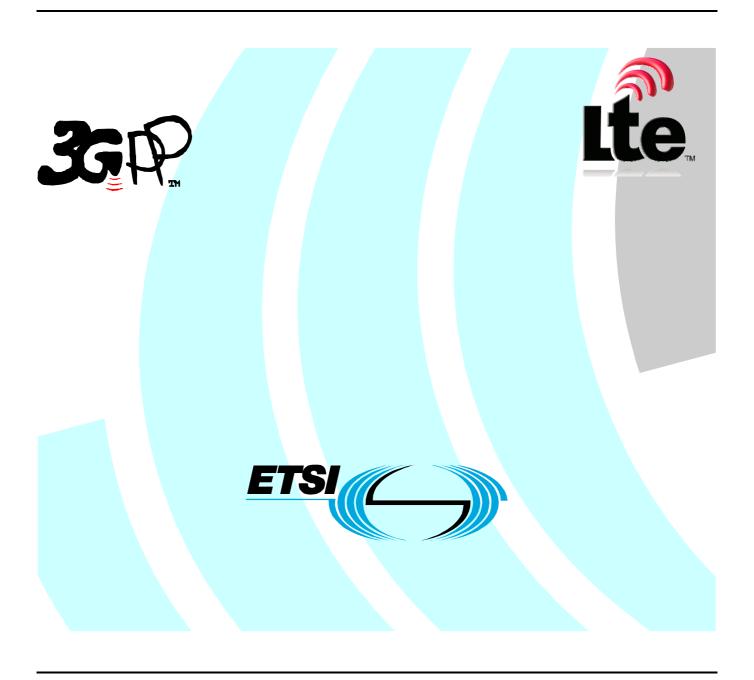
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# Contents

Intelle	ectual Property Rights	2
Forew	vord	2
Forew	vord	7
1	Scope	8
2	References	8
3	Definitions, symbols and abbreviations	g
3.1	Definitions	
3.2	Symbols	
3.3	Abbreviations	9
4	General	10
4.1	Procedure specification principles	
4.2	Forwards and backwards compatibility	
4.3	Specification notations	
5	X2AP services	11
5.1	X2AP procedure modules	
5.2	Parallel transactions.	
6	Services expected from signalling transport	
6		
7	Functions of X2AP	11
8	X2AP procedures	12
8.1	Elementary procedures	
8.2	Basic mobility procedures	
8.2.1	Handover Preparation	
8.2.1.1		
8.2.1.2	1	
8.2.1.3	1	
8.2.1.4		
8.2.2	SN Status Transfer	
8.2.2.1		
8.2.2.2	1	
8.2.2.3		
8.2.3 8.2.3.1	UE Context Release	
8.2.3.2		
8.2.3.3		
8.2.3.4		
8.2.4	Handover Cancel	
8.2.4.1		
8.2.4.2		
8.2.4.3	*	
8.2.4.4	1	
8.3	Global Procedures	18
8.3.1	Load Indication	18
8.3.1.1	1 General	18
8.3.1.2	2 Successful Operation	18
8.3.1.3		
8.3.1.4		
8.3.2	Error Indication	
8.3.2.1		
8.3.2.2	*	
8.3.2.3	1	
8.3.2.4	4 Abnormal Conditions	19

8.3.3	X2 Setup	20
8.3.3.1	General	20
8.3.3.2	Successful Operation	20
8.3.3.3	Unsuccessful Operation	21
8.3.3.4	Abnormal Conditions	
8.3.4	Reset	
8.3.4.1	General	
8.3.4.2	Successful Operation	
8.3.4.3	Unsuccessful Operation	
8.3.4.4	Abnormal Conditions	
8.3.5	eNB Configuration Update	
8.3.5.1	General	
8.3.5.2	Successful Operation.	
8.3.5.3	•	
8.3.5.4	Unsuccessful Operation	
	Abnormal Conditions	
8.3.6	Resource Status Reporting Initiation	
8.3.6.1	General	
8.3.6.2	Successful Operation	
8.3.6.3	Unsuccessful Operation	
8.3.6.4	Abnormal Conditions	25
8.3.7	Resource Status Reporting	26
8.3.7.1	General	26
8.3.7.2	Successful Operation	26
8.3.8	Mobility Settings Change	
8.3.8.1	General	
8.3.8.2	Successful Operation	
8.3.8.3	Unsuccessful Operation	
8.3.8.4	Abnormal Conditions	
8.3.9	Radio Link Failure Indication	
8.3.9.1	General	
8.3.9.2	Successful Operation	
8.3.9.3	Unsuccessful Operation	
8.3.9.4	Abnormal Conditions	
8.3.10	Handover Report	28
8.3.10.1	General	28
8.3.10.2	Successful Operation	28
8.3.10.3		
8.3.10.4	<u>.</u>	
8.3.11	Cell Activation	
8.3.11.1		
8.3.11.2		
8.3.11.2		
	1	
8.3.11.4	Abnormal Conditions	30
9 E	Elements for X2AP Communication	30
9.0	General	
9.1	Message Functional Definition and Content	
9.1.1	Messages for Basic Mobility Procedures	
9.1.1.1	HANDOVER REQUEST	
9.1.1.2	HANDOVER REQUEST ACKNOWLEDGE	
9.1.1.3	HANDOVER PREPARATION FAILURE	
9.1.1.4	SN STATUS TRANSFER	
9.1.1.5	UE CONTEXT RELEASE	
9.1.1.6	HANDOVER CANCEL	
9.1.2	Messages for global procedures	35
9.1.2.1	LOAD INFORMATION	
9.1.2.2	ERROR INDICATION	
9.1.2.3	X2 SETUP REQUEST	
9.1.2.4	X2 SETUP RESPONSE	
9.1.2.5	X2 SETUP FAILURE	
9.1.2.6	RESET REQUEST	
9.1.2.0	RESET RESPONSE	
7.1.4.1	NEOLI NEOFUNOL	

9.1.2.8	ENB CONFIGURATION UPDATE	
9.1.2.9	ENB CONFIGURATION UPDATE ACKNOWLEDGE	40
9.1.2.10	ENB CONFIGURATION UPDATE FAILURE	
9.1.2.11	RESOURCE STATUS REQUEST	40
9.1.2.12	RESOURCE STATUS RESPONSE	41
9.1.2.13	RESOURCE STATUS FAILURE	42
9.1.2.14	RESOURCE STATUS UPDATE	
9.1.2.15	MOBILITY CHANGE REQUEST	
9.1.2.16	MOBILITY CHANGE ACKNOWLEDGE	
9.1.2.17	MOBILITY CHANGE FAILURE	
9.1.2.18	RLF INDICATION	
9.1.2.19	HANDOVER REPORT	
9.1.2.20	CELL ACTIVATION REQUEST	
9.1.2.21	CELL ACTIVATION RESPONSE	
9.1.2.22	CELL ACTIVATION FAILURE	
9.2	Information Element definitions	
9.2.0	General	
9.2.1	GTP Tunnel Endpoint	
9.2.2	Trace Activation	
9.2.3	Handover Restriction List	
9.2.4	PLMN Identity	
9.2.5	DL Forwarding	
9.2.6	Cause	
9.2.7	Criticality Diagnostics	
9.2.8	Served Cell Information	
9.2.9	E-RAB Level QoS Parameters	
9.2.10	GBR QoS Information	
9.2.11	Bit Rate	
9.2.12	UE Aggregate Maximum Bit Rate	
9.2.13	Message Type	
9.2.14	ECGI	
9.2.15	COUNT Value	
9.2.16	GUMMEI	
9.2.17	UL Interference Overload Indication	
9.2.18	UL High Interference Indication	
9.2.19	Relative Narrowband Tx Power (RNTP)	
9.2.20 9.2.21	GU Group IdLocation Reporting Information	
9.2.21	Global eNB ID	
9.2.22	E-RAB ID	
9.2.23	eNB UE X2AP ID	
9.2.24	Subscriber Profile ID for RAT/Frequency priority	
9.2.26	EARFCN	
9.2.27	Transmission Bandwidth	
9.2.28	E-RAB List	
9.2.29	UE Security Capabilities	
9.2.30	AS Security Information	
9.2.31	Allocation and Retention Priority	
9.2.32	Time to Wait	
9.2.33	SRVCC Operation Possible	
9.2.34	Hardware Load Indicator	
9.2.35	S1 TNL Load Indicator	65
9.2.36	Load Indicator	
9.2.37	Radio Resource Status	
9.2.38	UE History Information	
9.2.39	Last Visited Cell Information	66
9.2.40	Last Visited E-UTRAN Cell Information	66
9.2.41	Last Visited GERAN Cell Information	
9.2.42	Cell Type	
9.2.43	Number of Antenna Ports	
9.2.44	Composite Available Capacity Group	
9.2.45	Composite Available Capacity	67

9.2.46	Cell Capacity Class Value	68
9.2.47	Capacity Value	68
9.2.50	PRACH Configuration	69
9.2.51	Subframe Allocation	69
9.3	Message and Information Element Abstract Syntax (with ASN.1)	70
9.3.1	General	70
9.3.2	Usage of Private Message Mechanism for Non-standard Use	70
9.3.3	Elementary Procedure Definitions	
9.3.4	PDU Definitions	76
9.3.5	Information Element definitions	93
9.3.6	Common definitions	111
9.3.7	Constant definitions	112
9.3.8	Container definitions	115
9.4	Message transfer syntax	120
9.5	Timers	
10	Handling of unknown, unforeseen and erroneous protocol data	120
Annex	x A (informative): Change History	121
Histor	у	122

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

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# 1 Scope

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

# 2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
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- 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". 3GPP TS 36.401: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); [2] Architecture Description". [3] 3GPP TS 36.420: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 General Aspects and Principles". [4] 3GPP TS 36.413: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP)". [5] ITU-T Recommendation X.691 (07/2002): "Information technology - ASN.1 encoding rules -Specification of Packed Encoding Rules (PER) ". 3GPP TS 32.422: "Telecommunication Management; Subscriber and Equipment Trace; Trace [6] Control and Configuration Management". [7] 3GPP TS 32.421: "Telecommunication Management; Subscriber and Equipment Trace; Trace concepts and requirements". 3GPP TS 36.424: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); X2 data [8] 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". 3GPP TS 36.213: "Evolved Universal Terrestrial Radio Access (E-UTRA); Physical layer [11] procedures ". [12] 3GPP TS 23.401: "General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access". [13] 3GPP TS 23.203: "Policy and charging control architecture". [14] 3GPP TS 24.301: "Non-Access-Stratum (NAS) protocol for Evolved Packet System; Stage 3".

[15]	3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA), Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; stage 2".
[16]	3GPP TS 36.104: "Base Station (BS) radio transmission and reception ".
[17]	3GPP TS 24.008: "Mobile Radio Interface Layer 3 Specification; Core Network Protocols; Stage 3".
[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]	3GPP TS 23.203: "Policy and charging control architecture".
[24]	3GPP TS 25.413: "UTRAN Iu interface RANAP signalling"

# 3 Definitions, symbols and abbreviations

### 3.1 Definitions

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

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

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

**E-RAB:** Defined in [2].

# 3.2 Symbols

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

<symbol> <Explanation>

# 3.3 Abbreviations

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

DL Downlink

EARFCN E-UTRA Absolute Radio Frequency Channel Number

eNB E-UTRAN NodeB
EP Elementary Procedure
EPC Evolved Packet Core

E-RAB E-UTRAN Radio Access Bearer

E-UTRAN Evolved UTRAN

GUMMEI Globally Unique MME Identifier

HFN Hyper Frame Number IE Information Element

MME Mobility Management Entity
PDCP Packet Data Convergence Protocol
PLMN Public Land Mobile Network

S-GW Serving Gateway
SN Sequence Number
TAC Tracking Area Code
UE User Equipment

UL Uplink

# 4 General

# 4.1 Procedure specification principles

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

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

- The procedure text discriminates between:
  - 1) Functionality which "shall" be executed

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

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

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

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

# 4.2 Forwards and backwards compatibility

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

# 4.3 Specification notations

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

Procedure When referring to an elementary procedure in the specification the Procedure Name is written with

the first letters in each word in upper case characters followed by the word "procedure", e.g.

Handover Preparation procedure.

Message When referring to a message in the specification the MESSAGE NAME is written with all letters

in upper case characters followed by the word "message", e.g. HANDOVER REQUEST message.

IE When referring to an information element (IE) in the specification the *Information Element Name* is written with the first letters in each word in upper case characters and all letters in Italic font followed by the abbreviation "IE", e.g. *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 [21].

# 7 Functions of X2AP

The X2AP protocol provides the following functions:

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

- Mobility Parameters Management. This function allows the eNB to coordinate adaptation of mobility parameter settings with a peer eNB.
- Mobility Robustness Optimisation. This function allows reporting of information related to mobility failure events.
- Energy Saving. This function allows decreasing energy consumption by enabling indication of cell activation/deactivation over the X2 interface.

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

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

Function	Elementary Procedure(s)		
Mobility Management	a) Handover Preparation		
	b) SN Status Transfer		
	c) UE Context Release		
	d) Handover Cancel		
Load Management	a) Load Indication		
	b) Resource Status Reporting Initiation		
	c) Resource Status Reporting		
Reporting of General Error Situations	Error Indication		
Resetting the X2	Reset		
Setting up the X2	X2 Setup		
eNB Configuration Update	a) eNB Configuration Update		
	b) Cell Activation		
Mobility Parameters Management	Mobility Settings Change		
Mobility Robustness Optimisation	a) Radio Link Failure Indication		
	b) Handover Report		
Energy Saving	a) eNB Configuration Update		
	b) Cell Activation		

# 8 X2AP procedures

# 8.1 Elementary procedures

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

Table 8.1-1: Class 1 Elementary Procedures

Elementary Initiating Message		Successful Outcome	Unsuccessful Outcome
Procedure		Response message	Response message
Handover	HANDOVER	HANDOVER	HANDOVER
Preparation	REQUEST	REQUEST	PREPARATION FAILURE
		ACKNOWLEDGE	
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

Elementary	Initiating Message Successful Outcome		Unsuccessful Outcome		
Procedure		Response message	Response message		
Cell Activation	CELL ACTIVATION REQUEST	CELL ACTIVATION RESPONSE	CELL ACTIVATION FAILURE		

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

Elementary Procedure	Initiating Message
Load Indication	LOAD INFORMATION
Handover Cancel	HANDOVER CANCEL
SN Status Transfer	SN STATUS TRANSFER
UE Context Release	UE CONTEXT RELEASE
Resource Status Reporting	RESOURCE STATUS UPDATE
Error Indication	ERROR INDICATION
Radio Link Failure Indication	RLF INDICATION
Handover Report	HANDOVER REPORT

# 8.2 Basic mobility procedures

# 8.2.1 Handover Preparation

#### 8.2.1.1 General

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

The procedure uses UE-associated signalling.

### 8.2.1.2 Successful Operation

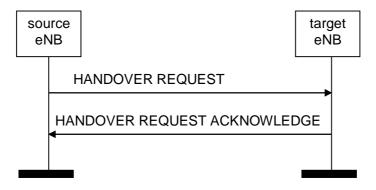


Figure 8.2.1.2-1: Handover Preparation, successful operation

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

The allocation of resources according to the values of the *Allocation and Retention Priority* IE shall follow the principles described for the E-RAB Setup procedure in [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 configuration of the AS security relation between UE and target eNB using the information in *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 [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  $T_{RELOC_{prep}}$ , start the timer  $TX2_{RELOC_{overall}}$  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 [6].

If the Handover Restriction List IE is

- contained in the HANDOVER REQUEST message, the target eNB shall store the information received in the *Handover Restriction List* IE in the UE context and the target eNB shall use this information to determine a target cell for the UE during subsequent handover attempts except when one of the E-RABs has some particular ARP values [12] in which case the information shall not apply.
- not contained in the HANDOVER REQUEST message, the target eNB shall consider that no roaming, no area and no access restriction applies to the UE.

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

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

If the *UE Security Capabilities* IE included in the HANDOVER REQUEST message only contains the EIA0 algorithm as defined in [18] and if this EIA0 algorithm is defined in the configured list of allowed integrity protection algorithms in the eNB [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 [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, for as long as the UE stays in one of its cells, and store the collected information to be used for future handover preparations.

### 8.2.1.3 Unsuccessful Operation

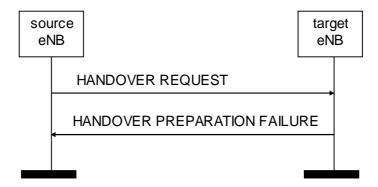


Figure 8.2.1.3-1: Handover Preparation, unsuccessful operation

If the target eNB does not admit at least one non-GBR E-RAB, or a failure occurs during the Handover Preparation, the target eNB shall send the HANDOVER PREPARATION FAILURE message to the source eNB. The message shall contain the *Cause* IE with an appropriate value.

If the target eNB receives a HANDOVER REQUEST message containing *RRC Context* IE that does not include required information as specified in [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<sub>RELOCprep</sub> 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 several *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 [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 [18], do not match any algorithms defined in the configured list of allowed encryption algorithms in the target eNB [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 EIAO algorithm in all UEs [18], do not match any algorithms defined in the configured list of allowed integrity protection algorithms in the eNB [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.

#### 8.2.2 SN Status Transfer

#### 8.2.2.1 General

The purpose of the SN Status Transfer procedure is to transfer the uplink PDCP SN and HFN receiver status and the downlink PDCP SN and HFN transmitter status from the source to the target eNB during an X2 handover for each respective E-RAB for which PDCP SN and HFN status preservation applies.

The procedure uses UE-associated signalling.

#### 8.2.2.2 Successful Operation

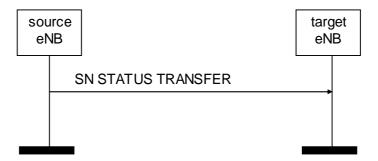


Figure 8.2.2.2-1: SN Status Transfer, successful operation

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

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

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

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

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

# 8.2.2.3 Abnormal Conditions

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

#### 8.2.3 UE Context Release

#### 8.2.3.1 General

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

The procedure uses UE-associated signalling.

### 8.2.3.2 Successful Operation



Figure 8.2.3.2-1: UE Context Release, successful operation

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

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

#### 8.2.3.3 Unsuccessful Operation

Not applicable.

#### 8.2.3.4 Abnormal Conditions

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

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

#### 8.2.4 Handover Cancel

#### 8.2.4.1 General

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

The procedure uses UE-associated signalling.

#### 8.2.4.2 Successful Operation



Figure 8.2.4.2-1: Handover Cancel, successful operation

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

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

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

#### 8.2.4.3 Unsuccessful Operation

Not applicable.

#### 8.2.4.4 Abnormal Conditions

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

### 8.3 Global Procedures

#### 8.3.1 Load Indication

#### 8.3.1.1 General

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

The procedure uses non UE-associated signalling.

#### 8.3.1.2 Successful Operation

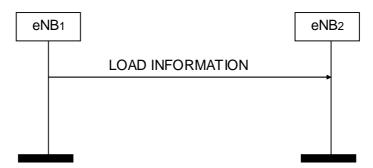


Figure 8.3.1.2-1: Load Indication, successful operation

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

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

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

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

#### 8.3.1.3 Unsuccessful Operation

Not applicable.

#### 8.3.1.4 Abnormal Conditions

Void.

#### 8.3.2 Error Indication

#### 8.3.2.1 General

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

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

#### 8.3.2.2 Successful Operation



Figure 8.3.2.2-1: Error Indication, successful operation.

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

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

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

#### 8.3.2.3 Unsuccessful Operation

Not applicable.

#### 8.3.2.4 Abnormal Conditions

Not applicable.

# 8.3.3 X2 Setup

#### 8.3.3.1 General

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

The procedure uses non UE-associated signalling.

#### 8.3.3.2 Successful Operation

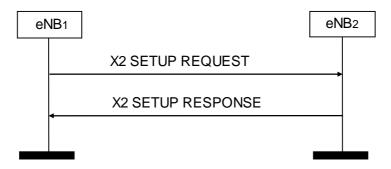


Figure 8.3.3.2-1: X2 Setup, successful operation

An eNB<sub>1</sub> initiates the procedure by sending the X2 SETUP REQUEST message to a candidate eNB<sub>2</sub>. The candidate eNB<sub>2</sub> replies with the X2 SETUP RESPONSE message. The initiating eNB<sub>1</sub> transfers the complete list of its served cells and, if available, a list of supported GU Group Ids to the candidate eNB<sub>2</sub>. The candidate eNB<sub>2</sub> replies with the complete list of its served cells and shall include, if available, a list of supported GU Group Ids in the reply.

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

The initiating  $eNB_1$  may include the *Neighbour Information* IE in the X2 SETUP REQUEST message. The candidate  $eNB_2$  may also include the *Neighbour Information* IE in the X2 SETUP RESPONSE message. The *Neighbour Information* IE shall only include E-UTRAN cells that are direct neighbours of cells in the reporting  $eNB_2$ . A direct neighbour of one cell of  $eNB_2$  may be any cell belonging to an eNB that is a neighbour of that  $eNB_2$  cell e.g. even if the cell has not been reported by a UE.

The initiating eNB<sub>1</sub> may include the *Number of Antenna Ports* IE in the X2 SETUP REQUEST message. The candidate eNB<sub>2</sub> 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 [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<sub>1</sub> may include the *MBSFN Subframe Info* IE in the X2 SETUP REQUEST message. The candidate eNB<sub>2</sub> may also include the *MBSFN Subframe Info* IE in the X2 SETUP RESPONSE message. The eNB receiving the IE may use it according to [9].

### 8.3.3.3 Unsuccessful Operation

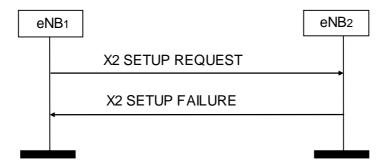


Figure 8.3.3.3-1: X2 Setup, unsuccessful operation

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

If the X2 SETUP FAILURE messages includes the *Time To Wait* IE the initiating eNB<sub>1</sub> shall wait at least for the indicated time before reinitiating the X2 Setup procedure towards the same eNB<sub>2</sub>.

#### 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<sub>1</sub> does not receive either X2 SETUP RESPONSE message or X2 SETUP FAILURE message, the eNB<sub>1</sub> 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<sub>1</sub> receives an X2 SETUP REQUEST message from the peer entity on the same X2 interface:

- In case the eNB<sub>1</sub> answers with an X2 SETUP RESPONSE message and receives a subsequent X2 SETUP FAILURE message, the eNB<sub>1</sub> 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<sub>1</sub> answers with an X2 SETUP FAILURE message and receives a subsequent X2 SETUP RESPONSE message, the eNB<sub>1</sub> 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 the X2 Setup procedure.

The procedure uses non UE-associated signalling.

### 8.3.4.2 Successful Operation

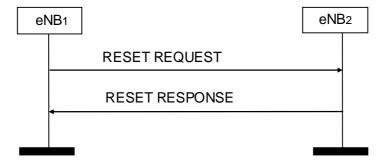


Figure 8.3.4.2-1: Reset, successful operation

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<sub>1</sub> 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

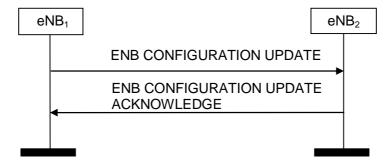


Figure 8.3.5.2-1: eNB Configuration Update, successful operation

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<sub>2</sub> 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<sub>2</sub> may use this information according to [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<sub>2</sub> 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<sub>2</sub> may use this information according to [9].

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<sub>2</sub> 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<sub>2</sub> shall delete information of cell indicated by Old ECGI IE.

#### **Update of GU Group ID List:**

- If GU Group Id To Add List IE is contained in the ENB CONFIGURATION UPDATE message, eNB<sub>2</sub> 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<sub>2</sub> 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  $enb_2$  may be any cell belonging to an  $enb_3$  that is a neighbour of that  $enb_3$  cell  $enb_3$  even if that cell has not been reported by a UE.

After successful update of requested information, eNB<sub>2</sub> shall reply with the ENB CONFIGURATION UPDATE ACKNOWLEDGE message to inform the initiating eNB<sub>1</sub> that the requested update of application data was performed

successfully. In case the peer eNB<sub>2</sub> 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<sub>1</sub> 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

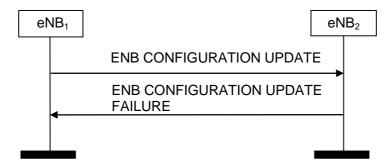


Figure 8.3.5.3-1: eNB Configuration Update, unsuccessful operation

If the eNB<sub>2</sub> 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<sub>1</sub> shall wait at least for the indicated time before reinitiating the eNB Configuration Update procedure towards the same eNB<sub>2</sub>. Both nodes shall continue to operate the X2 with their existing configuration data.

#### 8.3.5.4 Abnormal Conditions

If the eNB<sub>1</sub> after initiating eNB Configuration Update procedure receives neither ENB CONFIGURATION UPDATE ACKNOWLEDGE message nor ENB CONFIGURATION UPDATE FAILURE message, the eNB<sub>1</sub> may reinitiate the eNB Configuration Update procedure towards the same eNB<sub>2</sub>, 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

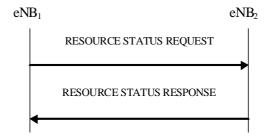


Figure 8.3.6.2-1: Resource Status Reporting Initiation, successful operation

The procedure is initiated with a RESOURCE STATUS REQUEST message sent from eNB<sub>1</sub> to eNB<sub>2</sub>. Upon receipt, eNB<sub>2</sub> shall initiate the requested measurement according to the parameters given in the request in case the *Registration Request* IE set to "start" and shall terminate the reporting in case the *Registration Request* IE 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 measurements eNB<sub>2</sub> shall perform.

For each request cell, the eNB2 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.

If the *Reporting Periodicity* IE is included in the RESOURCE STATUS REQUEST message, eNB<sub>2</sub> shall use its value as the time interval between two subsequent measurement reports.

If eNB<sub>2</sub> is capable to provide resource status information, it shall initiate the measurements as requested by eNB<sub>1</sub>, and respond with the RESOURCE STATUS RESPONSE message.

### 8.3.6.3 Unsuccessful Operation

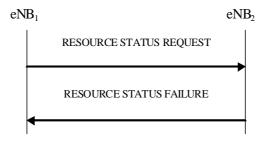


Figure 8.3.6.3-1: Resource Status Reporting Initiation, unsuccessful operation

If the requested measurement cannot 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".

#### 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  $eNB_1$  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 *Report Characteristics* IE bitmap is set to "0" (all bits are set to "0") in the RESOURCE STATUS REQUEST message then eNB<sub>2</sub> shall initiate a RESOURCE STATUS FAILURE message, the cause shall be set to appropriate value e.g. "ReportCharacteristicsEmpty".

If the *Reporting Periodicity* IE value is not specified when at least one of the bits of the *Report Characteristics* IE, for which semantics is specified, is set to 1 then eNB<sub>2</sub> shall initiate a RESOURCE STATUS FAILURE message, the cause shall be set to appropriate value e.g. "NoReportPeriodicity".

If the eNB<sub>2</sub> 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<sub>2</sub> 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<sub>2</sub> 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 requested by  $eNB_1$  using the Resource Status Reporting Initiation.

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<sub>2</sub> shall report the results of the measurements in RESOURCE STATUS UPDATE message for each requested cell.

# 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

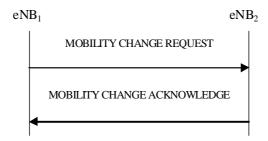


Figure 8.3.8.2-1: Mobility Settings Change, successful operation

The procedure is initiated with a MOBILITY CHANGE REQUEST message sent from eNB<sub>1</sub> to eNB<sub>2</sub>.

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

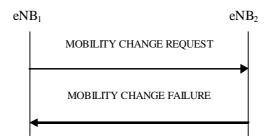


Figure 8.3.8.3-1: Mobility Settings Change, unsuccessful operation

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 between eNBs controlling neighbouring cells. The signalling takes place from the eNB at which a re-establishment attempt is made to an eNB to which the UE concerned may have previously been attached prior to radio link failure. This may aid the detection of handover failure cases [15].

The procedure uses non UE-associated signalling.

### 8.3.9.2 Successful Operation

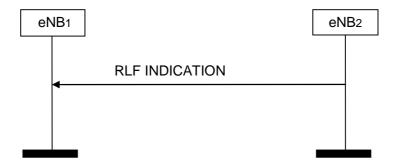


Figure 8.3.9.2-1: Radio Link Failure Indication, successful operation

eNB<sub>2</sub> initiates the procedure by sending the RLF INDICATION message to eNB<sub>1</sub> following a re-establishment attempt from a UE at eNB<sub>2</sub>, when eNB<sub>2</sub> considers that the UE may have previously been served by a cell controlled by eNB<sub>1</sub>.

 $eNB_2$  may include the ShortMAC-I IE in the RLF INDICATION message, which aids the  $eNB_1$  to resolve a potential PCI confusion situation.

eNB<sub>2</sub> may include the *UE RLF Report Container* IE in the RLF INDICATION message, which may be used by the eNB<sub>1</sub> to determine the nature of the failure.

#### 8.3.9.3 Unsuccessful Operation

Not applicable.

#### 8.3.9.4 Abnormal Conditions

Void.

# 8.3.10 Handover Report

#### 8.3.10.1 General

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

The procedure uses non UE-associated signalling.

#### 8.3.10.2 Successful Operation



Figure 8.3.10.2-1: Handover Report, successful operation

An eNB initiates the procedure by sending an HANDOVER REPORT message to another eNB controlling neighbouring cells. By sending the message eNB<sub>1</sub> indicates to eNB<sub>2</sub> that, following a successful handover from a cell of eNB<sub>2</sub> to a cell of eNB<sub>1</sub>, a radio link failure occurred and the UE attempted RRC Re-establishment either at the original

cell of eNB<sub>2</sub> (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 [15].

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.

#### 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

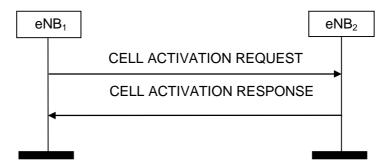


Figure 8.3.11.2-1: Cell Activation, successful operation

An eNB<sub>1</sub> initiates the procedure by sending a CELL ACTIVATION REQUEST message to a peer eNB<sub>2</sub>.

Upon receipt of this message, eNB<sub>2</sub> 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

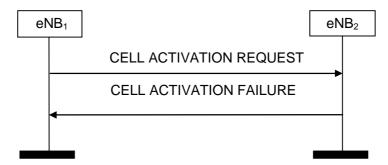


Figure 8.3.11.3-1: Cell Activation, unsuccessful operation

If the eNB<sub>2</sub> cannot activate any of the cells indicated in the CELL ACTIVATION REQUEST message, it shall respond with a CELL ACTIVATION FAILURE message with an appropriate cause value.

#### 8.3.11.4 Abnormal Conditions

Not applicable.

# 9 Elements for X2AP Communication

# 9.0 General

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

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

# 9.1 Message Functional Definition and Content

# 9.1.1 Messages for Basic Mobility Procedures

#### 9.1.1.1 HANDOVER REQUEST

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

Direction: source eNB  $\rightarrow$  target eNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13	•	YES	reject
Old eNB UE X2AP ID	М		eNB UE X2AP ID	Allocated at the source	YES	reject
Causa	N/		9.2.24	eNB	VEC	
Cause Target Cell ID	M		9.2.6 ECGI		YES YES	ignore
			9.2.14			reject
GUMMEI	М		9.2.16		YES	reject
UE Context Information		1	WITEOED		YES	reject
> MME UE S1AP ID	M		INTEGER (02 <sup>32</sup> -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	М		9.2.12		-	_
> Subscriber Profile ID for RAT/Frequency priority	0		9.2.25		-	_
>E-RABs To Be Setup List		1			_	_
>>E-RABs To Be Setup Item		1 to <maxnoof Bearers&gt;</maxnoof 			EACH	ignore
>>> E-RAB ID	М		9.2.23		_	_
>>> E-RAB Level QoS	M		9.2.9	Includes	_	_
Parameters				necessary QoS parameters		
>>> DL Forwarding	0		9.2.5		_	_
>>> UL GTP Tunnel Endpoint	М		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 [9].	-	_
>Handover Restriction List	0		9.2.3			_
>Location Reporting Information	0		9.2.21	Includes the necessary parameters for location reporting	-	-
UE History Information	М		9.2.38	Same definition as in [4].	YES	ignore
Trace Activation	0		9.2.2		YES	ignore
SRVCC Operation Possible	0		9.2.33		YES	ignore

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

### 9.1.1.2 HANDOVER REQUEST ACKNOWLEDGE

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

Direction: target eNB  $\rightarrow$  source eNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	М		9.2.13	•	YES	reject
Old eNB UE X2AP ID	М		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 to <maxnoof Bearers&gt;</maxnoof 			EACH	ignore
>> E-RAB ID	M		9.2.23		_	_
>> UL GTP Tunnel Endpoint	0		GTP Tunnel Endpoint 9.2.1	Identifies the X2 transport bearer used for forwarding of UL PDUs	-	_
>> DL GTP Tunnel Endpoint	0		GTP Tunnel Endpoint 9.2.1	Identifies the X2 transport bearer. used for forwarding of DL PDUs	-	-
E-RABs Not Admitted List	0		E-RAB List 9.2.28	a value for E-RAB ID shall only be present once in E-RABs Admitted List IE + in E- RABs Not Admitted List IE	YES	ignore
Target eNB To Source eNB Transparent Container	M		OCTET STRING	Includes the RRC E- UTRA Handover Command message as defined in subclause 10.2.2 in [9].	YES	ignore
Criticality Diagnostics	0		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  $\rightarrow$  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	0		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  $\rightarrow$  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	М		eNB UE X2AP ID 9.2.24	Allocated at the target eNB	YES	reject
E-RABs Subject To Status		1			YES	ignore
Transfer List						
>E-RABs Subject To Status Transfer Item		1 to <maxnoof Bearers&gt;</maxnoof 			EACH	ignore
>> E-RAB ID	M		9.2.23		_	_
>>Receive Status Of UL PDCP SDUs	0		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	М		COUNT Value 9.2.15	PDCP-SN and Hyper Frame Number of the first missing UL SDU	_	-
>> DL COUNT Value	M		COUNT Value 9.2.15	PDCP-SN and Hyper frame number that the target eNB should assign for the next DL SDU not having an SN yet	_	_

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

# 9.1.1.5 UE CONTEXT RELEASE

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

Direction: target eNB  $\rightarrow$  source eNB.

IE/Group Name	Presence	Range	IE type and	Semantics	Criticality	Assigned
			reference	description		Criticality
Message Type	M		9.2.13		YES	ignore
Old eNB UE X2AP ID	M		eNB UE	Allocated at	YES	reject
			X2AP ID	the source		
			9.2.24	eNB		
New eNB UE X2AP ID	M		eNB UE	Allocated at	YES	reject
			X2AP ID	the target		
			9.2.24	eNB		

# 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  $\rightarrow$  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	0		eNB UE X2AP ID 9.2.24	Allocated at the target eNB	YES	ignore
Cause	M		9.2.6		YES	ignore

# 9.1.2 Messages for global procedures

### 9.1.2.1 LOAD INFORMATION

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

Direction:  $eNB_1 \rightarrow eNB_2$ .

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

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	0		eNB UE X2AP ID 9.2.24	Allocated at the source eNB	YES	ignore
New eNB UE X2AP ID	0		eNB UE X2AP ID 9.2.24	Allocated at the target eNB	YES	ignore
Cause	0		9.2.6		YES	ignore
Criticality Diagnostics	0		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	Semantics	Criticality	Assigned
			reference	description		Criticality
Message Type	M		9.2.13		YES	reject
Global eNB ID	M		9.2.22		YES	reject
Served Cells		1 to		This IE shall	YES	reject
		maxCellineNB		contain the		
				complete list		
				of cells		
				served by		
				the eNB		
>Served Cell Information	M		9.2.8		-	_
>Neighbour Information		0 to			_	_
		maxnoofNeighbo				
		urs				
>>ECGI	M		ECGI	E-UTRAN	_	_
			9.2.14	Cell Global		
				Identifier of		
				the		
				neighbour		
>>PCI	M		INTEGER	cell		
>>PCI	IVI		(0503,)	Physical Cell Identifier of	_	_
			(0503,)	the		
				neighbour		
				cell		
>>EARFCN	М		9.2.26	DL EARFCN		
>>EARI ON	IVI		9.2.20	for FDD and	_	_
				EARFCN for		
				TDD		
GU Group Id List		0 to maxfPools		This is all	GLOBAL	reject
		13		the pools to	3-3	. 0,000
				which the		
				eNB belongs		
				to		
>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	М		9.2.13	decempne.	YES	reject
Global eNB ID	M		9.2.22		YES	reject
Served Cells		1 to maxCellineNB		This IE shall contain the complete list of cells served by the eNB	YES	reject
>Served Cell Information	M		9.2.8		_	-
>Neighbour Information		0 to maxnoofNeighbo urs			_	-
>>ECGI	М		ECGI 9.2.14	E-UTRAN Cell Global Identifier of the neighbour cell	-	-
>>PCI	М		INTEGER (0503,)	Physical Cell Identifier of the neighbour cell	-	ŀ
>>EARFCN	M		9.2.26	DL EARFCN for FDD and EARFCN for TDD	-	-
GU Group Id List		0 to maxPools		This is all the pools to which the eNB belongs to	GLOBAL	reject
>GU Group Id	М		9.2.20		-	-
Criticality Diagnostics	0		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	0		9.2.32		YES	ignore
Criticality Diagnostics	0		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	М		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	0		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	М		9.2.13	-	YES	reject
Served Cells To Add		0 to maxCellineNB		This IE shall contain the complete list of added cells served by the eNB	GLOBAL	reject
>Served Cell Information	M		9.2.8	•	_	_
>Neighbour Information		0 to maxnoofNeighbo urs			-	-
>>ECGI	M		ECGI 9.2.14	E-UTRAN Cell Global Identifier of the neighbour cell	-	-
>>PCI	М		INTEGER (0503,)	Physical Cell Identifier of the neighbour cell	-	-
>>EARFCN	М		9.2.26	DL EARFCN for FDD and EARFCN for TDD	-	1
Served Cells To Modify		0 to maxCellineNB		This IE shall contain the complete list of modified cells served by the eNB	GLOBAL	reject
>Old ECGI	М		ECGI 9.2.14	This is the old E- UTRAN Cell Global Identifier	-	-
>Served Cell Information	М		9.2.8		_	_
>Neighbour Information		0 to maxnoofNeighbo urs			-	-
>>ECGI	М		ECGI 9.2.14	E-UTRAN Cell Global Identifier of the neighbour cell	-	-
>>PCI	М		INTEGER (0503,)	Physical Cell Identifier of the neighbour cell	-	-
>>EARFCN	М		9.2.26	DL EARFCN for FDD and EARFCN for TDD	-	-
>Deactivation Indication	0		ENUMERAT ED(deactivat ed, )	Indicates the concerned cell is switched off for energy saving reasons	YES	ignore
Served Cells To Delete		0 to maxCellineNB		This IE shall contain the complete list	GLOBAL	reject

				of deleted cells served by the eNB		
>Old ECGI	M		ECGI 9.2.14	This is the old E- UTRAN Cell Global Identifier of the cell to be deleted	-	-
GU Group Id To Add List		0 to maxPools			GLOBAL	reject
>GU Group Id	М		9.2.20		-	-
GU Group Id To Delete List		0 to maxPools			GLOBAL	reject
>GU Group Id	М		9.2.20		-	-

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

### 9.1.2.9 ENB CONFIGURATION UPDATE ACKNOWLEDGE

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

Direction:  $eNB_2 \rightarrow eNB_1$ .

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
Criticality Diagnostics	0		9.2.7		YES	ignore

### 9.1.2.10 ENB CONFIGURATION UPDATE FAILURE

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

Direction:  $eNB_2 \rightarrow eNB_1$ .

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
Cause	M		9.2.6		YES	ignore
Time To Wait	0		9.2.32		YES	ignore
Criticality Diagnostics	0		9.2.7		YES	ignore

### 9.1.2.11 RESOURCE STATUS REQUEST

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

Direction:  $eNB_1 \rightarrow eNB_2$ .

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	М		9.2.13		YES	reject
eNB1 Measurement ID	М		INTEGER (14095,)	Allocated by eNB <sub>1</sub>	YES	reject
eNB2 Measurement ID	C- ifRegistrati onRequest Stop		INTEGER (14095,)	Allocated by eNB <sub>2</sub>	YES	ignore
Registration Request	M		ENUMERATE D(start, stop, )	In this Release, if the value is set to 'stop', the receiver shall stop all cells measurement.	YES	reject
Report Characteristics	0		BITSTRING (SIZE(32))	Each position in the bitmap indicates measurement object the eNB <sub>2</sub> 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. Bits 5 to 32 shall be ignored by the eNB <sub>2</sub>	YES	reject
Cell To Report		1		Cell ID list for which measurement is needed	YES	ignore
>Cell To Report Item		1 to maxCellineNB			EACH	ignore
>>Cell ID	М		ECGI 9.2.14			
Reporting Periodicity	0		ENUMERATE D(1000ms, 2000ms, 5000ms,10000 ms,)		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 measurements are successfully initiated. Direction: eNB $_2$   $\rightarrow$  eNB $_1$ .

IE/Group Name	Presence	Range	IE type and reference	Semantics	Criticality	Assigned
				description		Criticality
Message Type	M		9.2.13		YES	reject
eNB1 Measurement ID	M		INTEGER (14095,)		YES	reject
eNB2 Measurement ID	M		INTEGER (14095,)		YES	reject
Criticality Diagnostics	0		9.2.7		YES	ignore

### 9.1.2.13 RESOURCE STATUS FAILURE

This message is sent by the eNB<sub>2</sub> to indicate requested measurements cannot be initiated.

Direction:  $eNB_2 \rightarrow eNB_1$ .

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	М		9.2.13		YES	reject
eNB1 Measurement ID	М		INTEGER		YES	reject
			(14095,)			
eNB2 Measurement ID	M		INTEGER		YES	reject
			(14095,)			
Cause	М		9.2.6		YES	ignore
Criticality Diagnostics	0		9.2.7		YES	ignore

### 9.1.2.14 RESOURCE STATUS UPDATE

This message is sent by eNB<sub>2</sub> to neighbouring eNB<sub>1</sub> 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	М		INTEGER (14095,)		YES	reject
eNB2 Measurement ID	М		INTEGER (14095,)		YES	reject
Cell Measurement Result		1			YES	ignore
>Cell Measurement Result Item		1 to maxCellineNB			EACH	ignore
>>Cell ID	М		ECGI 9.2.14			
>>Hardware Load Indicator	0		9.2.34			
>>S1 TNL Load Indicator	0		9.2.35			
>>Radio Resource Status	0		9.2.37			
>>Composite Available Capacity Group	0		9.2.44		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<sub>1</sub> to neighbouring eNB<sub>2</sub> 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		YES	reject
			9.2.14			
eNB2 Cell ID	M		ECGI		YES	reject
			9.2.14			
eNB1 Mobility Parameters	0		Mobility	Configuration	YES	ignore
			Parameters	change in eNB₁		
			Information	cell.		
			9.2.48			
eNB2 Proposed Mobility	M		Mobility	Proposed	YES	reject
Parameters			Parameters	configuration		
			Information	change in eNB <sub>2</sub>		
			9.2.48	cell.		
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	М		ECGI 9.2.14		YES	reject
Criticality Diagnostics	0		9.2.7		YES	ignore

### 9.1.2.17 MOBILITY CHANGE FAILURE

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

Direction:  $eNB_2 \rightarrow eNB_1$ .

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
eNB1 Cell ID	M		ECGI		YES	ignore
			9.2.14			
eNB2 Cell ID	M		ECGI		YES	ignore
			9.2.14			
Cause	М		9.2.6		YES	ignore
eNB2 Mobility Parameters	0		9.2.49		YES	ignore
Modification Range						
Criticality Diagnostics	0		9.2.7		YES	ignore

#### 9.1.2.18 RLF INDICATION

This message is sent by the eNB<sub>2</sub> to indicate a RRC re-establishment attempt by a UE that was previously attached to eNB<sub>1</sub>.

Direction:  $eNB_2 \rightarrow eNB_1$ .

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13	-	YES	ignore
Failure cell PCI	М		INTEGER (0503,)	Physical Cell Identifier	YES	ignore
Re-establishment cell ECGI	M		ECGI 9.2.14		YES	ignore
C-RNTI	М		BIT STRING (SIZE (16))	C-RNTI contained in the RRC Re- establishment Request message [9]	YES	ignore
ShortMAC-I	0		BIT STRING (SIZE (16))	ShortMAC-I contained in the RRC Re- establishment Request message [9]	YES	ignore
UE RLF Report Container	0		OCTET STRING	rlfReport contained in the UEInformation Response message [9]	YES	ignore

### 9.1.2.19 HANDOVER REPORT

This message is sent by the eNB1 to report a handover failure event.

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,)		YES	ignore
Handover Cause	M		9.2.6	Indicates handover cause employed for handover from eNB <sub>2</sub> to eNB <sub>1</sub>	YES	ignore
Source cell ECGI	M		ECGI 9.2.14	ECGI of source cell for handover procedure (in eNB <sub>2</sub> )	YES	ignore
Failure cell ECGI	М		ECGI 9.2.14	ECGI of target (eventual failure) cell for handover procedure (in eNB <sub>1</sub> )	YES	ignore
Re-establishment cell ECGI	C- ifHandoverR eportType HoToWrong Cell		ECGI 9.2.14	ECGI of cell where UE attempted re- establishment	YES	ignore

Condition	Explanation
ifHandoverReportType HoToWrongCell	This IE shall be present if the Handover ReportType IE is set to the
	value "HO to wrong cell"

#### 9.1.2.20 CELL ACTIVATION REQUEST

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

Direction:  $eNB_1 \rightarrow eNB_2$ .

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Message Type	M		9.2.13		YES	reject
Served Cells To Activate		1 to			GLOBAL	reject
		maxCellineNB				-
>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
Massaga Typa	М		9.2.13	description	YES	
Message Type	IVI		9.2.13		TES	reject
Activated Cell List		1 to			GLOBAL	ignore
		maxCellineNB				
>ECGI	M		9.2.14		-	-
Criticality Diagnostics	0		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	Semantics	Criticality	Assigned
			reference	description		Criticality
Message Type	М		9.2.13		YES	reject
Cause	M		9.2.6		YES	ignore
Criticality Diagnostics	0		9.2.7		YES	ignore

## 9.2 Information Element definitions

### 9.2.0 General

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

- The first bit (leftmost bit) contains the most significant bit (MSB);
- The last bit (rightmost bit) contains the least significant bit (LSB);

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

## 9.2.1 GTP Tunnel Endpoint

The *GTP Tunnel Endpoint* IE identifies an X2 transport bearer or the S-GW endpoint of the S1 transport bearer associated to an E-RAB. It contains a Transport Layer Address and a GTP Tunnel Endpoint Identifier. The Transport Layer Address is an IP address to be used for the X2 user plane transport (see [8]) or for the S1 user plane transport (see [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 (1160,)	For details on the Transport Layer Address, see ref. [8], [19]	Т	-
GTP TEID	M		OCTET STRING (4)		-	_

### 9.2.2 Trace Activation

Defines parameters related to trace activation.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
E-UTRAN Trace ID	M		OCTET STRING (8)	The E- UTRAN Trace ID IE is composed of the following: Trace Reference defined in [6] (leftmost 6 octets, with PLMN information coded as in 9.2.4), and Trace Recording Session Reference defined in [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		ENUMERAT ED( minimum, medium, maximum, MinimumWit houtVendorS pecificExten sion, MediumWith outVendorSp ecificExtensi on, MaximumWit houtVendorS pecificExtensi on, maximumWit houtVendorS pecificExtensi on, maximumWit houtVendorS	Defined in [7]	_	_
Trace Collection Entity IP Address	М		BIT STRING (1160,)	For details on the Transport Layer Address, see	_	_

ref. [8], [19]

## 9.2.3 Handover Restriction List

This IE defines area roaming or access restrictions for handover and CSFB.

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 <maxnoofeplm Ns&gt;</maxnoofeplm 		Allowed PLMNs in addition to Serving PLMN. This list corresponds to the list of 'equivalent PLMNs list' as defined in [17].	-	-
>PLMN Identity	M		9.2.4		_	_
Forbidden TAs		0 <maxnoofeplm NsPlusOne&gt;</maxnoofeplm 		intra E- UTRAN roaming restrictions	-	_
>PLMN Identity	M		9.2.4	The PLMN of forbidden TACs	-	_
>Forbidden TACs		1 <maxnoofforbt ACs&gt;</maxnoofforbt 			1	_
>>TAC	М		OCTET STRING(2)	The forbidden TAC	-	_
Forbidden LAs		0 <maxnoofeplm NsPlusOne&gt;</maxnoofeplm 		inter-3GPP RAT roaming restrictions	I	-
>PLMN Identity	M		9.2.4		_	_
>Forbidden LACs		1 <maxnoofforbl ACs&gt;</maxnoofforbl 			1	_
>>LAC	М		OCTET STRING(2)		1	_
Forbidden inter RATs	0		ENUMERAT ED(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 lds. Value is 15.
maxnoofEPLMNsPlusOne	Maximum no. of equivalent PLMN lds 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 Selected PLMN identity consists of 3 digits from MCC followed by either -a filler digit plus 2 digits from MNC (in case of 2 digit MNC) or -3 digits from MNC (in case of a 3 digit MNC).

# 9.2.5 DL Forwarding

This element indicates that the E-RAB is proposed for forwarding of downlink packets.

IE/Group Name	Presence	Range	IE type and	Semantics description
			reference	
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		Reference	
>Radio Network Layer >>Racio 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 <sub>RELOCoverall</sub> Expiry, T <sub>RELOCprep</sub> 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, ReportCharacteri sticsEmpty, NoReportPeriodi city, ExistingMeasure mentID, Unknown eNB Measurement Temporarily not Available, Unspecified,, Load Balancing, Handover Optimisation, Value out of	
>Transport Layer			allowed range, Multiple E-RAB ID instances, Switch Off Ongoing, Not supported QCI value )	

>>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		eeeage/,/	
>>Miscellaneous Cause	M	ENUMERATED (Control Processing Overload, Hardware Failure, O&M Intervention, Not enough User Plane Processing Resources, Unspecified,)	

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

Radio Network Layer cause	Meaning
Cell not Available	The concerned cell is not available.
Handover Desirable for Radio Reasons	The reason for requesting handover is radio related.
Handover Target not Allowed	Handover to the indicated target cell is not allowed for the UE in question
Invalid MME Group ID	The target eNB doesn"t belong to the same pool area of the source eNB
·	i.e. S1 handovers should be attempted instead.
No Radio Resources Available in Target Cell	The target cell doesn"t have sufficient radio resources available.
Partial Handover	Provides a reason for the handover cancellation. The target eNB did not admit all E-RABs included in the HANDOVER REQUEST and the source eNB estimated service continuity for the UE would be better by not proceeding with handover towards this particular target eNB.
Reduce Load in Serving Cell	Load on serving cell needs to be reduced.
Resource Optimisation Handover	The reason for requesting handover is to improve the load distribution with the neighbour cells.
Time Critical Handover	handover is requested for time critical reason i.e. this cause value is reserved to represent all critical cases where the connection is likely to be dropped if handover is not performed.
TX2 <sub>RELOCoverall</sub> Expiry	The reason for the action is expiry of timer TX2 <sub>RELOCoverall</sub>
T <sub>RELOCprep</sub> Expiry	Handover Preparation procedure is cancelled when timer $T_{\text{RELOCprep}}$ 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	The target eNB is unable to support any of the encryption and/or integrity
Protection Algorithms Not	protection algorithms supported by the UE.
Supported	
ReportCharacteristicsEmpty	The action failed because there is no characteristic reported.
NoReportPeriodicity (ID)	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 eNB2 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

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

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

Miscellaneous cause	Meaning
Control Processing Overload	eNB control processing overload
Hardware Failure	eNB hardware failure
Not enough User Plane Processing	eNB has insufficient user plane processing resources available
Resources	
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	0		INTEGER (0255)	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	0		ENUMERAT ED(initiating message, successful outcome, unsuccessful outcome)	The Triggering Message is used only if the Criticality Diagnostics is part of Error Indication procedure.
Procedure Criticality	0		ENUMERAT ED(reject, ignore, notify)	This Procedure Criticality is used for reporting the Criticality of the Triggering message (Procedure).
Information Element Criticality Diagnostics		0 to <maxnroferrors></maxnroferrors>		
>IE Criticality	M		ENUMERAT ED(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	М		INTEGER (065535)	The IE ID of the not understood or missing IE
>Type Of Error	М		ENUMERAT ED(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	М		INTEGER (0503,)	Physical Cell ID	_	-
Cell ID	М		ECGI 9.2.14		_	_
TAC	М		OCTET STRING(2)	Tracking Area Code	_	_
Broadcast PLMNs		1 <maxnoofbpl MNs&gt;</maxnoofbpl 		Broadcast PLMNs	-	_
>PLMN Identity	М		9.2.4		_	_
CHOICE EUTRA-Mode- Info	M				_	_
>FDD						
>>FDD Info		1			_	_
>>>UL EARFCN	М		EARFCN 9.2.26	Corresponds to N <sub>UL</sub> in ref. [16]	-	_
>>>DL EARFCN	М		EARFCN 9.2.26	Corresponds to N <sub>DL</sub> in ref. [16]	_	_
>>>UL Transmission Bandwidth	М		Transmissio n Bandwidth 9.2 27		-	_
>>>DL Transmission Bandwidth	М		Transmissio n Bandwidth 9.2 27	Same as UL Transmissio n Bandwidth in this release.	-	_
>TDD					_	_
>>TDD Info		1			_	_
>>>EARFCN	М		9.2.26	Corresponds to N <sub>DL</sub> /N <sub>UL</sub> in ref. [16]	-	_
>>>Transmission Bandwidth	М		Transmissio n Bandwidth 9.2 27		-	_
>>>Subframe Assignment	M		ENUMERAT ED(sa0, sa1, sa2, sa3, sa4, sa5, sa6,)	Uplink- downlink subframe configuration information defined in ref. [10].	-	-
>>>Special Subframe Info		1		Special subframe configuration information defined in ref. [10].	-	-
>>>>Special Subframe Patterns	M		ENUMERAT ED(ssp0, ssp1, ssp2, ssp3, ssp4, ssp5, ssp6, ssp7, ssp8, )		-	_
>>>Cyclic Prefix DL	M		ENUMERAT ED(Normal, Extended,		_	_
>>>Cyclic Prefix UL	М		ENUMERAT ED(Normal, Extended,		-	_
Number of Antenna Ports	0		9.2.43		YES	ignore
PRACH Configuration	0		PRACH		YES	ignore

			Configuratio n 9.2.50			
MBSFN Subframe Info		0 to maxnoofMBSFN		MBSFN subframe configration information defined in ref. [9]	GLOBAL	ignore
>Radioframe Allocation Period	М		ENUMERAT ED(n1, n2, n4, n8, n16, n32,)		-	-
>Radioframe Allocation Offset	М		INTEGER (07,)		_	_
>Subframe Allocation	M		9.2.51		-	-

Range bound	Explanation
maxnoofBPLMNs	Maximum no. of Broadcast PLMN lds. Value is 6.
maxnoofMBSFN	Maximum no. of MBSFN frame allocation with different offset. Value is 8.

## 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 (0255)	QoS Class Identifier defined in [12]. Logical range and coding specified in [13].	-	-
Allocation and Retention Priority	M		9.2.31		1	_
GBR QoS Information	0		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	Semantics	Criticality	Assigned
			reference	description		Criticality
E-RAB Maximum Bit Rate	M		Bit Rate	Maximum Bit	_	_
Downlink			9.2.11	Rate in DL (i.e.		
				from EPC to E-		
				UTRAN) for		
				the bearer.		
				Details in [12].		
E-RAB Maximum Bit Rate	M		Bit Rate	Maximum Bit	_	_
Uplink			9.2.11	Rate in UL (i.e.		
				from E-UTRAN		
				to EPC) for the		
				bearer.		
				Details in [12].		
E-RAB Guaranteed Bit	M		Bit Rate	Guaranteed Bit	_	_
Rate Downlink			9.2.11	Rate (provided		
				that there is		
				data to deliver)		
				in DL (i.e. from		
				EPC to E-		
				UTRAN) for		
				the bearer.		
				Details in [12].		
E-RAB Guaranteed Bit	М		Bit Rate	Guaranteed Bit	_	_
Rate Uplink			9.2.11	Rate (provided		
rate spilling			0.2	that there is		
				data to deliver)		
				in UL (i.e. from		
				E-UTRAN to		
				EPC) for the		
				bearer.		
				Details in [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	Semantics description
			reference	
Bit Rate	M		INTEGER	The unit is: bit/s
			(010,000,0	
			00,000)	

## 9.2.12 UE Aggregate Maximum Bit Rate

On Handover Aggregate Maximum Bitrate is transferred to the target eNB. The UE Aggregate Maximum Bitrate is applicable for all Non-GBR bearers per UE which is defined for the Downlink and the Uplink direction and provided by the MME to the eNB.

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
UE Aggregate Maximum Bit	M		Bit Rate		_	-
Rate Downlink			9.2.11			
UE Aggregate Maximum Bit	M		Bit Rate		_	-
Rate Uplink			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	М		INTEGER (0255)	"0" = Handover Preparation "1" = Handover Cancel "2" = Load Indication "3" = Error Indication "4" = SN Status Transfer "5" = UE Context Release "6" = X2 Setup "7" = Reset "8" = eNB Configuration Update "9" = Resource Status Reporting Initiation "10" = Resource Status Reporting '11' = Private Message "12" = Mobility Settings Change '13' = Radio Link Failure Indication '14' = Handover Report '15' = Cell Activation
Type of Message	M		CHOICE (Initiating Message, Successful Outcome, Unsuccessful Outcome,)	

### 9.2.14 ECGI

The E-UTRAN Cell Global Identifier (ECGI) is used to globally identify a cell (see [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	М		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	М		INTEGER (04095)		_	_
HFN	М		INTEGER (01048575)		-	_

### 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 to <maxnoofprbs></maxnoofprbs>		
>UL Interference Overload Indication	М		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 (1110,)	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 (6110,)	Each position in the bitmap represents a n <sub>PRB</sub> value (i.e. first bit=PRB 0 and so on), for which the bit value represents <i>RNTP</i> (n <sub>PRB</sub> ), defined in [11].  Value 0 indicates "Tx not exceeding RNTP threshold".  Value 1 indicates "no promise on the Tx power is given"	-	_
RNTP Threshold	М		ENUMERATE D (-∞, -11, -10, -9, -8, -7, -6, - 5, -4, -3, -2, -1, 0, 1, 2, 3,)	RNTP <sub>threshold</sub> is defined in [11]	_	_
Number Of Cell-specific Antenna Ports	M		ENUMERATE D (1, 2, 4,)	P (number of antenna ports for cell-specific reference signals) defined in [10]	-	-
P_B	М		INTEGER (03,)	P <sub>B</sub> is defined in [11]	-	_
PDCCH Interference Impact	M		INTEGER (04,)	Measured by Predicted Number Of Occupied PDCCH OFDM Symbols (see [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	М		9.2.4		_	_
MME Group Id	М		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		ENUMERATE		_	_
			D (Change of			
			serving cell,			
			)			
Report Area	M		ENUMERATE		_	_
			D (ECGI,)			

#### 9.2.22 Global eNB ID

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

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
PLMN Identity	M		9.2.4		_	_
CHOICE eNB ID	M				_	_
>Macro eNB ID	М		BIT STRING (20)	Equal to the 20 leftmost bits of the value of the <i>E-UTRAN Cell Identifier</i> IE contained in the <i>ECGI</i> IE (see section 9.2.14) identifying each cell controlled by the eNB	-	_
>Home eNB ID	М		BIT STRING (28)	Equal to the value of the <i>E-UTRAN Cell Identifier</i> IE contained in the <i>ECGI</i> 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	М		INTEGER (015,)	

### 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 [2].

Presence	Range	IE type and reference	Semantics description
M		INTEGER	
_			reference

## 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 [15].

IE/Group Name	Presence	Range	IE type and reference	Semantics description
Subscriber Profile ID for	M		INTEGER	
RAT/Frequency Priority			(1256)	

### 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	М		INTEGER	The relation between
			(0maxEAR	EARFCN and carrier
			FCN)	frequency (in MHz) are
			·	defined in [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 " $N_{RB}$ " [16]. The values bw6, bw15, bw25, bw50, bw75, bw100 correspond to the number of resource blocks 'NRB' 6, 15, 25, 50, 75, 100.

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
Transmission Bandwidth	M		ENUMERAT ED (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 to < maxnoofBearers >			EACH	ignore
>E-RAB ID	M		9.2.23		-	_
>Cause	М		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, other bits reserved for future use. Value "1" indicates support and value '0' indicates no support of the algorithm.  Algorithms are defined in [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 ([18]) 'first bit' - 128-EIA1, 'second bit' - 128-EIA2, other bits reserved for future use. Value "1" indicates support and value '0' indicates no support of the algorithm. Algorithms are defined in [18].

## 9.2.30 AS Security Information

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

IE/Group Name	Presence	Range	IE Type and Reference	Semantics Description
Key eNodeB Star	M		BIT STRING (256)	The KeNB* as defined in [9]
Next Hop Chaining Count	M		INTEGER (07)	Next Hop Chaining Count (NCC) defined in [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 (015)	Desc.: This IE should be understood as 'priority of allocation and retention' (see [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		ENUMERAT ED(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		ENUMERAT ED(not pre- emptable, pre- emptable)	Desc.: This IE indicates the vulnerability of the E-RAB to preemption of other E-RABs. Usage: The E-RAB shall not be preempted by other E-RABs or the E-RAB may be preempted 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 [20].

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

### 9.2.34 Hardware Load Indicator

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

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

### 9.2.35 S1 TNL Load Indicator

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

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

### 9.2.36 Load Indicator

The Load Indicator IE indicates the status of Load.

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

#### 9.2.37 Radio Resource Status

The Radio Resource Status IE indicates the usage of the PRBs in Downlink and Uplink [22], [23].

IE/Group Name	Presence	Range	IE type and reference	Semantics description
DL GBR PRB usage	M		INTEGER (0100)	
UL GBR PRB usage	M		INTEGER (0100)	
DL non-GBR PRB usage	M		INTEGER (0100)	
UL non-GBR PRB usage	M		INTEGER (0100)	
DL Total PRB usage	M		INTEGER (0100)	
UL Total PRB usage	M		INTEGER (0100)	

## 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 [15].

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

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Last Visited Cell List		1 to maxnoofCells		Most recent information is added to the top of this list	-	-
>Last Visited Cell Information	М		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 Visted Cell Information	M				-	-
>E-UTRAN Cell					-	-
>>Last Visited E-UTRAN Cell Information	М		9.2.40		-	-
>UTRAN Cell					-	-
>>Last Visited UTRAN Cell Information	M		OCTET STRING	Defined in [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	М		INTEGER (04095)	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	-	-

### 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	М				-	-
>Undefined	М		NULL		-	-

## 9.2.42 Cell Type

The cell type provides the cell coverage area.

IE/Group Name	Presence	Range	IE type and	Semantics description	Criticality	Assigned
			reference			Criticality
Cell Size	М		ENUMERAT		-	-
			ED			
			(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			ENUMERAT	an1 = One antenna port
			ED (an1,	an2 = Two antenna ports
			an2, an4,)	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	Semantics description	Criticality	Assigned
			reference			Criticality
Cell Capacity Class Value	0		9.2.46		-	-
Capacity Value	M		9.2.47	"0" indicates no resource is available, Measured on a linear scale.	-	-

### 9.2.46 Cell Capacity Class Value

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

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Cell Capacity Class Value	М		INTEGER (1100,)	Value 1 shall indicate the minimum cell capacity, and 100 shall indicate the maximum cell capacity. There should be linear relation between cell capacity and Cell Capacity Class Value	-	-

## 9.2.47 Capacity Value

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

IE/Group Name	Presence	Range	IE type and reference	Semantics description	Criticality	Assigned Criticality
Capacity Value	М		INTEGER (0100)	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	М		INTEGER (- 2020)	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<sub>2</sub> 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 (- 2020)	The actual value is IE value * 0.5 dB.
Handover Trigger Change Upper Limit	M		INTEGER (- 2020)	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	М		INTEGER (0837)	See section 5.7.2. in [10]	_	_
ZeroCorrelationZoneConfigur ation	М		INTEGER (015)	See section 5.7.2. in [10]	_	-
HighSpeedFlag	M		BOOLEAN	TRUE corresponds to Restricted set and FALSE to Unrestricted set, see section 5.7.2 in [10]	-	-
PRACH-FrequencyOffset	М		INTEGER (094)	See section 5.7.1 of [10]	_	_
PRACH-ConfigurationIndex	0		INTEGER (063)	Mandatory for TDD, shall not be present for FDD. See section 5.7.1. in [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 [9].

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

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

### 9.3.1 General

Sub clause 9.3 presents the Abstract Syntax of the X2AP protocol with ASN.1. In case there is contradiction between the ASN.1 definition in this sub clause and the tabular format in sub clause 9.1 and 9.2, the ASN.1 shall take precedence, except for the definition of conditions for the presence of conditional elements, in which the tabular format shall take precedence.

The ASN.1 definition specifies the structure and content of X2AP messages. X2AP messages can contain any IEs specified in the object set definitions for that message without the order or number of occurrence being restricted by ASN.1. However, for this version of the standard, a sending entity shall construct a X2AP message according to the PDU definitions module and with the following additional rules (Note that in the following IE means an IE in the object set with an explicit id. If one IE needed to appear more than once in one object set, then the different occurrences have different IE ids):

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

If a X2AP message that is not constructed as defined above is received, this shall be considered as Abstract Syntax Error, and the message shall be handled as defined for Abstract Syntax Error in clause 10.

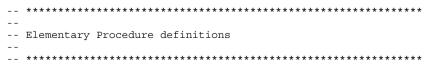
### 9.3.2 Usage of Private Message Mechanism for Non-standard Use

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



```
X2AP-PDU-Descriptions {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (21) modules (3) x2ap (2) version1 (1) x2ap-PDU-Descriptions (0) }
DEFINITIONS AUTOMATIC TAGS ::=
BEGIN
      *****************
-- IE parameter types from other modules.
__ ********************
IMPORTS
   Criticality,
   ProcedureCode
FROM X2AP-CommonDataTypes
   CellActivationRequest,
   CellActivationResponse,
   CellActivationFailure,
   ENBConfigurationUpdate,
   ENBConfigurationUpdateAcknowledge,
   ENBConfigurationUpdateFailure,
   ErrorIndication,
   HandoverCancel,
   HandoverReport,
   HandoverPreparationFailure,
   HandoverRequest,
   HandoverRequestAcknowledge,
   LoadInformation,
   PrivateMessage,
   ResetRequest,
   ResetResponse,
   ResourceStatusFailure,
   ResourceStatusRequest,
   ResourceStatusResponse,
   ResourceStatusUpdate,
   RLFIndication,
   SNStatusTransfer,
   UEContextRelease,
   X2SetupFailure, X2SetupRequest,
   X2SetupResponse,
   MobilityChangeRequest,
   MobilityChangeAcknowledge,
   MobilityChangeFailure
```

FROM X2AP-PDU-Contents

id-cellActivation,

```
id-eNBConfigurationUpdate,
   id-errorIndication,
   id-handoverCancel.
   id-handoverReport,
   id-handoverPreparation,
   id-loadIndication,
   id-privateMessage,
   id-reset,
   id-resourceStatusReporting,
   id-resourceStatusReportingInitiation,
   id-rLFIndication,
   id-snStatusTransfer,
   id-uEContextRelease,
   id-x2Setup,
   id-mobilitySettingsChange
FROM X2AP-Constants;
    ******************
-- Interface Elementary Procedure Class
        ***********
X2AP-ELEMENTARY-PROCEDURE ::= CLASS {
   &InitiatingMessage
   &SuccessfulOutcome
                               OPTIONAL,
   &UnsuccessfulOutcome
                                  OPTIONAL,
   &procedureCode
                       ProcedureCode UNIQUE,
   &criticality
                        Criticality
                                      DEFAULT ignore
WITH SYNTAX {
   INITIATING MESSAGE
                        &InitiatingMessage
                        &SuccessfulOutcome]
   [SUCCESSFUL OUTCOME
   [UNSUCCESSFUL OUTCOME
                           &UnsuccessfulOutcome]
                        &procedureCode
   PROCEDURE CODE
                        &criticality]
   [CRITICALITY
     *****************
  Interface PDU Definition
  ********************
X2AP-PDU ::= CHOICE {
   initiatingMessage
                    InitiatingMessage,
   successfulOutcome
                   SuccessfulOutcome,
   unsuccessfulOutcome UnsuccessfulOutcome,
```

```
InitiatingMessage ::= SEQUENCE
    procedureCode X2AP-ELEMENTARY-PROCEDURE.&procedureCode
                                                                    ({X2AP-ELEMENTARY-PROCEDURES}),
                                                                    ({X2AP-ELEMENTARY-PROCEDURES}{@procedureCode}),
    criticality
                   X2AP-ELEMENTARY-PROCEDURE.&criticality
    value
                                                                    ({X2AP-ELEMENTARY-PROCEDURES}{@procedureCode})
                   X2AP-ELEMENTARY-PROCEDURE.&InitiatingMessage
SuccessfulOutcome ::= SEQUENCE
    procedureCode X2AP-ELEMENTARY-PROCEDURE.&procedureCode
                                                                    ({X2AP-ELEMENTARY-PROCEDURES}),
    criticality X2AP-ELEMENTARY-PROCEDURE.&criticality
                                                                    ({X2AP-ELEMENTARY-PROCEDURES}{@procedureCode}),
                                                                    ({X2AP-ELEMENTARY-PROCEDURES}{@procedureCode})
    value
                   X2AP-ELEMENTARY-PROCEDURE.&SuccessfulOutcome
UnsuccessfulOutcome ::= SEQUENCE {
    procedureCode X2AP-ELEMENTARY-PROCEDURE.&procedureCode
                                                                    ({X2AP-ELEMENTARY-PROCEDURES}),
                                                                    ({X2AP-ELEMENTARY-PROCEDURES}{@procedureCode}),
    criticality
                   X2AP-ELEMENTARY-PROCEDURE.&criticality
                                                                    ({X2AP-ELEMENTARY-PROCEDURES} { @procedureCode})
    value
                   X2AP-ELEMENTARY-PROCEDURE.&UnsuccessfulOutcome
-- Interface Elementary Procedure List
X2AP-ELEMENTARY-PROCEDURES X2AP-ELEMENTARY-PROCEDURE ::= {
    X2AP-ELEMENTARY-PROCEDURES-CLASS-1
    X2AP-ELEMENTARY-PROCEDURES-CLASS-2
X2AP-ELEMENTARY-PROCEDURES-CLASS-1 X2AP-ELEMENTARY-PROCEDURE ::=
   handoverPreparation
    reset
    x2Setup
    resourceStatusReportingInitiation
    eNBConfigurationUpdate
    mobilitySettingsChange
    cellActivation
X2AP-ELEMENTARY-PROCEDURES-CLASS-2 X2AP-ELEMENTARY-PROCEDURE ::= {
    snStatusTransfer
    uEContextRelease
    handoverCancel
    errorIndication
    resourceStatusReporting
    loadIndication
    privateMessage
    rLFIndication
                                                handoverReport,
```

```
. . .
-- Interface Elementary Procedures
handoverPreparation X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE
                            HandoverRequest
    SUCCESSFUL OUTCOME
                            HandoverRequestAcknowledge
    UNSUCCESSFUL OUTCOME
                            HandoverPreparationFailure
    PROCEDURE CODE
                            id-handoverPreparation
                            reject
    CRITICALITY
snStatusTransfer X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE
                            SNStatusTransfer
    PROCEDURE CODE
                            id-snStatusTransfer
    CRITICALITY
                            ignore
uEContextRelease X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE
                            UEContextRelease
    PROCEDURE CODE
                            id-uEContextRelease
                            ignore
    CRITICALITY
handoverCancel X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE
                            HandoverCancel
                            id-handoverCancel
    PROCEDURE CODE
    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
                            X2SetupResponse
    SUCCESSFUL OUTCOME
                            X2SetupFailure
    UNSUCCESSFUL OUTCOME
    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
                            ENBConfigurationUpdateFailure
    UNSUCCESSFUL OUTCOME
    PROCEDURE CODE
                            id-eNBConfigurationUpdate
    CRITICALITY
                            reject
resourceStatusReportingInitiation
                                    X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE
                                    ResourceStatusRequest
                                    ResourceStatusResponse
    SUCCESSFUL OUTCOME
                                    ResourceStatusFailure
    UNSUCCESSFUL OUTCOME
                                    id-resourceStatusReportingInitiation
    PROCEDURE CODE
    CRITICALITY
                                    reject
resourceStatusReporting X2AP-ELEMENTARY-PROCEDURE ::= {
                            ResourceStatusUpdate
    INITIATING MESSAGE
                            id-resourceStatusReporting
    PROCEDURE CODE
    CRITICALITY
rLFIndication X2AP-ELEMENTARY-PROCEDURE ::= {
                            RLFIndication
    INITIATING MESSAGE
    PROCEDURE CODE
                            id-rLFIndication
    CRITICALITY
                            ignore
                        X2AP-ELEMENTARY-PROCEDURE ::=
privateMessage
    INITIATING MESSAGE
                            PrivateMessage
    PROCEDURE CODE
                            id-privateMessage
                            ignore
    CRITICALITY
mobilitySettingsChange X2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE
                            MobilityChangeRequest
```

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

END

## 9.3.4 PDU Definitions

```
*****************
-- PDU definitions for X2AP.
__ ********************
X2AP-PDU-Contents {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (21) modules (3) x2ap (2) version1 (1) x2ap-PDU-Contents (1)
DEFINITIONS AUTOMATIC TAGS ::=
BEGIN
    ****************
-- IE parameter types from other modules.
__ ********************
IMPORTS
   AS-SecurityInformation,
   Cause,
   CompositeAvailableCapacityGroup,
   COUNTvalue,
   CriticalityDiagnostics,
   CRNTI,
   DeactivationIndication,
   DL-Forwarding,
   ECGI,
   E-RAB-ID,
   E-RAB-Level-QoS-Parameters,
   E-RAB-List,
```

```
EUTRANTraceID,
    GlobalENB-ID,
    GTPtunnelEndpoint,
    GUGroupIDList,
    GUMMEI,
    HandoverReportType,
    HandoverRestrictionList,
    LocationReportingInformation,
    Neighbour-Information,
    PCI,
    PDCP-SN,
    PLMN-Identity,
    ReceiveStatusofULPDCPSDUs,
    Registration-Request,
    RelativeNarrowbandTxPower,
    RadioResourceStatus,
    UE-RLF-Report-Container,
    RRC-Context,
    ServedCell-Information,
    ServedCells,
    ShortMAC-I,
    SRVCCOperationPossible,
    SubscriberProfileIDforRFP,
    TargeteNBtoSource-eNBTransparentContainer,
    TimeToWait.
    TraceActivation,
    TraceDepth,
    TransportLayerAddress,
    UEAggregateMaximumBitRate,
    UE-HistoryInformation,
    UE-S1AP-ID,
    UESecurityCapabilities,
    UE-X2AP-ID,
    UL-HighInterferenceIndicationInfo,
    UL-InterferenceOverloadIndication,
    HWLoadIndicator,
    S1TNLLoadIndicator,
    Measurement-ID,
    ReportCharacteristics,
    MobilityParametersInformation,
    MobilityParametersModificationRange
FROM X2AP-IEs
    PrivateIE-Container{},
    ProtocolExtensionContainer{},
    ProtocolIE-Container{},
    ProtocolIE-ContainerList{},
    ProtocolIE-ContainerPair(),
    ProtocolIE-ContainerPairList{},
```

```
ProtocolIE-Single-Container{},
    X2AP-PRIVATE-IES,
    X2AP-PROTOCOL-EXTENSION.
    X2AP-PROTOCOL-IES,
    X2AP-PROTOCOL-IES-PAIR
FROM X2AP-Containers
    id-ActivatedCellList,
    id-Cause,
    id-CellInformation,
    id-CellInformation-Item,
    id-CellMeasurementResult.
    id-CellMeasurementResult-Item.
    id-CellToReport,
    id-CellToReport-Item,
    id-CompositeAvailableCapacityGroup,
    id-CriticalityDiagnostics,
    id-DeactivationIndication,
    id-E-RABs-Admitted-Item,
    id-E-RABs-Admitted-List,
    id-E-RABs-NotAdmitted-List,
    id-E-RABs-SubjectToStatusTransfer-List,
    id-E-RABs-SubjectToStatusTransfer-Item,
    id-E-RABs-ToBeSetup-Item,
    id-GlobalENB-ID,
    id-GUGroupIDList,
    id-GUGroupIDToAddList,
    id-GUGroupIDToDeleteList,
    id-GUMMEI-ID,
    id-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,
    maxCellineNB.
    maxnoofBearers.
    maxnoof PDCP-SN
FROM X2AP-Constants;
  *****************
-- HANDOVER REQUEST
HandoverRequest ::= SEQUENCE {
    protocolIEs
                                   ProtocolIE-Container
                                                              {{HandoverRequest-IEs}},
HandoverRequest-IEs X2AP-PROTOCOL-IES ::= {
     ID id-Old-eNB-UE-X2AP-ID
                                           CRITICALITY reject TYPE UE-X2AP-ID
                                                                                              PRESENCE mandatory
     ID id-Cause
                                           CRITICALITY ignore TYPE Cause
                                                                                              PRESENCE mandatory
     ID id-TargetCell-ID
                                           CRITICALITY reject TYPE ECGI
                                                                                              PRESENCE mandatory
     ID id-GUMMEI-ID
                                           CRITICALITY reject TYPE GUMMEI
                                                                                              PRESENCE mandatory
                                           CRITICALITY reject TYPE UE-ContextInformation
     ID id-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 },
UE-ContextInformation ::= SEQUENCE {
    mME-UE-S1AP-ID
                                       UE-S1AP-ID,
    uESecurityCapabilities
                                       UESecurityCapabilities,
    aS-SecuritvInformation
                                       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 ::= {
E-RABs-ToBeSetup-List ::= SEQUENCE (SIZE(1..maxnoofBearers)) OF ProtocolIE-Single-Container { {E-RABs-ToBeSetup-ItemIEs} }
E-RABs-ToBeSetup-ItemIEs
                       X2AP-PROTOCOL-IES ::= {
   TYPE E-RABs-ToBeSetup-Item PRESENCE mandatory },
   . . .
E-RABs-ToBeSetup-Item ::= SEQUENCE {
   e-RAB-ID
                           E-RAB-ID.
   e-RAB-Level-OoS-Parameters
                               E-RAB-Level-OoS-Parameters,
   dL-Forwarding
                               DL-Forwarding
                                                                                     OPTIONAL,
                               GTPtunnelEndpoint,
   uL-GTPtunnelEndpoint
   iE-Extensions
                               ProtocolExtensionContainer { {E-RABs-ToBeSetup-ItemExtIEs} } OPTIONAL,
E-RABs-ToBeSetup-ItemExtIEs X2AP-PROTOCOL-EXTENSION ::= {
   -- HANDOVER REQUEST ACKNOWLEDGE
__ ********************************
HandoverRequestAcknowledge ::= SEQUENCE {
   protocolIEs
                               ProtocolIE-Container
                                                       {{HandoverRequestAcknowledge-IEs}},
   . . .
HandoverRequestAcknowledge-IEs X2AP-PROTOCOL-IES ::= {
     ID id-Old-eNB-UE-X2AP-ID
                                                 CRITICALITY ignore TYPE UE-X2AP-ID
                                                                                                             PRESENCE mandatory
     ID id-New-eNB-UE-X2AP-ID
                                                 CRITICALITY ignore TYPE UE-X2AP-ID
                                                                                                             PRESENCE mandatory
     ID id-E-RABs-Admitted-List
                                                CRITICALITY ignore TYPE E-RABs-Admitted-List
                                                                                                             PRESENCE mandatory }
     ID id-E-RABs-NotAdmitted-List
                                                CRITICALITY ignore TYPE E-RAB-List
                                                                                                             PRESENCE optional }
     ID id-TargeteNBtoSource-eNBTransparentContainer CRITICALITY ignore TYPE TargeteNBtoSource-eNBTransparentContainer
                                                                                                             PRESENCE mandatory }
    ID id-CriticalityDiagnostics
                                                CRITICALITY ignore TYPE CriticalityDiagnostics
                                                                                                             PRESENCE optional }.
E-RABs-Admitted-List
                        ::= SEQUENCE (SIZE (1..maxnoofBearers)) OF ProtocolIE-Single-Container { {E-RABs-Admitted-ItemIEs} }
E-RABs-Admitted-ItemIEs X2AP-PROTOCOL-IES ::= {
```

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

```
__ *******************
-- SN Status Transfer
  *****************
SNStatusTransfer ::= SEQUENCE {
                                                           {{SNStatusTransfer-IEs}},
   protocolIEs
                                 ProtocolIE-Container
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,
                                 COUNTvalue,
   uL-COUNTvalue
   dL-COUNTvalue
                                 COUNTvalue,
                                        ProtocolExtensionContainer { {E-RABs-SubjectToStatusTransfer-ItemExtIEs} } OPTIONAL,
   iE-Extensions
   . . .
E-RABs-SubjectToStatusTransfer-ItemExtIEs X2AP-PROTOCOL-EXTENSION ::= {
-- UE Context Release
__ *******************************
UEContextRelease ::= SEQUENCE {
                                                           {{UEContextRelease-IEs}},
   protocolIEs
                                 ProtocolIE-Container
   . . .
```

```
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
                                                                           PRESENCE mandatory |
                                  CRITICALITY reject TYPE UE-X2AP-ID
     ID id-New-eNB-UE-X2AP-ID
                                  CRITICALITY ignore TYPE UE-X2AP-ID
                                                                           PRESENCE optional |
                                  CRITICALITY ignore TYPE Cause
   { ID id-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 {
                                                      {{ResetRequest-IEs}},
   protocolIEs
                              ProtocolIE-Container
```

```
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 REOUEST
X2SetupRequest ::= SEQUENCE {
                                                         {{X2SetupRequest-IEs}},
   protocolIEs
                                ProtocolIE-Container
   . . .
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 {
                                                         {{X2SetupResponse-IEs}},
   protocolIEs
                                ProtocolIE-Container
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
                                   CRITICALITY reject TYPE GUGroupIDList
    ID id-GUGroupIDList
                                                                             PRESENCE optional }
   { ID id-CriticalityDiagnostics
                                   CRITICALITY ignore TYPE CriticalityDiagnostics
                                                                             PRESENCE optional },
  *******************
-- X2 SETUP FAILURE
  ******************
X2SetupFailure ::= SEQUENCE {
                                                   {{X2SetupFailure-IEs}},
   protocolIEs
                             ProtocolIE-Container
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
                                                                              PRESENCE optional },
                                                TYPE CriticalityDiagnostics
__ **********************
-- LOAD INFORMATION
  **********************
LoadInformation ::= SEQUENCE {
   protocolIEs
                                                   {{LoadInformation-IEs}},
                             ProtocolIE-Container
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 ::= {
   CellInformation-Item ::= SEQUENCE {
   cell-ID
                             ECGI,
```

```
UL-InterferenceOverloadIndication
   ul-InterferenceOverloadIndication
                                                                                                  OPTIONAL,
   ul-HighInterferenceIndicationInfo
                                        UL-HighInterferenceIndicationInfo
                                                                                                  OPTIONAL,
   relativeNarrowbandTxPower
                                        RelativeNarrowbandTxPower
                                                                                                  OPTIONAL.
   iE-Extensions
                                        ProtocolExtensionContainer { {CellInformation-Item-ExtIEs} }
                                                                                                  OPTIONAL,
CellInformation-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
  ********************
-- ENB CONFIGURATION UPDATE
           **************
ENBConfigurationUpdate ::= SEQUENCE
                                                          {{ENBConfigurationUpdate-IEs}},
   protocolIEs
                                 ProtocolIE-Container
ENBConfigurationUpdate-IEs X2AP-PROTOCOL-IES ::= {
     ID id-ServedCellsToAdd
                                 CRITICALITY reject TYPE ServedCells
                                                                                PRESENCE optional }
     ID id-ServedCellsToModify
                                                                                PRESENCE optional }
                                CRITICALITY reject TYPE ServedCellsToModify
     ID id-ServedCellsToDelete
                                 CRITICALITY reject TYPE Old-ECGIs
                                                                                PRESENCE optional }
     ID id-GUGroupIDToAddList
                                                                                PRESENCE optional}
                                 CRITICALITY reject TYPE GUGroupIDList
    ID id-GUGroupIDToDeleteList CRITICALITY reject TYPE GUGroupIDList
                                                                                PRESENCE optional },
ServedCellsToModify::= SEQUENCE (SIZE (1..maxCellineNB)) OF ServedCellsToModify-Item
ServedCellsToModify-Item::= SEQUENCE {
   old-ecgi
                                 ECGI.
                                 ServedCell-Information,
   servedCellInfo
   neighbour-Info
                                Neighbour-Information
                                                              OPTIONAL,
                                 ProtocolExtensionContainer { { ServedCellsToModify-Item-ExtIEs} } OPTIONAL,
   iE-Extensions
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 {
                                                      {{ENBConfigurationUpdateFailure-IEs}},
   protocolIEs
                              ProtocolIE-Container
   . . .
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 {
                               ProtocolIE-Container
                                                      {{ResourceStatusRequest-IEs}},
   protocolIEs
   . . .
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-Reguest
                              CRITICALITY reject TYPE Registration-Request
                                                                               PRESENCE mandatory }
     PRESENCE optional }
     ID id-CellToReport
                              CRITICALITY ignore TYPE CellToReport-List
                                                                               PRESENCE mandatory}
    ID id-ReportingPeriodicity
                              CRITICALITY ignore TYPE ReportingPeriodicity
                                                                               PRESENCE optional } ,
```

```
::= SEQUENCE (SIZE (1..maxCellineNB)) OF ProtocolIE-Single-Container { {CellToReport-ItemIEs} }
CellToReport-List
CellToReport-ItemIEs X2AP-PROTOCOL-IES ::= {
   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,
__ *********************
-- Resource Status Response
__ **********************
ResourceStatusResponse ::= SEQUENCE
   protocolIEs
                                                    {{ResourceStatusResponse-IEs}},
                             ProtocolIE-Container
   . . .
ResourceStatusResponse-IEs X2AP-PROTOCOL-IES ::= {
    ID id-ENB1-Measurement-ID
                                                                           PRESENCE mandatory
                             CRITICALITY reject TYPE Measurement-ID
    ID id-ENB2-Measurement-ID
                             CRITICALITY reject TYPE Measurement-ID
                                                                           PRESENCE mandatory}
    ID id-CriticalityDiagnostics CRITICALITY ignore TYPE CriticalityDiagnostics
                                                                           PRESENCE optional },
    *****************
-- Resource Status Failure
__ ********************
ResourceStatusFailure ::= SEQUENCE {
   protocolIEs
                             ProtocolIE-Container
                                                    {{ResourceStatusFailure-IEs}},
   . . .
```

```
ResourceStatusFailure-IEs X2AP-PROTOCOL-IES ::= {
    ID id-ENB1-Measurement-ID CRITICALITY reject TYPE Measurement-ID
                                                                         PRESENCE mandatory
    PRESENCE mandatory }
    ID id-Cause CRITICALITY ignore TYPE Cause
                                                                         PRESENCE mandatory
   { ID id-CriticalityDiagnostics CRITICALITY ignore TYPE CriticalityDiagnostics
                                                                         PRESENCE optional },
   ************
-- Resource Status Update
     ***************
ResourceStatusUpdate ::= SEQUENCE {
                                                  {{ResourceStatusUpdate-IEs}},
   protocolIEs
                             ProtocolIE-Container
ResourceStatusUpdate-IEs X2AP-PROTOCOL-IES ::= {
    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 ::= {
   PRESENCE mandatory
CellMeasurementResult-Item ::= SEQUENCE {
   hWOverLoadIndicator
                            HWLoadIndicator
                                                                                    OPTIONAL,
   s1TNLOverLoadIndicator
                            S1TNLLoadIndicator
                                                                                    OPTIONAL,
   radioResourceStatus
                            RadioResourceStatus
                                                                                    OPTIONAL,
                            ProtocolExtensionContainer { {CellMeasurementResult-Item-ExtIEs} }
   iE-Extensions
                                                                                    OPTIONAL,
CellMeasurementResult-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
{ ID id-CompositeAvailableCapacityGroup CRITICALITY ignore EXTENSION CompositeAvailableCapacityGroup
                                                                                          PRESENCE optional
-- PRIVATE MESSAGE
```

PRESENCE

PRESENCE

PRESENCE

PRESENCE optional

PRESENCE mandatory

```
__ *******************
PrivateMessage ::= SEOUENCE {
   privateIEs
            PrivateIE-Container {{PrivateMessage-IEs}},
   . . .
PrivateMessage-IEs X2AP-PRIVATE-IES ::= {
  *****************
-- MOBILITY CHANGE REQUEST
    ******************
MobilityChangeRequest ::= SEQUENCE {
               ProtocolIE-Container {{MobilityChangeRequest-IEs}},
   protocolIEs
MobilityChangeRequest-IEs X2AP-PROTOCOL-IES ::= {
   { ID id-ENB1-Cell-ID
                                    CRITICALITY reject TYPE ECGI
mandatory }|
   { ID id-ENB2-Cell-ID
                                    CRITICALITY reject TYPE ECGI
mandatory }|
    ID id-ENB1-Mobility-Parameters
                                    CRITICALITY ignore TYPE MobilityParametersInformation
    ID id-Cause
                                    CRITICALITY reject TYPE Cause
mandatory },
-- MOBILITY CHANGE ACKNOWLEDGE
__ ********************
MobilityChangeAcknowledge ::= SEQUENCE {
                                               {{MobilityChangeAcknowledge-IEs}},
   protocolIEs
                           ProtocolIE-Container
   . . .
MobilityChangeAcknowledge-IEs X2AP-PROTOCOL-IES ::= {
   PRESENCE mandatory
    ID id-ENB2-Cell-ID
                                                                     PRESENCE mandatory }
                         CRITICALITY reject TYPE ECGI
   { 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
                                                         {{RLFIndication-IEs}},
                                ProtocolIE-Container
   . . .
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 },
-- Cell Activation Request
__ ********************
CellActivationRequest ::= SEQUENCE {
```

```
ProtocolIE-Container
                                                        {{CellActivationRequest-IEs}},
   protocolIEs
CellActivationRequest-IEs X2AP-PROTOCOL-IES ::= {
   { ID id-ServedCellsToActivate CRITICALITY reject TYPE ServedCellsToActivate
                                                                               PRESENCE mandatory },
ServedCellsToActivate::= SEOUENCE (SIZE (1..maxCellineNB)) OF ServedCellsToActivate-Item
ServedCellsToActivate-Item::= SEQUENCE {
   ecai
   iE-Extensions
                                ProtocolExtensionContainer { { ServedCellsToActivate-Item-ExtIEs} } OPTIONAL,
ServedCellsToActivate-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    -- Cell Activation Response
  *****************
CellActivationResponse ::= SEQUENCE {
                                                        {{CellActivationResponse-IEs}},
   protocolIEs
                                ProtocolIE-Container
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 {
   ecqi
                                    ECGI,
   iE-Extensions
                                   ProtocolExtensionContainer { { ActivatedCellList-Item-ExtIEs} } OPTIONAL,
ActivatedCellList-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::=
___********************
-- CELL ACTIVATION FAILURE
```

## 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,
    maxnoofBearers,
    maxCellineNB,
    maxEARFCN,
    maxInterfaces,
    maxnoofBPLMNs,
    maxnoofCells,
    maxnoofEPLMNs,
    maxnoofEPLMNsPlusOne,
    maxnoofForbLACs,
    maxnoofForbTACs,
    maxnoofNeighbours,
    maxnoofPRBs,
    maxNrOfErrors,
    maxPools,
```

```
maxnoofMBSFN
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
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 ::= {
-- B
BitRate ::= INTEGER (0..1000000000)
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,
                        CauseMisc,
    misc
CauseMisc ::= ENUMERATED {
    control-processing-overload,
    hardware-failure,
    om-intervention,
    not-enough-user-plane-processing-resources,
    unspecified,
CauseProtocol ::= ENUMERATED {
    transfer-syntax-error,
    abstract-syntax-error-reject,
    abstract-syntax-error-ignore-and-notify,
    message-not-compatible-with-receiver-state,
    semantic-error,
    unspecified,
    abstract-syntax-error-falsely-constructed-message,
CauseRadioNetwork ::= ENUMERATED {
    handover-desirable-for-radio-reasons.
    time-critical-handover,
    resource-optimisation-handover,
    reduce-load-in-serving-cell,
    partial-handover,
    unknown-new-eNB-UE-X2AP-ID,
    unknown-old-eNB-UE-X2AP-ID,
    unknown-pair-of-UE-X2AP-ID,
    ho-target-not-allowed,
    tx2relocoverall-expiry,
    trelocprep-expiry,
    cell-not-available,
    no-radio-resources-available-in-target-cell,
    invalid-MME-GroupID,
    unknown-MME-Code,
    encryption-and-or-integrity-protection-algorithms-not-supported,
    reportCharacteristicsEmpty,
    noReportPeriodicity,
    existingMeasurementID,
    unknown-eNB-Measurement-ID,
    measurement-temporarily-not-available,
    unspecified,
```

```
load-balancing,
    handover-optimisation,
    value-out-of-allowed-range,
    multiple-E-RAB-ID-instances,
    switch-off-ongoing,
    not-supported-QCI-value
CauseTransport ::= ENUMERATED {
    transport-resource-unavailable,
    unspecified,
    . . .
Cell-Size ::= ENUMERATED {verysmall, small, medium, large, ... }
CellType ::= SEQUENCE {
    cell-Size
                                     Cell-Size,
    iE-Extensions
                                    ProtocolExtensionContainer { { CellType-ExtIEs}}
                                                                                          OPTIONAL,
    . . .
CellType-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
CompositeAvailableCapacityGroup ::= SEQUENCE {
    dL-CompositeAvailableCapacity
                                                     CompositeAvailableCapacity,
    uL-CompositeAvailableCapacity
                                                     CompositeAvailableCapacity,
    iE-Extensions
                                                     ProtocolExtensionContainer { { CompositeAvailableCapacityGroup-ExtIEs} } OPTIONAL,
    . . .
CompositeAvailableCapacityGroup-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
CompositeAvailableCapacity ::= SEQUENCE {
    cellCapacityClassValue
                                                     CellCapacityClassValue
                                                                                          OPTIONAL,
    capacityValue
                                                     CapacityValue,
    iE-Extensions
                                                     ProtocolExtensionContainer { { CompositeAvailableCapacity-ExtIEs} } OPTIONAL,
CompositeAvailableCapacity-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
COUNTvalue ::= SEQUENCE {
    pDCP-SN
                            PDCP-SN,
```

```
hFN
    iE-Extensions
                            ProtocolExtensionContainer { { COUNTvalue-ExtIEs} } OPTIONAL,
COUNTvalue-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
CriticalityDiagnostics ::= SEQUENCE {
    procedureCode
                                    ProcedureCode
                                                                                                           OPTIONAL,
    triggeringMessage
                                    TriggeringMessage
                                                                                                           OPTIONAL,
    procedureCriticality
                                    Criticality
                                                                                                           OPTIONAL,
                                    CriticalityDiagnostics-IE-List
    iEsCriticalityDiagnostics
                                                                                                           OPTIONAL,
    iE-Extensions
                                    ProtocolExtensionContainer { {CriticalityDiagnostics-ExtIEs} }
                                                                                                           OPTIONAL,
    . . .
CriticalityDiagnostics-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
CriticalityDiagnostics-IE-List ::= SEQUENCE (SIZE (1..maxNrOfErrors)) OF
    SEQUENCE {
        iECriticality
                                Criticality,
                                ProtocolIE-ID,
        iE-ID
        typeOfError
                                TypeOfError,
                                ProtocolExtensionContainer { {CriticalityDiagnostics-IE-List-ExtIEs} } OPTIONAL,
       iE-Extensions
CriticalityDiagnostics-IE-List-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
CRNTI ::= BIT STRING (SIZE (16))
CyclicPrefixDL ::= ENUMERATED {
    normal,
    extended,
    . . .
CyclicPrefixUL ::= ENUMERATED {
    normal,
    extended,
    . . .
-- D
```

```
DeactivationIndication::= ENUMERATED {
    deactivated.
    . . .
DL-Forwarding ::= ENUMERATED {
    dL-forwardingProposed,
    . . .
-- E
EARFCN ::= INTEGER (0..maxEARFCN)
FDD-Info ::= SEQUENCE {
    uL-EARFCN
                                     EARFCN,
    dL-EARFCN
                                     EARFCN,
    uL-Transmission-Bandwidth
                                     Transmission-Bandwidth,
    dL-Transmission-Bandwidth
                                     Transmission-Bandwidth,
                                 ProtocolExtensionContainer { {FDD-Info-ExtIEs} } OPTIONAL,
    iE-Extensions
    . . .
FDD-Info-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
TDD-Info ::= SEQUENCE {
    eARFCN
                                     EARFCN,
                                     Transmission-Bandwidth,
    transmission-Bandwidth
    subframeAssignment
                                     SubframeAssignment,
    specialSubframe-Info
                                         SpecialSubframe-Info,
    iE-Extensions
                                 ProtocolExtensionContainer { {TDD-Info-ExtIEs} } OPTIONAL,
TDD-Info-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
EUTRA-Mode-Info ::= CHOICE {
    fDD
            FDD-Info,
    t.DD
            TDD-Info,
    . . .
ECGI ::= SEQUENCE {
    pLMN-Identity
                                 PLMN-Identity,
    eUTRANcellIdentifier
                                 EUTRANCellIdentifier,
                                 ProtocolExtensionContainer { {ECGI-ExtIEs} } OPTIONAL,
    iE-Extensions
    . . .
ECGI-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
    . . .
```

```
ENB-ID ::= CHOICE {
   macro-eNB-ID BIT STRING (SIZE (20)),
   home-eNB-ID BIT STRING (SIZE (28)),
EncryptionAlgorithms ::= BIT STRING (SIZE (16, ...))
EPLMNs ::= SEQUENCE (SIZE(1..maxnoofEPLMNs)) OF PLMN-Identity
E-RAB-ID ::= INTEGER (0..15, ...)
E-RAB-Level-Oos-Parameters ::= SEQUENCE {
                                  OCI,
   allocationAndRetentionPriority AllocationAndRetentionPriority,
   qbr0osInformation
                                  GBR-OosInformation
                                                                                                     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 ::= {
   PRESENCE mandatory },
                                             TYPE E-RAB-Item
   . . .
E-RAB-Item ::= SEQUENCE {
   e-RAB-ID
                          E-RAB-ID,
   cause
                              ProtocolExtensionContainer { {E-RAB-Item-ExtIEs} } OPTIONAL,
   iE-Extensions
E-RAB-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
EUTRANCellIdentifier ::= BIT STRING (SIZE (28))
EUTRANTraceID
                ::= OCTET STRING (SIZE (8))
EventType ::= ENUMERATED{
   change-of-serving-cell,
   . . .
```

```
-- F
ForbiddenInterRATs ::= ENUMERATED {
    all,
   geran,
    utran,
    cdma2000,
    geranandutran,
    cdma2000andutran
ForbiddenTAs ::= SEQUENCE (SIZE(1.. maxnoofEPLMNsPlusOne)) OF ForbiddenTAs-Item
ForbiddenTAs-Item ::= SEQUENCE {
    pLMN-Identity
                       PLMN-Identity,
    forbiddenTACs
                        ForbiddenTACs,
                        ProtocolExtensionContainer { {ForbiddenTAs-Item-ExtIEs} } OPTIONAL,
    iE-Extensions
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,
                       ProtocolExtensionContainer { {ForbiddenLAs-Item-ExtIEs} } OPTIONAL,
   iE-Extensions
ForbiddenLAs-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
ForbiddenLACs ::= SEQUENCE (SIZE(1..maxnoofForbLACs)) OF LAC
Fourframes ::= BIT STRING (SIZE (24))
-- 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,
    qTP-TEID
                                   GTP-TEI,
                                   ProtocolExtensionContainer { GTPtunnelEndpoint-ExtIEs} } OPTIONAL,
    iE-Extensions
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 {
    qU-Group-ID
                   GU-Group-ID,
    mME-Code
                       MME-Code,
                                   ProtocolExtensionContainer { {GUMMEI-ExtIEs} } OPTIONAL,
    iE-Extensions
    . . .
```

3GPP TS 36.423 version 9.4.0 Release 9

```
GUMMEI-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
-- H
HandoverReportType ::= ENUMERATED {
    hoTooEarly,
   hoToWrongCell,
    . . .
HandoverRestrictionList ::= SEQUENCE {
    servingPLMN
                                PLMN-Identity,
    equivalentPLMNs
                                EPLMNs
                                                                                                   OPTIONAL,
    forbiddenTAs
                                ForbiddenTAs
                                                                                                   OPTIONAL,
    forbiddenLAs
                                ForbiddenLAs
                                                                                                   OPTIONAL,
    forbiddenInterRATs
                                ForbiddenInterRATs
                                                                                                   OPTIONAL,
    iE-Extensions
                                ProtocolExtensionContainer { {HandoverRestrictionList-ExtIEs} } OPTIONAL,
HandoverRestrictionList-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
HFN ::= INTEGER (0..1048575)
HWLoadIndicator ::= SEQUENCE {
    dLHWLoadIndicator
                                LoadIndicator,
    uLHWLoadIndicator
                                LoadIndicator,
    iE-Extensions
                                ProtocolExtensionContainer { { HWLoadIndicator-ExtIEs} } OPTIONAL,
    . . .
HWLoadIndicator-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
-- I
IntegrityProtectionAlgorithms ::= BIT STRING (SIZE (16, ...))
InterfacesToTrace ::= BIT STRING (SIZE (8))
-- J
-- K
Key-eNodeB-Star ::= BIT STRING (SIZE(256))
-- L
```

103

```
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 ::= {
LastVisitedUTRANCellInformation ::= OCTET STRING
LastVisitedGERANCellInformation ::= CHOICE {
    undefined
                                    NULL,
    . . .
LoadIndicator ::= ENUMERATED {
   lowLoad,
    mediumLoad,
    highLoad,
    overLoad,
LocationReportingInformation ::= SEQUENCE {
    eventType
                    EventType,
    reportArea
                    ReportArea,
    iE-Extensions
                       ProtocolExtensionContainer { {LocationReportingInformation-ExtIEs} } OPTIONAL,
LocationReportingInformation-ExtIES X2AP-PROTOCOL-EXTENSION ::={
-- M
```

```
MME-Group-ID
                ::= OCTET STRING (SIZE (2))
MME-Code
                ::= OCTET STRING (SIZE (1))
Measurement-ID ::= INTEGER (1..4095, ...)
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 ::= {
MobilityParametersModificationRange ::= SEQUENCE {
    handoverTriggerChangeLowerLimit
                                        INTEGER (-20..20),
    handoverTriggerChangeUpperLimit
                                        INTEGER (-20..20),
MobilityParametersInformation ::= SEQUENCE {
    handoverTriggerChange
                                    INTEGER (-20..20),
-- N
Neighbour-Information ::= SEQUENCE (SIZE (0..maxnoofNeighbours)) OF SEQUENCE {
                                ECGI.
    pCI
                            PCI,
    eARFCN
                                EARFCN,
                         ProtocolExtensionContainer { {Neighbour-Information-ExtIEs} } OPTIONAL,
    iE-Extensions
Neighbour-Information-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
NextHopChainingCount ::= INTEGER (0..7)
Number-of-Antennaports ::= ENUMERATED {
        an1,
        an2,
        an4,
```

```
-- O
Oneframe ::= BIT STRING (SIZE (6))
-- P
PDCP-SN ::= INTEGER (0..4095)
PCI ::= INTEGER (0..503, ...)
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
                          ::= INTEGER { spare (0), highest (1), lowest (14), no-priority (15) } (0..15)
PriorityLevel
-- 0
QCI ::= INTEGER (0..255)
-- R
ReceiveStatusofULPDCPSDUs ::= BIT STRING (SIZE(4096))
Registration-Request
                      ::= ENUMERATED {
    start,
    stop,
    . . .
```

```
RelativeNarrowbandTxPower ::= SEQUENCE {
    rNTP-PerPRB
                                         BIT STRING (SIZE(6..110, ...)),
    rNTP-Threshold
                                         RNTP-Threshold,
    numberOfCellSpecificAntennaPorts
                                         ENUMERATED {one, two, four, ...},
                                         INTEGER (0..3,...),
    pDCCH-InterferenceImpact
                                         INTEGER (0..4,...),
    iE-Extensions
                                         ProtocolExtensionContainer { { RelativeNarrowbandTxPower-ExtIEs} } OPTIONAL,
RelativeNarrowbandTxPower-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
ReportArea ::= ENUMERATED{
    ecgi,
    . . .
ReportCharacteristics ::= BIT STRING (SIZE (32))
RNTP-Threshold ::= ENUMERATED {
    minusInfinity,
    minusEleven,
    minusTen,
    minusNine,
    minusEight,
    minusSeven,
    minusSix,
    minusFive,
    minusFour,
    minusThree,
    minusTwo,
    minusOne,
    zero,
    one,
    two,
    three,
RRC-Context ::= OCTET STRING
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,
```

107

```
ProtocolExtensionContainer { {RadioResourceStatus-ExtIEs} } OPTIONAL,
    iE-Extensions
RadioResourceStatus-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
DL-GBR-PRB-usage::= INTEGER (0..100)
UL-GBR-PRB-usage::= INTEGER (0..100)
DL-non-GBR-PRB-usage::= INTEGER (0..100)
UL-non-GBR-PRB-usage::= INTEGER (0..100)
DL-Total-PRB-usage::= INTEGER (0..100)
UL-Total-PRB-usage::= INTEGER (0..100)
RadioframeAllocationPeriod ::= ENUMERATED{
    n1,
    n2,
    n4,
    n8,
    n16,
    n32,
RadioframeAllocationOffset ::= INTEGER (0..7, ...)
-- S
S1TNLLoadIndicator ::= SEQUENCE {
    dLS1TNLLoadIndicator
                                    LoadIndicator,
    uLS1TNLLoadIndicator
                                    LoadIndicator,
                                    ProtocolExtensionContainer { { S1TNLLoadIndicator-ExtIEs} } OPTIONAL,
    iE-Extensions
S1TNLLoadIndicator-ExtIES X2AP-PROTOCOL-EXTENSION ::= {
ServedCells ::= SEQUENCE (SIZE (1.. maxCellineNB)) OF SEQUENCE {
                                    ServedCell-Information,
    servedCellInfo
    neighbour-Info
                                    Neighbour-Information
                                                                     OPTIONAL,
                                    ProtocolExtensionContainer { {ServedCell-ExtIEs} } OPTIONAL,
    iE-Extensions
```

```
ServedCell-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
ServedCell-Information ::= SEQUENCE {
    pCI
                        PCI,
    cellId
                        ECGI,
    † AC
                        TAC,
                        BroadcastPLMNs-Item,
    broadcastPLMNs
    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 },
    . . .
ShortMAC-I ::= BIT STRING (SIZE(16))
SRVCCOperationPossible ::= ENUMERATED {
    possible,
    . . .
SubframeAssignment ::= ENUMERATED {
    sa0,
    sal,
    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,
TAC ::= OCTET STRING (SIZE (2))
TargeteNBtoSource-eNBTransparentContainer ::= OCTET STRING
TimeToWait ::= ENUMERATED {
    vls,
    v2s,
    v5s,
    v10s,
    v20s,
    v60s,
Time-UE-StayedInCell ::= INTEGER (0..4095)
TraceActivation ::= SEQUENCE {
    eUTRANTraceID
                                    EUTRANTraceID,
    interfacesToTrace
                                    InterfacesToTrace,
    traceDepth
                                    TraceDepth,
    traceCollectionEntityIPAddress TraceCollectionEntityIPAddress,
    iE-Extensions
                                    ProtocolExtensionContainer { {TraceActivation-ExtIEs} } OPTIONAL,
    . . .
TraceActivation-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
TraceCollectionEntityIPAddress ::= BIT STRING (SIZE(1..160, ...))
```

```
TraceDepth
                ::= ENUMERATED {
    minimum,
    medium,
    maximum.
    minimumWithoutVendorSpecificExtension,
    mediumWithoutVendorSpecificExtension,
    maximumWithoutVendorSpecificExtension,
Transmission-Bandwidth ::= ENUMERATED {
       bw6,
       bw15,
       bw25,
       bw50,
       bw75,
       bw100,
        . . .
TransportLayerAddress
                                ::= BIT STRING (SIZE(1..160, ...))
TypeOfError ::= ENUMERATED {
    not-understood,
    missing,
-- U
UE-HistoryInformation ::= SEQUENCE (SIZE(1..maxnoofCells)) OF LastVisitedCell-Item
UE-S1AP-ID
                            ::= INTEGER (0.. 4294967295)
UE-X2AP-ID
                            ::= INTEGER (0..4095) -- Value FFS
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-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
    ul-interferenceindication
                                    UL-HighInterferenceIndication,
                                    ProtocolExtensionContainer { { UL-HighInterferenceIndicationInfo-Item-ExtIEs} } OPTIONAL,
    iE-Extensions
    . . .
UL-HighInterferenceIndicationInfo-Item-ExtIEs X2AP-PROTOCOL-EXTENSION ::= {
UL-HighInterferenceIndication ::= BIT STRING (SIZE(1..110, ...))
UE-RLF-Report-Container::= OCTET STRING
-- This IE is a transparent container and shall be encoded as the rlfReport field contained in the UEInformationResponse message as defined in [9]
-- W
-- Y
-- Z
END
```

#### 9.3.6 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
__ *********************
            ::= ENUMERATED { reject, ignore, notify }
Criticality
        ::= ENUMERATED { optional, conditional, mandatory }
Presence
PrivateIE-ID ::= CHOICE {
   local
                   INTEGER (0.. maxPrivateIEs),
   qlobal
                   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

```
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
                                                             ProcedureCode ::= 0
id-handoverPreparation
id-handoverCancel
                                                             ProcedureCode ::= 1
                                                             ProcedureCode ::= 2
id-loadIndication
id-errorIndication
                                                             ProcedureCode ::= 3
id-snStatusTransfer
                                                             ProcedureCode ::= 4
id-uEContextRelease
                                                             ProcedureCode ::= 5
                                                             ProcedureCode ::= 6
id-x2Setup
                                                             ProcedureCode ::= 7
id-reset
id-eNBConfigurationUpdate
                                                             ProcedureCode ::= 8
id-resourceStatusReportingInitiation
                                                             ProcedureCode ::= 9
                                                             ProcedureCode ::= 10
id-resourceStatusReporting
                                                             ProcedureCode ::= 11
id-privateMessage
id-mobilitySettingsChange
                                                             ProcedureCode ::= 12
id-rLFIndication
                                                             ProcedureCode ::= 13
id-handoverReport
                                                             ProcedureCode ::= 14
id-cellActivation
                                                             ProcedureCode ::= 15
-- Lists
__ ********************
maxEARFCN
                                         INTEGER ::= 65535
maxInterfaces
                                         INTEGER ::= 16
maxCellineNB
                                         INTEGER ::= 256
maxnoofBearers
                                         INTEGER ::= 256
maxNrOfErrors
                                         INTEGER ::= 256
maxnoofPDCP-SN
                                         INTEGER ::= 16
                                                             -- FFS Value to be checked
maxnoofEPLMNs
                                         INTEGER ::= 15
                                         INTEGER ::= 16
maxnoofEPLMNsPlusOne
maxnoofForbLACs
                                         INTEGER ::= 4096
maxnoofForbTACs
                                         INTEGER ::= 4096
maxnoofBPLMNs
                                         INTEGER ::= 6
                                         INTEGER ::= 512
maxnoofNeighbours
```

id-UE-X2AP-ID

id-ServedCells

id-TimeToWait

id-GUMMEI-ID

id-GlobalENB-ID

id-GUGroupIDList

id-CellToReport

id-ServedCellsToAdd

id-ServedCellsToModify

id-ServedCellsToDelete

id-Registration-Reguest

id-ReportingPeriodicity

id-CellMeasurementResult

id-GUGroupIDToDeleteList

id-ReportCharacteristics

id-ENB1-Measurement-ID

id-ENB2-Measurement-ID

id-SRVCCOperationPossible

id-CellMeasurementResult-Item

id-CellToReport-Item

id-GUGroupIDToAddList

id-Measurement-ID

id-CriticalityDiagnostics

id-E-RABs-SubjectToStatusTransfer-List

id-E-RABs-SubjectToStatusTransfer-Item

```
maxnoofPRBs
                                      INTEGER ::= 110
maxPools
                                      INTEGER ::= 16
                                      INTEGER ::= 16
maxnoofCells
maxnoofMBSFN
                                      TNTEGER ::= 8
  ********************
-- IEs
__ ********************
id-E-RABs-Admitted-Item
id-E-RABs-Admitted-List
id-E-RAB-Item
id-E-RABs-NotAdmitted-List
id-E-RABs-ToBeSetup-Item
id-Cause
id-CellInformation
id-CellInformation-Item
id-New-eNB-UE-X2AP-TD
id-Old-eNB-UE-X2AP-ID
id-TargetCell-ID
id-TargeteNBtoSource-eNBTransparentContainer
id-TraceActivation
id-UE-ContextInformation
id-UE-HistoryInformation
```

ProtocolIE-ID ::= 1 ProtocolIE-ID ::= 2 ProtocolIE-ID ::= 3 ProtocolIE-ID ::= 4 ProtocolIE-ID ::= 5 ProtocolIE-ID ::= 6 ProtocolIE-ID ::= 7 ProtocolIE-ID ::= 9 ProtocolIE-ID ::= 10 ProtocolIE-ID ::= 11 ProtocolIE-ID ::= 12 ProtocolIE-ID ::= 13 ProtocolIE-ID ::= 14 ProtocolIE-ID ::= 15 ProtocolIE-ID ::= 16 ProtocolIE-ID ::= 17 ProtocolIE-ID ::= 18 ProtocolIE-ID ::= 19 ProtocolIE-ID ::= 20 ProtocolIE-ID ::= 21 ProtocolIE-ID ::= 22 ProtocolIE-ID ::= 23 ProtocolIE-ID ::= 24 ProtocolIE-ID ::= 25 ProtocolIE-ID ::= 26 ProtocolIE-ID ::= 27 ProtocolIE-ID ::= 28 ProtocolIE-ID ::= 29 ProtocolIE-ID ::= 30 ProtocolIE-ID ::= 31 ProtocolIE-ID ::= 32 ProtocolIE-ID ::= 33 ProtocolIE-ID ::= 34 ProtocolIE-ID ::= 35 ProtocolIE-ID ::= 36 ProtocolIE-ID ::= 37 ProtocolIE-ID ::= 38 ProtocolIE-ID ::= 39 ProtocolIE-ID ::= 40

ProtocolIE-ID ::= 0

115

```
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
```

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 {
                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
   FIRST CRITICALITY
                      &firstCriticality
                      &FirstValue
   FIRST TYPE
   SECOND CRITICALITY
                      &secondCriticality
                      &SecondValue
   SECOND TYPE
   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 {
                   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 {
           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
                    X2AP-PROTOCOL-IES-PAIR.&id
                                                          ({IEsSetParam}),
                                                          ({IEsSetParam}{@id}),
   firstCriticality X2AP-PROTOCOL-IES-PAIR.&firstCriticality
   firstValue
                                                          ({IEsSetParam}{@id}),
              X2AP-PROTOCOL-IES-PAIR.&FirstValue
   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} ::= SEOUENCE
                   X2AP-PROTOCOL-EXTENSION.&id
                                                       ({ExtensionSetParam}),
   criticality
                    X2AP-PROTOCOL-EXTENSION. & criticality
                                                       ({ExtensionSetParam}{@id}),
                                                       ({ExtensionSetParam}{@id})
   extensionValue
                    X2AP-PROTOCOL-EXTENSION. & Extension
   -- 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 {
               X2AP-PRIVATE-IES.&id
                                            ({IEsSetParam}),
   criticality
                X2AP-PRIVATE-IES.&criticality ({IEsSetParam}{@id}),
```

#### 9.4 Message transfer syntax

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

#### 9.5 Timers

#### $T_{RELOCprep}$

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

#### $TX2_{RELOCoverall} \\$

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

## Handling of unknown, unforeseen and erroneous protocol data

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

# Annex A (informative): Change History

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

### History

Document history					
V9.0.0	October 2009	Publication			
V9.1.0	February 2010	Publication			
V9.2.0	April 2010	Publication			
V9.3.0	June 2010	Publication			
V9.4.0	October 2010	Publication			