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Technical Specification

**LTE;
Evolved Universal Terrestrial Radio
Access Network (E-UTRAN);
M2 Application Protocol (M2AP)
(3GPP TS 36.443 version 10.0.0 Release 10)**



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Foreword

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1 Scope

The present document specifies the E-UTRAN radio network layer signalling protocol for the M2 interface. The M2 Application Protocol (M2AP) supports the functions of M2 interface by signalling procedures defined in this document. M2AP 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".
- [2] 3GPP TS 36.401: "E-UTRAN Architecture Description".
- [3] 3GPP TS 36.300: "Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Universal Terrestrial Radio Access Network (E-UTRAN); Overall description; Stage 2".
- [4] 3GPP TS 36.413: " Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 Application Protocol (S1AP)".
- [5] ITU-T Recommendation X.691 (07/2002): "Information technology - ASN.1 encoding rules - Specification of Packed Encoding Rules (PER) ".
- [6] ITU-T Recommendation X.680 (07/2002): "Information technology - Abstract Syntax Notation One (ASN.1): Specification of basic notation".
- [7] 3GPP TS 36.412: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); S1 signalling transport ".
- [8] 3GPP TS 23.246: "Multimedia Broadcast/Multicast Service (MBMS); Architecture and functional description".
- [9] 3GPP TS 29.061 "Interworking between the Public Land Mobile Network (PLMN) supporting packet based services and Packet Data Networks (PDN)".
- [10] 3GPP TS 23.203: "Policy and charging control architecture".
- [11] 3GPP TS 36.331: "Evolved Universal Terrestrial Radio Access (E-UTRAN); Radio Resource Control (RRC) Protocol Specification".
- [12] 3GPP TS 36.211: "Evolved Universal Terrestrial Radio Access (E-UTRAN); Physical Channels and Modulation".
- [13] 3GPP TS 36.445: "Evolved Universal Terrestrial Radio Access Network (E-UTRAN); M1 Data Transport".

3 Definitions, symbols and abbreviations

3.1 Definitions

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

Elementary Procedure: M2AP consists of Elementary Procedures (EPs). An Elementary Procedure is a unit of interaction between eNBs and the MCE. These Elementary Procedures are defined separately and are intended to be used to build up complete sequences in a flexible manner. If the independence between some EPs is restricted, it is described under the relevant EP description. Unless otherwise stated by the restrictions, the EPs may be invoked independently of each other as stand alone procedures, which can be active in parallel. The usage of several M2AP EPs together or together with EPs from other interfaces is specified in stage 2 specifications (e.g. [3] and [8]).

An EP consists of an initiating message and possibly a response message. Two kinds of EPs are used:

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

For Class 1 EPs, the types of responses can be as follows:

Successful:

- A signalling message explicitly indicates that the elementary procedure successfully completed with the receipt of the response.

Unsuccessful:

- A signalling message explicitly indicates that the EP failed.
- On time supervision expiry (i.e. absence of expected response).

Successful and Unsuccessful:

- One signalling message reports both successful and unsuccessful outcome for the different included requests. The response message used is the one defined for successful outcome.

Class 2 EPs are considered always successful.

eNB MBMS M2AP ID: Unique identity, referencing the MBMS-service-associated logical M2-connection within an eNB.

MCE MBMS M2AP ID: Unique identity, referencing the MBMS-service-associated logical M2-connection within an MCE.

MBMS E-RAB: denotes both, the data bearer established between the eNB and the UE(s) to transport MBMS data and the MBMS M1 data bearer.

MBMS-service-associated signalling: When M2AP messages associated to one MBMS service uses the MBMS-service-associated logical M2-connection for association of the message to the respective MBMS service in eNB and EPC.

MBMS-service-associated logical M2-connection: The MBMS-service-associated logical M2-connection uses the identities *eNB MBMS M2AP ID* and *MCE MBMS M2AP ID*. For a received M2AP message the MCE identifies the associated MBMS E-RAB based on the *MCE MBMS M2AP ID IE* and the eNB identifies the associated MBMS-RAB based on the *eNB MBMS M2AP ID IE*.

3.2 Abbreviations

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

| | |
|------|----------------------------|
| MCCH | Multicast Control CHannel |
| PMCH | Physical Multicast CHannel |

4 General

4.1 Procedure Specification Principles

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

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

- The procedure text discriminates between:

- 1) Functionality which "shall" be executed

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

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

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

- Any required inclusion of an optional IE in a response message is explicitly indicated in the procedure text. If the procedure text does not explicitly indicate that an optional IE shall be included in a response message, the optional IE shall not be included. For requirements on including *Criticality Diagnostics* IE, see section 10 in [4].

4.2 Forwards and Backwards Compatibility

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

4.3 Specification Notations

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

| | |
|-----------|--|
| Procedure | When referring to an elementary procedure in the specification the Procedure Name is written with the first letters in each word in upper case characters followed by the word "procedure", e.g. E-RAB procedure. |
| Message | When referring to a message in the specification the MESSAGE NAME is written with all letters in upper case characters followed by the word "message", e.g. MESSAGE NAME message. |
| IE | When referring to an information element (IE) in the specification the <i>Information Element Name</i> 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. <i>Information Element</i> IE. |

Value of an IE When referring to the value of an information element (IE) in the specification the "Value" is written as it is specified in subclause 9.2 enclosed by quotation marks, e.g. "Value".

5 M2AP Services

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

5.1 M2AP procedure modules

The M2 interface M2AP procedures may be sub-divided as follows:

1. M2AP MBMS session control procedures;
2. M2AP global procedures;

The M2AP session control procedures are related to MBMS services.

The Global Procedures module contains procedures that are not related to a specific MBMS service.

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 M2AP procedure related to a certain MBMS service.

6 Services Expected from Signalling Transport

The signalling connection shall provide in sequence delivery of M2AP messages. M2AP shall be notified if the signalling connection breaks.

7 Functions of M2AP

The M2AP protocol provides the following functions:

- MBMS Session Handling. This function supports start, stop and modify of an MBMS session, as well as configuration and modification of basic radio transmission parameters related to that service.
- MBMS Scheduling Information. This function provides MCCH related information to the eNB.
- 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 M2. This function is used to reset the M2 interface.
- Setting up the M2. This function is used to exchange necessary data for the eNB for setup the M2 interface, provides basic configuration of radio parameters for transmission of MBMS data and implicitly perform an M2 Reset.
- eNB and MCE Configuration Update functions are to update configuration data exchanged during setup of M2.

The mapping between the above functions and M2 EPs is shown in the table below.

Table 1: Mapping between M2AP functions and M2AP EPs

| Function | Elementary Procedure(s) |
|---------------------------------------|---|
| MBMS Session Handling | a) MBMS Session Start b) MBMS Session Stop c) MBMS Session Update |
| MBMS Scheduling Information | MBMS Scheduling Information |
| Reporting of General Error Situations | Error Indication |
| Resetting the M2 | Reset |
| Setting up the M2 | M2 Setup |
| Configuration Update | a) eNB Configuration Update b) MCE Configuration Update |

8 M2AP Procedures

8.1 List of M2AP Elementary procedures

In the following tables, all EPs are divided into Class 1 and Class 2 EPs (see subclause 3.1 for explanation of the different classes):

Table 2: Class 1 procedures

| Elementary Procedure | Initiating Message | Successful Outcome | Unsuccessful Outcome |
|-----------------------------|-----------------------------|--------------------------------------|----------------------------------|
| | | Response message | Response message |
| MBMS Session Start | MBMS SESSION START REQUEST | MBMS SESSION START RESPONSE | MBMS SESSION START FAILURE |
| MBMS Session Stop | MBMS SESSION STOP REQUEST | MBMS SESSION STOP RESPONSE | |
| MBMS Session Update | MBMS SESSION UPDATE REQUEST | MBMS SESSION UPDATE RESPONSE | MBMS SESSION UPDATE FAILURE |
| MBMS Scheduling Information | MBMS SCHEDULING INFORMATION | MBMS SCHEDULING INFORMATION RESPONSE | |
| Reset | RESET | RESET ACKNOWLEDGE | |
| M2 Setup | M2 SETUP REQUEST | M2 SETUP RESPONSE | M2 SETUP FAILURE |
| eNB Configuration Update | ENB CONFIGURATION UPDATE | ENB CONFIGURATION UPDATE ACKNOWLEDGE | ENB CONFIGURATION UPDATE FAILURE |
| MCE Configuration Update | MCE CONFIGURATION UPDATE | MCE CONFIGURATION UPDATE ACKNOWLEDGE | MCE CONFIGURATION UPDATE FAILURE |

Table 3: Class 2 procedures

| Elementary Procedure | Message |
|----------------------|------------------|
| Error Indication | ERROR INDICATION |

The following applies concerning interference between Elementary Procedures:

- The Reset procedure takes precedence over all other EPs.

8.2 MBMS Session Start

8.2.1 General

The purpose of the MBMS Session Start procedure is to request the eNB to notify UEs about an upcoming MBMS Session of a given MBMS Bearer Service and to establish an MBMS E-RAB and an MBMS-service-associated logical M2-connection. The MBMS Session Start procedure is triggered by the MCE.

The procedure uses MBMS-Service-associated signalling.

8.2.2 Successful Operation

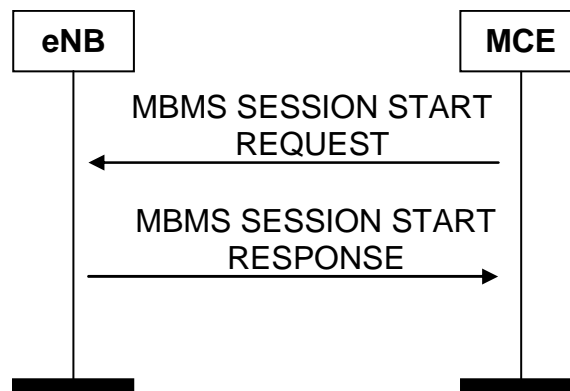


Figure 8.2.2-1. MBMS Session Start procedure. Successful operation.

The MCE initiates the procedure by sending an MBMS SESSION START REQUEST message. If the eNB accepts the MBMS session start request, the eNB responds with the MBMS SESSION START RESPONSE message. The eNB shall join the transport network IP multicast address (including the IP address of the multicast source) as described by the *TNL Information* IE to enable the reception of MBMS data.

If the MBMS SESSION START REQUEST message contains the *MBMS Session Identity* IE, the eNB shall notify the UEs about the information for the MBMS session.

8.2.3 Unsuccessful Operation

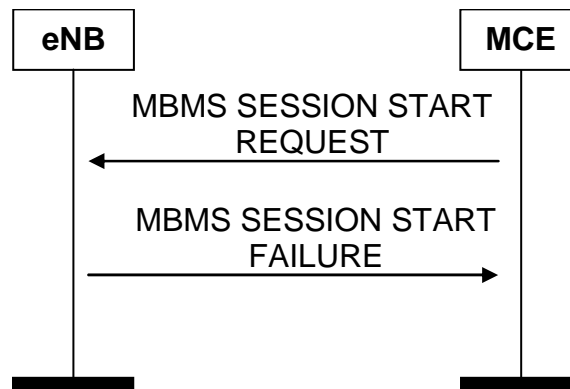


Figure 8.2.3-1. MBMS Session Start procedure. Unsuccessful operation.

If the eNB is not capable of correctly processing the request (e.g. the MBMS resources could not be established at all in any cell), the MCE shall be informed by the MBMS SESSION START FAILURE message.

8.2.4 Abnormal Conditions

Void.

8.3 MBMS Session Stop

8.3.1 General

The purpose of the MBMS Session Stop procedure is to request the eNB to notify UEs about the end of a given MBMS Session of a given MBMS Bearer Service and to release the corresponding MBMS E-RAB and the MBMS-service-associated logical M2-connection. The MBMS Session Stop procedure is triggered by the MCE.

The procedure uses MBMS-Service-associated signalling.

8.3.2 Successful Operation

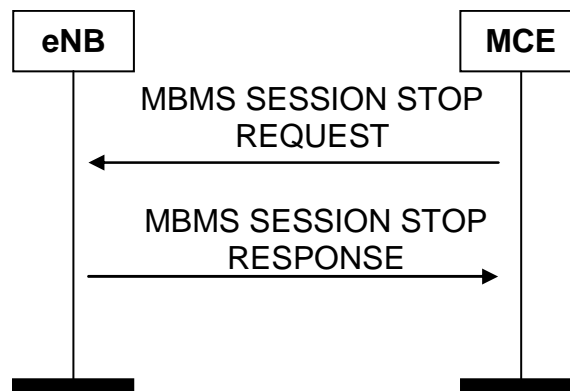


Figure 8.3.2-1. MBMS Session Stop procedure. Successful operation.

The MCE initiates the procedure by sending a MBMS SESSION STOP REQUEST message. Upon receipt of the MBMS SESSION STOP REQUEST message, the eNB shall respond with the MBMS SESSION STOP RESPONSE message. The eNB shall disable the reception from the IP backbone of the particular MBMS bearer service, release the affected resources and remove the MBMS bearer context.

8.3.3 Abnormal Conditions

Void.

8.4 MBMS Scheduling Information

8.4.1 General

The purpose of the MBMS Scheduling Information Procedure is to provide MCCH related information to the eNB

The procedure uses non MBMS-Service-associated signalling.

8.4.2 Successful Operation

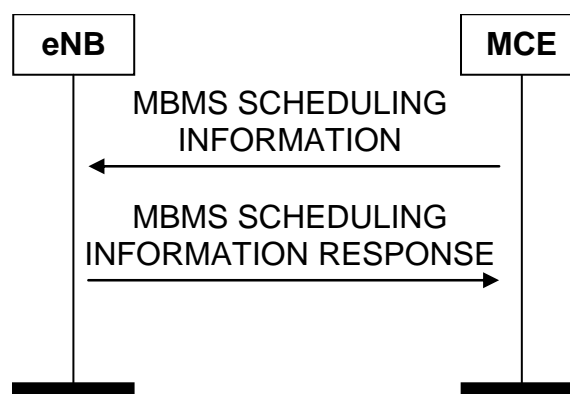


Figure 8.4.2-1. MBMS Scheduling Information procedure. Successful operation.

The MCE initiates the procedure by sending the MBMS SCHEDULING INFORMATION message to the eNB. If PMCH configuration information is contained in this message, the eNB shall do PMCH transmission according to the PMCH configuration information. If PMCH configuration information for an existing PMCH is not contained in this message, the eNB should stop PMCH transmission for the PMCH. The eNB shall store the *MBSFN Area Configuration Item* IE, and apply the MCCH update from the modification period defined in the *MCCH Update Time* IE. The eNB shall schedule the MBMS services appear in the MCCH according to the order defined in the *MBMS Session List per PMCH* IE.

8.4.3 Abnormal Conditions

Void.

8.5 Reset

8.5.1 General

The purpose of the Reset procedure is to initialise or re-initialise the eNB M2AP MBMS-service-related contexts, in the event of a failure in the MCE or vice versa. This procedure doesn't affect the application level configuration data exchanged during the M2 Setup procedure.

The procedure uses non MBMS-service-associated signalling.

8.5.2 Successful Operation

8.5.2.1 Reset Procedure Initiated from the MCE

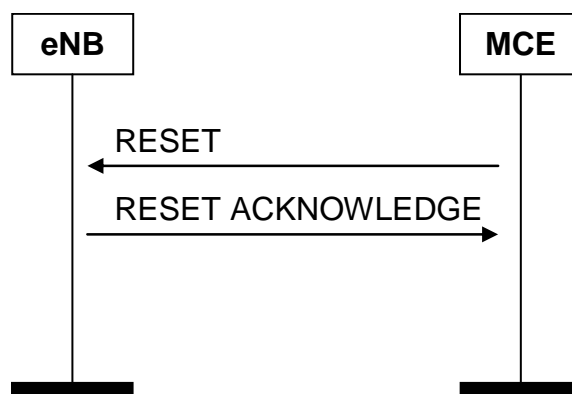


Figure 8.5.2.1-1. Reset procedure initiated from the MCE. Successful operation.

In the event of a failure at the MCE, which has resulted in the loss of some or all transaction reference information, a RESET message shall be sent to the eNB.

At reception of RESET message the eNB shall release all allocated resources on M2 and M1/Uu related to MBMS-service association(s) and remove all MBMS-service contexts including MBMS M2AP IDs.

After the eNB has released all assigned M2 resources and MBMS-service contexts, the eNB shall respond with the RESET ACKNOWLEDGE message. The eNB does not need to wait for the release of radio resources to be completed before returning the RESET ACKNOWLEDGE message.

If the RESET message contains the *MBMS-Service-associated logical M2-connection list* IE, then:

- The eNB shall use the *MCE MBMS M2AP ID* IE and/or the *eNB MBMS M2AP ID* IE to explicitly identify the MBMS service association(s) to be reset.
- The eNB shall in the RESET ACKNOWLEDGE message include, for each MBMS service association to be reset, the *MBMS-Service-associated logical M2-connection Item* IE in the *MBMS-Service-associated logical M2-connection list* IE. The *MBMS-Service-associated logical M2-connection Item* IEs shall be in the same order as received in the RESET message and shall include also unknown MBMS-Service-associated logical M2-connections. Empty *MBMS-Service-associated logical M2-connection Item* IEs, received in the RESET message, may be omitted in the RESET ACKNOWLEDGE message.
- If the *MCE MBMS M2AP ID* IE is included in the *MBMS-Service-associated logical M2-connection Item* IE for an MBMS service association, the eNB shall include the *MCE MBMS M2AP ID* IE in the corresponding *MBMS-Service-associated logical M2-connection Item* IE in the RESET ACKNOWLEDGE message.

- If the *eNB MBMS M2AP ID IE* is included in an *MBMS-Service-associated logical M2-connection Item IE* for an MBMS service association, the eNB shall include the *eNB MBMS M2AP ID IE* in the corresponding *MBMS-Service-associated logical M2-connection Item IE* in the RESET ACKNOWLEDGE message.

Interactions with other procedures:

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

8.5.2.2 Reset Procedure Initiated from the eNB

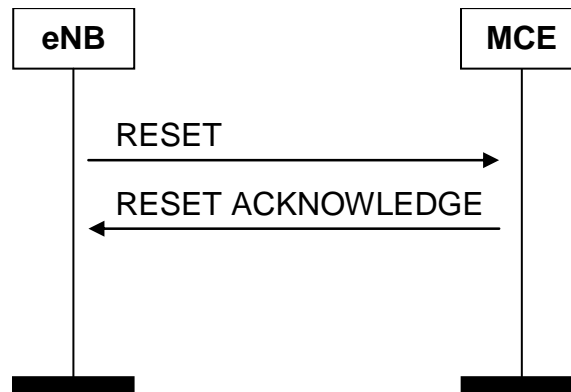


Figure 8.5.2.2-1. Reset procedure initiated from the eNB. Successful operation.

In the event of a failure at the eNB, which has resulted in the loss of some or all transaction reference information, a RESET message shall be sent to the MCE.

At reception of RESET message the MCE shall release all allocated resources and MBMS-service contexts on M2 for the eNB.

After the MCE has released all assigned M2 resources and MBMS-service contexts for the eNB, the MCE shall respond with the RESET ACKNOWLEDGE message.

If the RESET message contains the *MBMS-Service-associated logical M2-connection list IE*, then:

- The MCE shall use the *MCE MBMS M2AP ID IE* and/or the *eNB MBMS M2AP ID IE* to explicitly identify the MBMS service association(s) to be reset.
- The MCE shall in the RESET ACKNOWLEDGE message include, for each MBMS service association to be reset, the *MBMS-Service-associated logical M2-connection Item IE* in the *MBMS-Service-associated logical M2-connection list IE*. The *MBMS-Service-associated logical M2-connection Item IE*s shall be in the same order as received in the RESET message and shall include also unknown MBMS-Service-associated logical M2-connections. Empty *MBMS-Service-associated logical M2-connection Item IE*s, received in the RESET message, may be omitted in the RESET ACKNOWLEDGE message.
- If the *MCE MBMS M2AP ID IE* is included in the *MBMS-Service-associated logical M2-connection Item IE* for an MBMS service association, the MCE shall include the *MCE MBMS M2AP ID IE* in the corresponding *MBMS-Service-associated logical M2-connection Item IE* in the RESET ACKNOWLEDGE message.
- If the *eNB MBMS M2AP ID IE* is included in an *MBMS-Service-associated logical M2-connection Item IE* for an MBMS service association, the MCE shall include the *eNB MBMS M2AP ID IE* in the corresponding *MBMS-Service-associated logical M2-connection Item IE* in the RESET ACKNOWLEDGE message.

Interactions with other procedures:

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

8.5.3 Abnormal Conditions

8.5.3.1 Abnormal Condition at the MCE

If the RESET message includes the *MBMS-Service-associated logical M2-connection list IE*, but neither the *MCE MBMS M2AP ID IE* nor the *eNB MBMS M2AP ID IE* is present for a *MBMS-Service-associated logical M2-connection Item IE*, then the MCE shall ignore the *MBMS-Service-associated logical M2-connection Item IE*. The MCE may return the empty *MBMS-Service-associated logical M2-connection Item IE* in the *MBMS-Service-associated logical M2-connection list IE* in the RESET ACKNOWLEDGE message.

8.5.3.2 Abnormal Condition at the eNB

If the RESET message includes the *MBMS-Service-associated logical M2-connection list IE*, but neither the *MCE MBMS M2AP ID IE* nor the *eNB MBMS M2AP ID IE* is present for a *MBMS-Service-associated logical M2-connection Item IE*, then the eNB shall ignore the *MBMS-Service-associated logical M2-connection Item IE*. The eNB may return the empty *MBMS-Service-associated logical M2-connection Item IE* in the *MBMS-Service-associated logical M2-connection list IE* in the RESET ACKNOWLEDGE message.

8.5.3.3 Crossing of Reset Messages

If Reset procedure is ongoing in eNB and the eNB receives a RESET message from the peer entity on the same M2 interface related to one or several MBMS service associations previously requested to be reset, indicated explicitly or implicitly in the received RESET message, the eNB shall respond with RESET ACKNOWLEDGE message as described in 8.5.2.1.

If Reset procedure is ongoing in MCE and the MCE receives a RESET message from the peer entity on the same M2 interface related to one or several MBMS service associations previously requested to be reset, indicated explicitly or implicitly in the received RESET message, the MCE shall respond with RESET ACKNOWLEDGE message as described in 8.5.2.2.

8.6 M2 Setup

8.6.1 General

The purpose of the M2 Setup procedure is to exchange application level data needed for the eNB and MCE to interoperate correctly on the M2 interface and to configure MCCH related content on the BCCH for each of the cells controlled by the eNB which is foreseen to participate in MBMS service data transmission. This procedure shall be the first M2AP procedure triggered after the TNL association has become operational. The procedure uses non MBMS-service-associated signalling.

This procedure erases any existing application level in the eNB and the MCE and MCCH related BCCH data in all cells served by the eNB. This procedure also re-initialises the E-UTRAN M2AP MBMS service related contexts (if any) and erases all related signalling connections in the two nodes like a Reset procedure would do.

8.6.2 Successful Operation

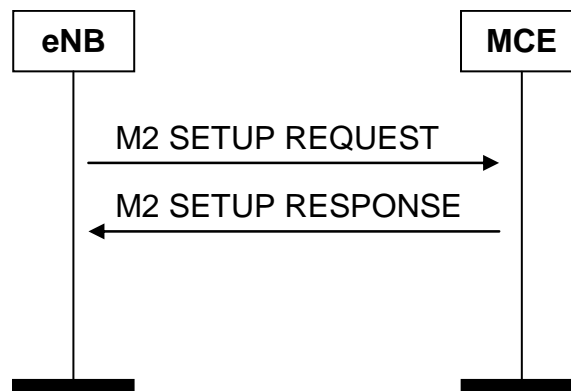


Figure 8.6.2-1. M2 Setup procedure. Successful operation.

The eNB initiates the procedure by sending a M2 SETUP REQUEST message including the appropriate data to the MCE. The eNB shall include in the M2 SETUP REQUEST message the cell(s) which are foreseen to participate in MBMS service data transmission.

The MCE responds with M2 SETUP RESPONSE message including the appropriate data. The MCE shall provide MCCH related BCCH data for all cells indicated in the M2 SETUP REQUEST message.

The exchanged data shall be stored in the respective node, MCCH related BCCH data broadcasted as provided by the MCE in the respective cell(s), and used for the duration of the TNL association.

When this procedure is finished the M2 interface is operational, all affected cells are ready for MBMS service data transmission and other M2 messages can be exchanged.

If the M2 SETUP REQUEST message contains the *eNB Name* IE the MCE may use this IE as a human readable name of the eNB.

If the M2 SETUP RESPONSE message contains the *MCE Name* IE the eNB may use this IE as a human readable name of the MCE. If the M2 SETUP RESPONSE message contains the *Cell Information List* IE the eNB shall broadcast the MCCH related BCCH configuration in the cells indicated in the IE. If the M2 SETUP RESPONSE message does not contain the *Cell Information List* IE the eNB shall not broadcast the MCCH related BCCH configuration in any cell.

8.6.3 Unsuccessful Operation

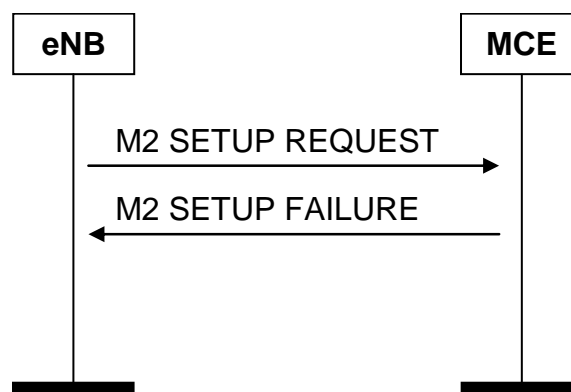


Figure 8.6.2-1. M2 Setup procedure. Unsuccessful operation.

If the MCE can not accept the setup it should respond with a M2 SETUP FAILURE message and appropriate cause value.

If the M2 SETUP FAILURE messages include the *Time To Wait* IE the eNB shall wait at least for the indicated time before reinitiating the M2 setup towards the same MCE.

8.6.4 Abnormal Conditions

Void.

8.7 eNB Configuration Update

8.7.1 General

The purpose of the eNB Configuration Update procedure is to update application level configuration data needed for the eNB and MCE to interoperate correctly on the M2 interface.

The procedure uses non MBMS-service-associated signalling.

8.7.2 Successful Operation

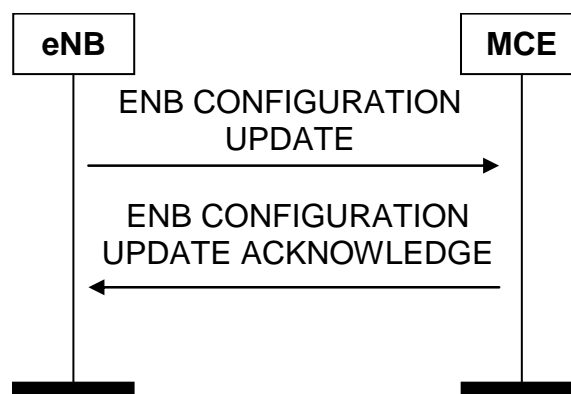


Figure 8.7.2-1. eNB Configuration Update procedure. Successful operation.

The eNB initiates the procedure by sending an ENB CONFIGURATION UPDATE message to the MCE including an appropriate set of updated configuration data that it has just taken into operational use. The eNB CONFIGURATION UPDATE message may contain:

- the *Global eNB ID* IE,
- the *eNB Name* IE,
- the *eNB MBMS Configuration data per cell* IE.

The MCE responds with ENB CONFIGURATION UPDATE ACKNOWLEDGE message to acknowledge that it successfully updated the configuration data. If the ENB CONFIGURATION ACKNOWLEDGE message contains the *Cell Information List* IE the eNB shall broadcast the MCCH related BCCH configuration in the cells indicated in the IE. If the ENB CONFIGURATION ACKNOWLEDGE message does not contain the *Cell Information List* IE the eNB shall not broadcast the MCCH related BCCH configuration in any cell.

The eNB may update the configured MBMS Services Areas and the MBSFN Synchronisation Area per cell:

- If the eNB includes the *E-UTRAN CGI* IE for a cell within the ENB CONFIGURATION UPDATE message, the MCE shall assume that the eNB does neither broadcast MCCH related data in the BCCH nor any MBMS service data in that cell any more.
- If the eNB includes the *eNB MBMS Configuration data Item* IE for a cell within the ENB CONFIGURATION UPDATE message, the MCE may decide to include in the ENB CONFIGURATION UPDATE ACKNOWLEDGE message MCCH related BCCH data for that cell.

The exchanged data shall be stored in the respective node, MCCH related BCCH data broadcasted as provided by the MCE in the respective cell(s), and used for the duration of the TNL association.

When this procedure is finished all affected cells are ready for MBMS service data transmission and other M2 messages can be exchanged.

8.7.3 Unsuccessful Operation

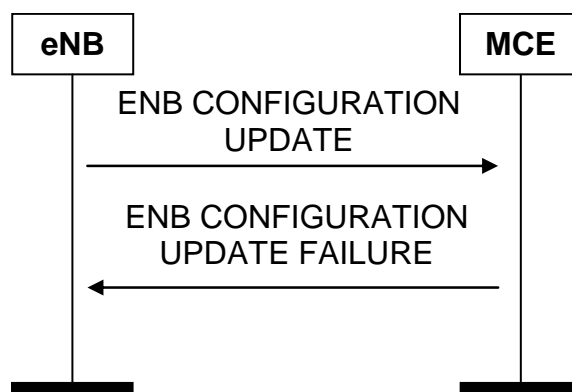


Figure 8.7.3-1. eNB Configuration Update procedure. Unsuccessful operation.

If the MCE can not accept the update it shall respond with an ENB CONFIGURATION UPDATE FAILURE message and appropriate cause value.

If the ENB CONFIGURATION UPDATE FAILURE message includes the *Time To Wait* IE the eNB shall wait at least for the indicated time before reinitiating the ENB Configuration Update procedure towards the MCE. Both nodes shall continue to operate the M2 interface with their respective configuration data.

8.7.4 Abnormal Conditions

Void.

8.8 MCE Configuration Update

8.8.1 General

The purpose of the MCE Configuration Update procedure is to update application level configuration data needed for the eNB and MCE to interoperate correctly on the M2 interface and to re-configure MCCH related content on the BCCH for each of the cells controlled by the eNB which is foreseen to participate in MBMS service data transmission. The procedure uses non MBMS-service-associated signalling.

8.8.2 Successful Operation

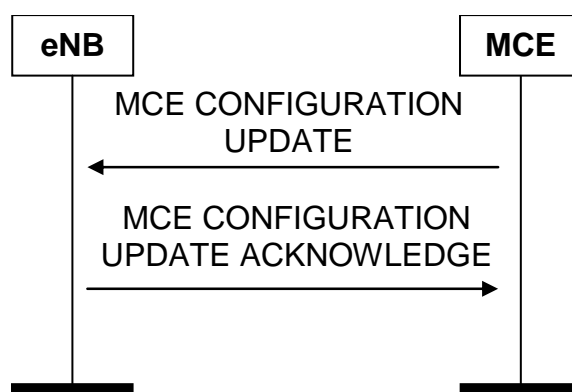


Figure 8.8.2-1. MCE Configuration Update procedure. Successful operation.

The MCE initiates the procedure by sending an MCE CONFIGURATION UPDATE message to the eNB including an appropriate set of updated configuration data. The MCE CONFIGURATION UPDATE message may contain:

- the *Global MCE ID* IE,

- the *MCE Name IE*,
- the *MCCH related BCCH Configuration data per cell IE*.

The eNB responds with the MCE CONFIGURATION UPDATE ACKNOWLEDGE message to acknowledge that it successfully updated the configuration data.

If the MCE CONFIGURATION UPDATE message contains the *Cell Information List IE* the eNB shall broadcast the MCCH related BCCH configuration in the cells indicated in the IE. If the MCE CONFIGURATION UPDATE message does not contain the *Cell Information List IE* the eNB shall not broadcast the MCCH related BCCH configuration in any cell.

8.8.3 Unsuccessful Operation

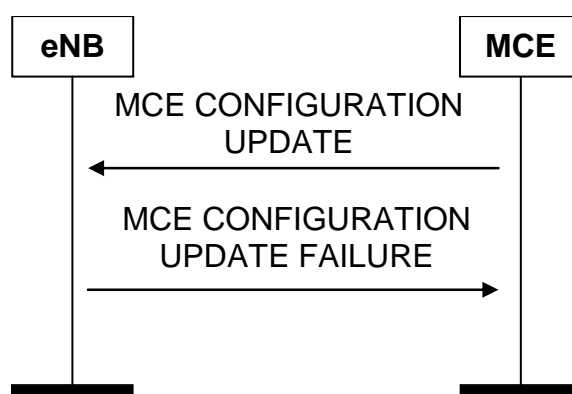


Figure 8.78.3-1. MCE Configuration Update procedure. Unsuccessful operation.

If the eNB can not accept the update it shall respond with an MCE CONFIGURATION UPDATE FAILURE message and appropriate cause value.

If the MCE CONFIGURATION UPDATE FAILURE message includes the *Time To Wait IE* the MCE shall wait at least for the indicated time before reinitiating the MCE Configuration Update procedure towards the eNB. Both nodes shall continue to operate the M2 interface with their respective configuration data.

8.8.4 Abnormal Conditions

Void.

8.9 Error Indication

8.9.1 General

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

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

8.9.2 Successful Operation

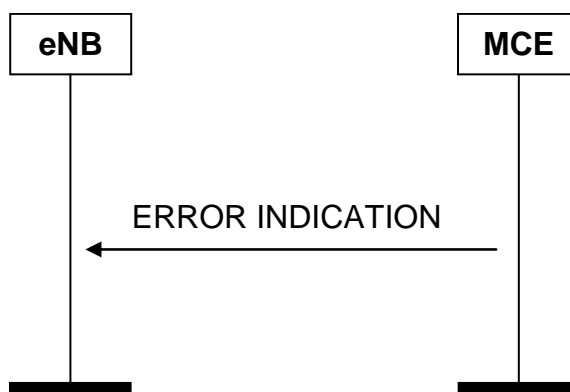


Figure 8.9.2-1. Error Indication procedure, MCE originated. Successful operation.

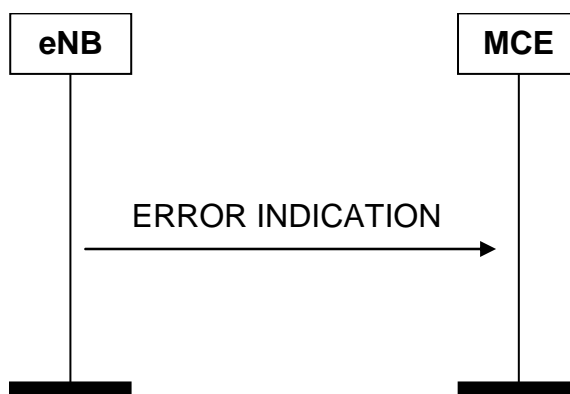


Figure 8.9.2.1-2. Error Indication procedure, eNB originated. Successful operation.

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

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

In case the Error Indication procedure is triggered by utilising MBMS-service-associated signalling the *MCE MBMS M2AP ID* IE and the *eNB MBMS M2AP ID* IE shall be included in the ERROR INDICATION message. If one or both of *MCE MBMS M2AP ID* IE and the *eNB MBMS M2AP ID* IE are not correct, the cause shall be set to appropriate value e.g. "Unknown or already allocated MCE MBMS M2AP ID", "Unknown or already allocated eNB MBMS M2AP ID" or "Unknown or inconsistent pair of MBMS M2AP ID".

8.9.3 Abnormal Conditions

Void.

8.10 MBMS Session Update

8.10.1 General

The purpose of the MBMS Session Update procedure is to inform the eNB about changing characteristics of the MBMS session e.g. change in the service area.

The procedure uses MBMS-Service-associated signalling.

8.10.2 Successful Operation

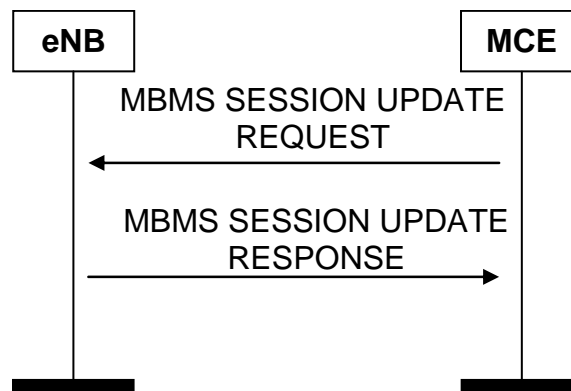


Figure 8.10.2-1. MBMS Session Update procedure. Successful operation.

The MCE initiates the procedure by sending a MBMS SESSION UPDATE REQUEST message.

If the *MBMS Service Area* IE is included in the MBMS SESSION UPDATE REQUEST message, the eNB shall check the involvement of its cells in the new service area, update correspondingly the MBMS context and resources, join or leave the IP multicast if needed and send the MBMS SESSION UPDATE RESPONSE message. The eNB shall use the *TNL Information* IE included in the MBMS SESSION UPDATE REQUEST message to join the IP multicast when needed. If the MBMS SESSION UPDATE REQUEST message contains the *MBMS Session Identity* IE for an MBMS service, the eNB shall use it for broadcast of the MBMS Session Identity on air interface.

8.10.3 Unsuccessful Operation

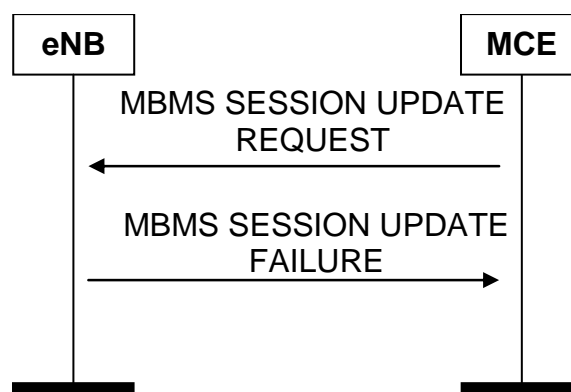


Figure 8.10.3-1. MBMS Session Update procedure. Unsuccessful operation.

If the eNB fails to update the MBMS session, it shall return a MBMS SESSION UPDATE FAILURE message.

8.10.4 Abnormal Conditions

Void.

9 Elements for M2AP Communication

9.1 Message Functional Definition and Content

9.1.1 General

Sub clauses 9.1 and 9.2 describe the structure of the messages and information elements required for the M2AP 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.

9.1.1 Message Contents

9.1.1.1 Presence

All information elements in the message descriptions below are marked mandatory, optional or conditional according to table 4.

Table 4. Meaning of abbreviations used in M2AP messages

| Abbreviation | Meaning |
|--------------|--|
| M | IEs marked as Mandatory (M) shall always be included in the message. |
| O | IEs marked as Optional (O) may or may not be included in the message. |
| C | IEs marked as Conditional (C) shall be included in a message only if the condition is satisfied. Otherwise the IE shall not be included. |

9.1.1.2 Criticality

Each Information Element or Group of Information Elements may have criticality information applied to it. Following cases are possible:

Table 5. Meaning of content within "Criticality" column

| Abbreviation | Meaning |
|---------------|---|
| – | No criticality information is applied explicitly. |
| YES | Criticality information is applied. This is usable only for non-repeatable IEs |
| GLOBAL | The IE and all its repetitions together have one common criticality information. This is usable only for repeatable IEs. |
| EACH | Each repetition of the IE has its own criticality information. It is not allowed to assign different criticality values to the repetitions. This is usable only for repeatable IEs. |

9.1.1.3 Range

The Range column indicates the allowed number of copies of repetitive IEs/IE groups.

9.1.1.4 Assigned Criticality

This column provides the actual criticality information as defined in subclause 10.3.2 in [4], if applicable.

9.1.2 MBMS SESSION START REQUEST

This message is sent by the MCE to establish an MBMS-service-associated logical M2-connection.

Direction: MCE → eNB.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|------------------------|----------|-------|-----------------------|-----------------------|-------------|----------------------|
| Message Type | M | | 9.2.1.1 | | YES | reject |
| MCE MBMS M2AP ID | M | | 9.2.3.1 | | YES | reject |
| TMGI | M | | 9.2.3.3 | | YES | reject |
| MBMS Session Identity | O | | 9.2.3.4 | | YES | ignore |
| MBMS Service Area | M | | 9.2.3.6 | | YES | reject |
| TNL Information | | 1 | | | YES | reject |
| >IP Multicast Address | M | | IP Address 9.2.2.1 | | - | |
| >IP Source Address | M | | IP Address 9.2.2.1 | | - | |
| >GTP DL TEID | M | | GTP-TEID 9.2.2.2 | | - | |

9.1.3 MBMS SESSION START RESPONSE

This message is sent by the eNB to report the successful outcome of the request from the MBMS SESSION START REQUEST message.

Direction: eNB → MCE.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|-------------------------|----------|-------|-----------------------|-----------------------|-------------|----------------------|
| Message Type | M | | 9.2.1.1 | | YES | reject |
| MCE MBMS M2AP ID | M | | 9.2.3.1 | | YES | ignore |
| eNB MBMS M2AP ID | M | | 9.2.3.2 | | YES | ignore |
| Criticality Diagnostics | O | | 9.2.1.7 | | YES | ignore |

9.1.4 MBMS SESSION START FAILURE

This message is sent by the eNB to report the unsuccessful outcome of the request from the MBMS SESSION START REQUEST message.

Direction: eNB → MCE.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|-------------------------|----------|-------|-----------------------|-----------------------|-------------|----------------------|
| Message Type | M | | 9.2.1.1 | | YES | reject |
| MCE MBMS M2AP ID | M | | 9.2.3.1 | | YES | ignore |
| Cause | M | | 9.2.1.2 | | YES | ignore |
| Criticality Diagnostics | O | | 9.2.1.7 | | YES | ignore |

9.1.5 MBMS SESSION STOP REQUEST

This message is sent by the MCE to release the corresponding MBMS E-RAB and the MBMS-service-associated logical M2-connection.

Direction: MCE → eNB.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|------------------|----------|-------|-----------------------|-----------------------|-------------|----------------------|
| Message Type | M | | 9.2.1.1 | | YES | reject |
| MCE MBMS M2AP ID | M | | 9.2.3.1 | | YES | reject |
| eNB MBMS M2AP ID | M | | 9.2.3.2 | | YES | reject |

9.1.6 MBMS SESSION STOP RESPONSE

This message is sent by the eNB to acknowledge the MBMS SESSION STOP message.

Direction: eNB → MCE.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|-------------------------|----------|-------|-----------------------|-----------------------|-------------|----------------------|
| Message Type | M | | 9.2.1.1 | | YES | reject |
| MCE MBMS M2AP ID | M | | 9.2.3.1 | | YES | ignore |
| eNB MBMS M2AP ID | M | | 9.2.3.2 | | YES | ignore |
| Criticality Diagnostics | O | | 9.2.1.7 | | YES | ignore |

9.1.7 MBMS SCHEDULING INFORMATION

This message is sent by the MCE to provide MCCH related information to the eNB.

Direction: MCE → eNB.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|--------------------------------------|----------|------------------------------------|-----------------------|-----------------------|-------------|----------------------|
| Message Type | M | | 9.2.1.1 | | YES | reject |
| MCCH Update Time | M | | 9.2.1.19 | | YES | reject |
| MBSFN Area Configuration List | | 1 | | | YES | reject |
| >MBSFN Area Configuration Item IEs | | 1 to <maxnoofMBSFNareas> | | | EACH | reject |
| >>PMCH Configuration List | | 1 | | | YES | reject |
| >>>PMCH Configuration Item IEs | | 0 to <maxnoofPMCHsperMBSFNarea> | | | EACH | reject |
| >>>>PMCH Configuration | M | | 9.2.1.8 | | - | |
| >>>>MBMS Session List per PMCH | M | | 9.2.1.9 | | - | |
| >>Subframes Configuration List | | 1 | | | YES | reject |
| >>>Subframes Configuration Item IEs | | 1 to <maxnoofMBSFNallocations> | | | EACH | reject |
| >>>>MBSFN Subframe Configuration | M | | 9.2.1.17 | | - | |
| >>Common Subframe Allocation Period | M | | 9.2.1.18 | | YES | reject |
| >>MBSFN Area ID | M | | 9.2.1.14 | | YES | reject |

| Range bound | Explanation |
|--------------------------|---|
| maxnoofMBSFNareas | Maximum no. of MBSFN areas served by a single eNB. The value for maxnoofMBSFNareas is 256. |
| maxnoofPMCHsperMBSFNarea | Maximum no. of PMCHs possible per MBSFN. The value for maxnoofPMCHsperMBSFNarea is 15. |
| maxnoofMBSFNallocations | Maximum no. of MBSFN frame allocations with different offset. The value for maxnoofMBSFNallocations is 8. |

9.1.8 MBMS SCHEDULING INFORMATION RESPONSE

This message is sent by the eNB to acknowledge the MBMS SCHEDULING INFORMATION message.

Direction: eNB → MCE.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|-------------------------|----------|-------|-----------------------|-----------------------|-------------|----------------------|
| Message Type | M | | 9.2.1.1 | | YES | reject |
| Criticality Diagnostics | O | | 9.2.1.7 | | YES | ignore |

9.1.9 RESET

This message is either sent by the eNB or the MCE and is used to request the M2 interface to be reset.

Direction: eNB → MCE, MCE → eNB

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|----------|---|-----------------------------|-----------------------|-------------|----------------------|
| Message Type | M | | 9.2.1.1 | | YES | reject |
| Cause | M | | 9.2.1.2 | | YES | ignore |
| CHOICE <i>Reset Type</i> | M | | | | YES | reject |
| >M2 interface | | | | | | |
| >>Reset All | M | | ENUMERATED (Reset all, ...) | | – | – |
| >Part of M2 interface | | | | | | |
| >>MBMS-Service-associated logical M2-connection list | | 1 | | | – | – |
| >>>MBMS-Service - associated logical M2-connection Item | | 1 to < <i>maxnoofIndividualM2ConnectionsToReset</i> > | | | EACH | reject |
| >>>>eNB MBMS M2AP ID | O | | 9.2.3.2 | | – | – |
| >>>>MCE MBMS M2AP ID | O | | 9.2.3.1 | | – | – |

| Range bound | Explanation |
|---------------------------------------|--|
| maxnoofIndividualM2ConnectionsToReset | Maximum no. of MBMS-Service-associated logical M2-connections allowed to reset in one message. Value is 256. |

9.1.10 RESET ACKNOWLEDGE

This message is sent as a response to the RESET message.

Direction: MCE → eNB, eNB → MCE.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|----------|---|-----------------------|-----------------------|-------------|----------------------|
| Message Type | M | | 9.2.1.1 | | YES | reject |
| MBMS-Service-associated logical M2-connection list | | 0..1 | | | YES | ignore |
| >MBMS-Service - associated logical M2-connection Item | | 1 to < <i>maxnoofIndividualM2ConnectionsToReset</i> > | | | EACH | ignore |
| >>eNB MBMS M2AP ID | O | | 9.2.3.2 | | – | – |
| >>MCE MBMS M2AP ID | O | | 9.2.3.1 | | – | – |
| Criticality Diagnostics | O | | 9.2.1.7 | | YES | ignore |

| Range bound | Explanation |
|---------------------------------------|--|
| maxnoofIndividualM2ConnectionsToReset | Maximum no. of MBMS-Service-associated logical M2-connections allowed to reset in one message. Value is 256. |

9.1.11 M2 SETUP REQUEST

This message is sent by the eNB to initiate the M2 interface instance.

Direction: eNB → MCE.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---------------------------------------|----------|---------------------|-------------------------------|-----------------------|-------------|----------------------|
| Message Type | M | | 9.2.1.1 | | YES | reject |
| Global eNB ID | M | | 9.2.1.10 | | YES | reject |
| eNB Name | O | | Printable String (1..150,...) | | YES | ignore |
| eNB MBMS Configuration data per cell | | 1 | | | YES | reject |
| >eNB MBMS Configuration data Item IEs | | 1 to <maxnoofCells> | | | EACH | reject |
| >>eNB MBMS Configuration data Item | M | | 9.2.1.12 | | - | |

| Range bound | Explanation |
|--------------|---|
| maxnoofCells | Maximum no. of cells that may be served by an eNB. The value for maxnoofCells is 256. |

9.1.12 M2 SETUP RESPONSE

This message is sent by the MCE to complete the initiation of an M2 interface instance, providing MCCH related BCCH information.

Direction: MCE → eNB.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|----------|--------------------------|-------------------------------|-----------------------|-------------|----------------------|
| Message Type | M | | 9.2.1.1 | | YES | reject |
| Global MCE ID | M | | 9.2.1.16 | | YES | reject |
| MCE Name | O | | Printable String (1..150,...) | | YES | ignore |
| MCCH related BCCH Configuration data per MBSFN area | | 1 | | | YES | reject |
| >MCCH related BCCH Configuration data Item IEs | | 1 to <maxnoofMBSFNareas> | | | EACH | reject |
| >> MCCH related BCCH Configuration Item | M | | 9.2.1.13 | | - | |

| Range bound | Explanation |
|-------------------|--|
| maxnoofMBSFNareas | Maximum no. of MBSFN areas served by a single eNB. The value for maxnoofMBSFNareas is 256. |

9.1.13 M2 SETUP FAILURE

This message is sent by the MCE to indicate non acceptance of the M2 Setup Request.

Direction: MCE → eNB.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|-------------------------|----------|-------|-----------------------|-----------------------|-------------|----------------------|
| Message Type | M | | 9.2.1.1 | | YES | reject |
| Cause | M | | 9.2.1.2 | | YES | ignore |
| Time To Wait | O | | 9.2.1.15 | | YES | ignore |
| Criticality Diagnostics | O | | 9.2.1.7 | | YES | ignore |

9.1.14 ENB CONFIGURATION UPDATE

This message is sent by the eNB to indicate that application level configuration data has changed in the eNB.

Direction: eNB → MCE.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---------------------------------------|----------|------------------------|----------------------------------|-----------------------|-------------|----------------------|
| Message Type | M | | 9.2.1.1 | | YES | reject |
| Global eNB ID | O | | 9.2.1.10 | | YES | reject |
| eNB Name | O | | Printable String (1..150,...) | | YES | ignore |
| eNB MBMS Configuration data per cell | | 0..1 | | | YES | reject |
| >eNB MBMS Configuration data Item IEs | | 1 to <maxnoofCells> | | | EACH | reject |
| >>CHOICE eNB ID | M | | | | | |
| >>>eNB MBMS Configuration data Item | | | 9.2.1.12 | | | |
| >>>E-UTRAN CGI | | | 9.2.1.11 | | | |

| Range bound | Explanation |
|--------------|---|
| maxnoofCells | Maximum no. of cells that may be served by an eNB. The value for maxnoofCells is 256. |

9.1.15 ENB CONFIGURATION UPDATE ACKNOWLEDGE

This message acknowledges the ENB CONFIGURATION UPDATE message.

Direction: MCE → eNB.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|---|----------|-----------------------------|-----------------------|-----------------------|-------------|----------------------|
| Message Type | M | | 9.2.1.1 | | YES | reject |
| MCCH related BCCH Configuration data per MBSFN area | | 0..1 | | | YES | reject |
| >MCCH related BCCH Configuration data Item IEs | | 1 to <maxnoofMBSFNareas> | | | EACH | reject |
| >>MCCH related BCCH Configuration Item | M | | 9.2.1.13 | | - | |
| Criticality Diagnostics | O | | 9.2.1.7 | | YES | ignore |

| Range bound | Explanation |
|-------------------|--|
| maxnoofMBSFNareas | Maximum no. of MBSFN areas served by a single eNB. The value for maxnoofMBSFNareas is 256. |

9.1.16 ENB CONFIGURATION UPDATE FAILURE

This message is sent by the MCE to indicate non acceptance of the eNB Configuration Update.

Direction: MCE → eNB.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|-------------------------|----------|-------|-----------------------|-----------------------|-------------|----------------------|
| Message Type | M | | 9.2.1.1 | | YES | reject |
| Cause | M | | 9.2.1.2 | | YES | ignore |
| Time To Wait | O | | 9.2.1.15 | | YES | ignore |
| Criticality Diagnostics | O | | 9.2.1.7 | | YES | ignore |

9.1.17 MCE CONFIGURATION UPDATE

This message is sent by the MCE to indicate that application level configuration data has changed in the MCE.

Direction: MCE → eNB.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|--|----------|--------------------------|-------------------------------|-----------------------|-------------|----------------------|
| Message Type | M | | 9.2.1.1 | | YES | reject |
| Global MCE ID | O | | 9.2.1.16 | | YES | reject |
| MCE Name | O | | Printable String (1..150,...) | | YES | ignore |
| MCCH related BCCH Configuration data per MBSFN area | | 0..1 | | | YES | reject |
| >MCCH related BCCH Configuration data Item IEs | | 1 to <maxnoofMBSFNareas> | | | EACH | reject |
| >>MCCH related BCCH Configuration Item | M | | 9.2.1.13 | | - | |

| Range bound | Explanation |
|-------------------|--|
| maxnoofMBSFNareas | Maximum no. of MBSFN areas served by a single eNB. The value for maxnoofMBSFNareas is 256. |

9.1.18 MCE CONFIGURATION UPDATE ACKNOWLEDGE

This message acknowledges the MCE CONFIGURATION UPDATE message.

Direction: eNB → MCE.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|-------------------------|----------|-------|-----------------------|-----------------------|-------------|----------------------|
| Message Type | M | | 9.2.1.1 | | YES | reject |
| Criticality Diagnostics | O | | 9.2.1.7 | | YES | ignore |

9.1.19 MCE CONFIGURATION UPDATE FAILURE

This message is sent by the eNB to indicate non acceptance of the MCE Configuration Update.

Direction: eNB → MCE.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|-------------------------|----------|-------|-----------------------|-----------------------|-------------|----------------------|
| Message Type | M | | 9.2.1.1 | | YES | reject |
| Cause | M | | 9.2.1.2 | | YES | ignore |
| Time To Wait | O | | 9.2.1.15 | | YES | ignore |
| Criticality Diagnostics | O | | 9.2.1.7 | | YES | ignore |

9.1.20 ERROR INDICATION

This message is sent by both the MCE and the eNB and is used to indicate that some error has been detected in the node.

Direction: MCE → eNB and eNB → MCE.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|-------------------------|----------|-------|-----------------------|-----------------------|-------------|----------------------|
| Message Type | M | | 9.2.1.1 | | YES | ignore |
| MCE MBMS M2AP ID | O | | 9.2.3.1 | | YES | ignore |
| eNB MBMS M2AP ID | O | | 9.2.3.2 | | YES | ignore |
| Cause | O | | 9.2.1.2 | | YES | ignore |
| Criticality Diagnostics | O | | 9.2.1.7 | | YES | ignore |

9.1.21 MBMS SESSION UPDATE REQUEST

This message is sent by the MCE to the eNB in order to inform of the change of session characteristics e.g. service area of one MBMS service session.

Direction: MCE → eNB.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|------------------------|----------|-------|-----------------------|-----------------------|-------------|----------------------|
| Message Type | M | | 9.2.1.1 | | YES | reject |
| MCE MBMS M2AP ID | M | | 9.2.3.1 | | YES | reject |
| eNB MBMS M2AP ID | M | | 9.2.3.2 | | YES | reject |
| TMGI | M | | 9.2.3.3 | | YES | reject |
| MBMS Session Identity | O | | 9.2.3.4 | | YES | ignore |
| MBMS Service Area | O | | 9.2.3.6 | | YES | ignore |
| TNL Information | O | | | | YES | reject |
| >IP Multicast Address | M | | 9.2.2.1 | | - | |
| >IP Source Address | M | | IP Address 9.2.2.1 | | - | |
| >GTP DL TEID | M | | GTP-TEID 9.2.2.2 | | - | |

9.1.22 MBMS SESSION UPDATE RESPONSE

This message is sent by the eNB to report the successful outcome of the request from the MBMS SESSION UPDATE REQUEST message.

Direction: eNB → MCE.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|-------------------------|----------|-------|-----------------------|-----------------------|-------------|----------------------|
| Message Type | M | | 9.2.1.1 | | YES | reject |
| MCE MBMS M2AP ID | M | | 9.2.3.1 | | YES | ignore |
| eNB MBMS M2AP ID | M | | 9.2.3.2 | | YES | ignore |
| Criticality Diagnostics | O | | 9.2.1.7 | | YES | ignore |

9.1.23 MBMS SESSION UPDATE FAILURE

This message is sent by the eNB to report the unsuccessful outcome of the request from the MBMS SESSION UPDATE REQUEST message.

Direction: eNB → MCE.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description | Criticality | Assigned Criticality |
|-------------------------|----------|-------|-----------------------|-----------------------|-------------|----------------------|
| Message Type | M | | 9.2.1.1 | | YES | reject |
| MCE MBMS M2AP ID | M | | 9.2.3.1 | | YES | ignore |
| eNB MBMS M2AP ID | M | | 9.2.3.2 | | YES | ignore |
| Cause | M | | 9.2.1.2 | | YES | ignore |
| Criticality Diagnostics | O | | 9.2.1.7 | | YES | ignore |

9.2 Information Element Definitions

9.2.1 Radio Network Layer Related IEs

9.2.1.1 Message Type

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

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|---------------------|----------|-------|--|------------------------------------|
| Message Type | | | | Assumed max no of messages is 256. |
| >Procedure Code | M | | (Session Start, Session Stop, MBMS Scheduling Information, Reset, M2 Setup, eNB Configuration Update, MCE Configuration Update, Error Indication, Session Update, ...) | |
| >Type of Message | M | | CHOICE (Initiating Message, Successful Outcome, Unsuccessful Outcome, ...) | |

9.2.1.2 Cause

The purpose of the *Cause* IE is to indicate the reason for a particular event for the M2AP protocol.

| IE/Group Name | Presence | Range | IE Type and Reference | Semantics Description |
|-----------------------------|----------|-------|--|-----------------------|
| CHOICE Cause Group | M | | | |
| >Radio Network Layer | | | | |
| >>Radio Network Layer Cause | M | | ENUMERATED (Unknown or already allocated MCE MBMS M2AP ID, Unknown or already allocated eNB MBMS M2AP ID, Unknown or inconsistent pair of MBMS M2AP IDs, Radio resources not available, Interaction with other procedure, Unspecified, ...) | |
| >Transport Layer | | | | |
| >>Transport Layer Cause | M | | ENUMERATED (Transport Resource Unavailable, Unspecified, ...) | |
| > NAS | | | | |
| >> NAS Cause | M | | ENUMERATED (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, Abstract Syntax Error (Falsely Constructed Message), Unspecified, ...) | |
| >Misc | | | | |
| >>Miscellaneous Cause | M | | ENUMERATED (Control Processing Overload, Hardware Failure, O&M Intervention, Unspecified, ...) | |

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

| Radio Network Layer cause | Meaning |
|---|--|
| Unknown or already allocated MCE MBMS M2AP ID | The action failed because the MCE MBMS M2AP ID is either unknown, or (for a first message received at the eNB) is known and already allocated to an existing MBMS service related context. |
| Unknown or already allocated eNB MBMS M2AP ID | The action failed because the eNB MBMS M2AP ID is either unknown, or (for a first message received at the MCE) is known and already allocated to an existing context. |
| Unknown or inconsistent pair of MBMS M2AP IDs | The action failed because both MBMS M2AP IDs are unknown, or are known but do not define a single MBMS context. |
| Radio resources not available | No requested radio resources are available |
| Interaction with other procedure | The action is due to an ongoing interaction with another procedure |
| Unspecified | Sent for radio network layer cause when none of the specified cause values applies |

| Transport Layer cause | Meaning |
|--------------------------------|---|
| Transport Resource Unavailable | The required transport resources are not available |
| Unspecified | Sent for transport network layer cause when none of the specified cause values applies. |

| NAS cause | Meaning |
|------------------|---|
| Unspecified | Sent for NAS cause when none of the specified cause values applies. |

| Protocol cause | Meaning |
|---|---|
| Transfer Syntax Error | The received message included a transfer syntax error. |
| Abstract Syntax Error (Reject) | The received message included an abstract syntax error and the concerning criticality indicated "reject". |
| Abstract Syntax Error (Ignore And Notify) | The received message included an abstract syntax error and the concerning criticality indicated "ignore and notify". |
| Message Not Compatible With Receiver State | The received message was not compatible with the receiver state. |
| Semantic Error | The received message included a semantic error. |
| Abstract Syntax Error (Falsely Constructed Message) | The received message contained IEs or IE groups in wrong order or with too many occurrences. |
| Unspecified | Sent for protocol cause when none of the specified cause values applies. |
| Miscellaneous cause | Meaning |
| Control Processing Overload | Control processing overload |
| Hardware Failure | Action related to hardware failure |
| O&M Intervention | The action is due to O&M intervention. |
| 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, NAS or Protocol. |

9.2.1.3 Void

9.2.1.4 Void

9.2.1.5 Void

9.2.1.6 Void

9.2.1.7 Criticality Diagnostics

The *Criticality Diagnostics* IE is sent by the eNB or the MCE when parts of a received message have not been comprehended or were missing, or if the message contained logical errors. When applicable, it contains information about which IEs were not comprehended or were missing.

For further details on how to use the *Criticality Diagnostics* IE, (see section 10 in [4]).

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

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

9.2.1.8 PMCH Configuration

This information element provided PMCH configuration related content for MCCH.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|------------------------------|----------|-------|---|---|
| Allocated Subframes End | M | | INTEGER (0..1535) | Encoded as the <i>sf-AllocEnd</i> IE in[11] |
| Modulation and Coding Scheme | M | | INTEGER (0..28) | Encoded as the <i>dataMCS</i> IE in[11] |
| MCH Scheduling Period | M | | ENUMERATED (rf8, rf16, rf32, rf64, rf128, rf256, rf512, rf1024) | Encoded as the <i>mch-SchedulingPeriod</i> IE in [11] |

9.2.1.9 MBMS Session List per PMCH

This information element provided PMCH configuration related content for MCCH.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|--|----------|----------------------------------|-----------------------|--------------------------|
| MBMS Session List per PMCH Item IEs | | 1 to <maxnoofSessionsPerPMCH> | | |
| >MBMS Service Identity | M | | TMGI 9.2.3.3 | |
| >LCID | M | | INTEGER (0..28) | Logical Channel Identity |

| Range bound | Explanation |
|------------------------|---|
| maxnoofSessionsPerPMCH | Maximum no. of Sessions per PMCH. The value for maxnoofSessionsPerPMCH is 29. |

9.2.1.10 Global eNB ID

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

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|----------------------|----------|-------|-----------------------|---|
| PLMN Identity | M | | 9.2.3.7 | |
| CHOICE eNB ID | M | | | |
| >Macro eNB ID | | | BIT STRING (20) | Equal to the 20 leftmost bits of the <i>Cell Identity</i> IE contained in the <i>E-UTRAN CGI</i> IE (see section 9.2.1.11) of each cell served by the eNB |

9.2.1.11 E-UTRAN CGI

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

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|---------------|----------|-------|-----------------------|--|
| PLMN Identity | M | | 9.2.3.7 | |
| Cell Identity | M | | BIT STRING (28) | The 20 leftmost bits of the Cell Identity correspond to the eNB ID (<i>Global eNB ID</i> IE defined in section 9.2.1.10). |

9.2.1.12 eNB MBMS Configuration data Item IEs

This information element provides MBMS related configuration information from the eNB.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|-------------------------------|----------|--|-----------------------|-----------------------|
| E-UTRAN CGI | M | | 9.2.1.11 | |
| MBSFN Synchronisation Area Id | M | | 9.2.1.20 | |
| MBMS Service Area List | | 1 | | |
| >MBMS Service Area Item | | 1 to <maxnoofMBMSServiceAreasPerCell> | | |
| >>MBMS Service Area | M | | 9.2.3.6 | |

| Range bound | Explanation |
|--------------------------------|---|
| maxnoofMBMSServiceAreasPerCell | Maximum no. of Service Areas per cell. The value for maxnoofMBMSServiceAreasPerCell is 256. |

9.2.1.13 MCCH related BCCH Configuration Item

This information element provides MCCH related BCCH configuration information to the eNB.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|------------------------------|----------|---------------------|---|--|
| MBSFN Area Id | M | | 9.2.1.14 | |
| PDCCH Length | M | | ENUMERATED (s1, s2,...) | This IE is encoded along the number of OFDM symbols for PDCCH as of table 6.7-1. in [12]. |
| Repetition Period | M | | ENUMERATED (rf32, rf64, rf128, rf256) | The same encoding as the <i>mcch-RepetitionPeriod</i> in <i>mcch-Config</i> as specified in [11] |
| Offset | M | | INTEGER (0..10) | The same encoding as the <i>mcch-Offset</i> in <i>mcch-Config</i> as specified in [11] |
| Modification Period | M | | ENUMERATED (rf512, rf1024) | The same encoding as the <i>mcch-ModificationPeriod</i> in <i>mcch-Config</i> as specified in [11] |
| Subframe Allocation Info | M | | BIT STRING (SIZE(6)) | The same encoding as the <i>sf-AllocInfo</i> specified in [11] |
| Modulation and Coding Scheme | M | | ENUMERATED (n2, n7, n13, n19) | The same encoding as the <i>signallingMCS</i> specified in [11] |
| Cell Information List | | 0..1 | | |
| >Cell Information | | 1 to <maxnoofCells> | | |
| >>E-UTRAN CGI | M | | 9.2.1.11 | |
| >>Cell Reservation Info | M | | ENUMERATED (reservedCell, nonReservedCell, ...) | |

| Range bound | Explanation |
|--------------|---|
| maxnoofCells | Maximum no. of cells that may be served by an eNB. The value for maxnoofCells is 256. |

9.2.1.14 MBSFN Area Id

This IE defines the MBSFN Area Id.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|---------------|----------|-------|-----------------------|---|
| MBSFN Area Id | M | | INTEGER (0..255) | The same encoding as the <i>mbsfn-AreaId</i> specified in [11]. |

9.2.1.15 Time to Wait

This IE defines the minimum allowed waiting time.

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

9.2.1.16 Global MCE ID

This IE is used to globally identify an MCE.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|---------------|----------|-------|-----------------------|-----------------------|
| PLMN Identity | M | | 9.2.3.8 | |
| MCE ID | M | | OCTET STRING(SIZE(2)) | |

9.2.1.17 MBSFN Subframe Configuration

This IE indicates the MBSFN Subframe Configuration, as defined in [11].

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|-----------------------------------|----------|-------|--------------------------------------|---|
| Radio Frame Allocation Period | M | | ENUMERATED(n1, n2, n4, n8, n16, n32) | Semantics along the IE definition in [11] |
| Radio Frame Allocation Offset | M | | INTEGER(0..7) | Semantics along the IE definition in [11] |
| CHOICE Subframe Allocation | M | | | |
| >One Frame | | | | |
| >>One Frame Item | M | | BIT STRING(SIZE(6)) | Semantics along the IE definition in [11] |
| >Four Frames | | | | |
| >> Four Frame Item | M | | BIT STRING(SIZE(24)) | Semantics along the IE definition in [11] |

9.2.1.18 Common Subframe Allocation Period

This IE defines the period during which allocated subframes are divided between PMCHs configured for the MBSFN area, see [11].

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|-----------------------------------|----------|-------|---|---|
| Common Subframe Allocation Period | M | | ENUMERATED(rf4, rf8, rf6, rf32, rf64, rf128, rf256) | The same encoding as the <i>commonSF-AllocPeriod</i> as specified in [11] |

9.2.1.19 MCCH Update Time

This IE indicates the time at which the eNB shall apply the update of the MCCH as specified in [3].

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|------------------|----------|-------|-----------------------|--|
| MCCH Update Time | M | | INTEGER (0..255) | This IE indicates the modification period, as an absolute value, from when the MCCH update should be applied. Note: The duration of the modification period is configured in eNB and MCE: |

9.2.1.20 MBSFN Synchronisation Area Id

This IE defines the MBSFN Synchronisation Area Identity as specified in [3].

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|-------------------------------|----------|-------|-----------------------|--|
| MBSFN Synchronisation Area Id | M | | INTEGER (0..65535) | The MBSFN Synchronisation Area is defined in [3] |

9.2.2 Transport Network Layer Related IEs

9.2.2.1 IP Address

This information element is an IP address.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|---------------|----------|-------|-----------------------|---|
| IP Address | M | | OCTET STRING (4..16) | The Radio Network Layer is not supposed to interpret the address information. It should pass it to the transport layer for interpretation. For details on the IP Address, see ref. [13]. |

9.2.2.2 GTP-TEID

This information element is the GTP Tunnel Endpoint Identifier to be used for the user plane transport between eNB and the MBMS-GW.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|---------------|----------|-------|-----------------------|-----------------------|
| GTP TEID | M | | OCTET STRING (4) | |

9.2.3 NAS Related IEs

9.2.3.1 MCE MBMS M2AP ID

The MCE MBMS M2AP ID uniquely identifies the MBMS Service association over the M2 interface within the MCE.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|------------------|----------|-------|----------------------------|-----------------------|
| MCE MBMS M2AP ID | M | | INTEGER (0 .. $2^{24}-1$) | |

9.2.3.2 eNB MBMS M2AP ID

The eNB MBMS M2AP ID uniquely identifies the MBMS Service association over the M2 interface within the eNB.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|------------------|----------|-------|-----------------------|-----------------------|
| eNB MBMS M2AP ID | M | | INTEGER (0 .. 65535) | |

9.2.3.3 TMGI

The TMGI uniquely identifies the MBMS Bearer Service.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|----------------|----------|-------|-------------------------|-----------------------|
| TMGI | | | | |
| >PLMN identity | M | | 9.2.3.7 | |
| >Service ID | M | | OCTET STRING (SIZE (3)) | |

9.2.3.4 MBMS Session Identity

The MBMS Session Identity identifies the session of an MBMS Bearer Service in E-UTRAN and is used by the UE to recognise repetitions of the session.

This IE is transparent to RAN.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|-----------------------|----------|-------|-------------------------|---|
| MBMS Session Identity | M | | OCTET STRING (SIZE (1)) | Coded same way as the MBMS Session Identity IE as defined in [9]. |

9.2.3.5 Void

9.2.3.6 MBMS Service Area

The MBMS Service Area IE consists of a list of one or several MBMS Service Area Identities where each MBMS Service Area Identity is frequency agnostic and can be mapped onto one or more cells.

| IE/Group Name | Presence | Range | IE type and reference | Semantics description |
|-------------------|----------|-------|-----------------------|---|
| MBMS Service Area | M | | OCTET STRING | Value part coded per MBMS Service Area AVP as defined in [9]. |

9.2.3.7 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 (SIZE (3)) | <ul style="list-style-type: none">- 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 <p>-The Selected PLMN identity consists of 3 digits from MCC followed by either</p> <ul style="list-style-type: none">-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). |

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

9.3.1 General

M2AP ASN.1 definition conforms with [5] and [6].

Sub clause 9.3 presents the Abstract Syntax of the M2AP 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 M2AP messages. M2AP messages can contain any IEs specified in the object set definitions for that message without the order or number of occurrence being restricted by ASN.1. However, for this version of the standard, a sending entity shall construct an M2AP 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 an M2AP message that is not constructed as defined above is received, this shall be considered as Abstract Syntax Error, and the message shall be handled as defined for Abstract Syntax Error in clause 10.

9.3.2 Usage of Private Message Mechanism for Non-standard Use

The private message mechanism for non-standard use may be used:

- for special operator (and/or vendor) specific features considered not to be part of the basic functionality, i.e. the functionality required for a complete and high-quality specification in order to guarantee multivendor inter-operability.
- by vendors for research purposes, e.g. to implement and evaluate new algorithms/features before such features are proposed for standardisation.

The private message mechanism shall not be used for basic functionality. Such functionality shall be standardised.

9.3.3 Elementary Procedure Definitions

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

```
M2AP-PDU-Descriptions {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (21) modules (3) m2ap (4) version1 (1) m2ap-PDU-Descriptions (0) }
```

```
DEFINITIONS AUTOMATIC TAGS ::=
```

```
BEGIN
```

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

```
IMPORTS
```

```
    Criticality,
    ProcedureCode
```

```
FROM M2AP-CommonDataTypes
```

```
    SessionStartRequest,
    SessionStartResponse,
    SessionStartFailure,
    SessionStopRequest,
    SessionStopResponse,
    SessionUpdateRequest,
    SessionUpdateResponse,
    SessionUpdateFailure,
    MbmsSchedulingInformation,
    MbmsSchedulingInformationResponse,
    ErrorIndication,
    Reset,
    ResetAcknowledge,
    M2SetupRequest,
    M2SetupResponse,
    M2SetupFailure,
    ENBConfigurationUpdate,
    ENBConfigurationUpdateAcknowledge,
    ENBConfigurationUpdateFailure,
    MCEConfigurationUpdate,
    MCEConfigurationUpdateAcknowledge,
    MCEConfigurationUpdateFailure,
    PrivateMessage
```

```
FROM M2AP-PDU-Contents
```

```
    id-sessionStart,
    id-sessionStop,
    id-sessionUpdate,
    id-mbmsSchedulingInformation,
    id-errorIndication,
    id-reset,
    id-m2Setup,
    id-eNBConfigurationUpdate,
```

```

    id-mCEConfigurationUpdate,
    id-privateMessage
FROM M2AP-Constants;

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

M2AP-ELEMENTARY-PROCEDURE ::= CLASS {
    &InitiatingMessage          ,
    &SuccessfulOutcome          OPTIONAL,
    &UnsuccessfulOutcome        OPTIONAL,
    &procedureCode              ProcedureCode UNIQUE,
    &criticality                 Criticality   DEFAULT ignore
}
WITH SYNTAX {
    INITIATING MESSAGE          &InitiatingMessage
    [SUCCESSFUL OUTCOME        &SuccessfulOutcome]
    [UNSUCCESSFUL OUTCOME      &UnsuccessfulOutcome]
    PROCEDURE CODE             &procedureCode
    [CRITICALITY                &criticality]
}

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

M2AP-PDU ::= CHOICE {
    initiatingMessage      InitiatingMessage,
    successfulOutcome      SuccessfulOutcome,
    unsuccessfulOutcome    UnsuccessfulOutcome,
    ...
}

InitiatingMessage ::= SEQUENCE {
    procedureCode      M2AP-ELEMENTARY-PROCEDURE.&procedureCode      ( {M2AP-ELEMENTARY-PROCEDURES} ),
    criticality        M2AP-ELEMENTARY-PROCEDURE.&criticality          ( {M2AP-ELEMENTARY-PROCEDURES} { @procedureCode } ),
    value              M2AP-ELEMENTARY-PROCEDURE.&InitiatingMessage ( {M2AP-ELEMENTARY-PROCEDURES} { @procedureCode } )
}

SuccessfulOutcome ::= SEQUENCE {
    procedureCode      M2AP-ELEMENTARY-PROCEDURE.&procedureCode      ( {M2AP-ELEMENTARY-PROCEDURES} ),
    criticality        M2AP-ELEMENTARY-PROCEDURE.&criticality          ( {M2AP-ELEMENTARY-PROCEDURES} { @procedureCode } ),
    value              M2AP-ELEMENTARY-PROCEDURE.&SuccessfulOutcome ( {M2AP-ELEMENTARY-PROCEDURES} { @procedureCode } )
}

UnsuccessfulOutcome ::= SEQUENCE {
    procedureCode      M2AP-ELEMENTARY-PROCEDURE.&procedureCode      ( {M2AP-ELEMENTARY-PROCEDURES} ),
    criticality        M2AP-ELEMENTARY-PROCEDURE.&criticality          ( {M2AP-ELEMENTARY-PROCEDURES} { @procedureCode } ),
}

```



```

    value          M2AP-ELEMENTARY-PROCEDURE.&UnsuccessfulOutcome  ({M2AP-ELEMENTARY-PROCEDURES}{@procedureCode})
  }

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

M2AP-ELEMENTARY-PROCEDURES M2AP-ELEMENTARY-PROCEDURE ::= {
  M2AP-ELEMENTARY-PROCEDURES-CLASS-1      |
  M2AP-ELEMENTARY-PROCEDURES-CLASS-2      ,
  ...
}

M2AP-ELEMENTARY-PROCEDURES-CLASS-1 M2AP-ELEMENTARY-PROCEDURE ::= {
  sessionStart
  sessionStop
  sessionUpdate
  mbmsSchedulingInformation
  reset
  m2Setup
  eNBConfigurationUpdate
  mCEConfigurationUpdate
  ...
}

M2AP-ELEMENTARY-PROCEDURES-CLASS-2 M2AP-ELEMENTARY-PROCEDURE ::= {
  errorIndication
  privateMessage
  ...
}

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

sessionStart M2AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE      SessionStartRequest
  SUCCESSFUL OUTCOME      SessionStartResponse
  UNSUCCESSFUL OUTCOME    SessionStartFailure
  PROCEDURE CODE          id-sessionStart
  CRITICALITY             reject
}

sessionStop M2AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE      SessionStopRequest
  SUCCESSFUL OUTCOME      SessionStopResponse
  PROCEDURE CODE          id-sessionStop
}

```

```
    CRITICALITY          reject
}

sessionUpdate M2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE    SessionUpdateRequest
    SUCCESSFUL OUTCOME    SessionUpdateResponse
    UNSUCCESSFUL OUTCOME SessionUpdateFailure
    PROCEDURE CODE        id-sessionUpdate
    CRITICALITY           reject
}

mbmsSchedulingInformation M2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE    MbmsSchedulingInformation
    SUCCESSFUL OUTCOME    MbmsSchedulingInformationResponse
    PROCEDURE CODE        id-mbmsSchedulingInformation
    CRITICALITY           reject
}

errorIndication M2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE    ErrorIndication
    PROCEDURE CODE        id-errorIndication
    CRITICALITY           ignore
}

reset M2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE    Reset
    SUCCESSFUL OUTCOME    ResetAcknowledge
    PROCEDURE CODE        id-reset
    CRITICALITY           reject
}

m2Setup M2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE    M2SetupRequest
    SUCCESSFUL OUTCOME    M2SetupResponse
    UNSUCCESSFUL OUTCOME M2SetupFailure
    PROCEDURE CODE        id-m2Setup
    CRITICALITY           reject
}

eNBConfigurationUpdate M2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE    ENBConfigurationUpdate
    SUCCESSFUL OUTCOME    ENBConfigurationUpdateAcknowledge
    UNSUCCESSFUL OUTCOME ENBConfigurationUpdateFailure
    PROCEDURE CODE        id-eNBConfigurationUpdate
    CRITICALITY           reject
}

mCEConfigurationUpdate M2AP-ELEMENTARY-PROCEDURE ::= {
    INITIATING MESSAGE    MCEConfigurationUpdate
    SUCCESSFUL OUTCOME    MCEConfigurationUpdateAcknowledge
    UNSUCCESSFUL OUTCOME MCEConfigurationUpdateFailure
    PROCEDURE CODE        id-mCEConfigurationUpdate
    CRITICALITY           reject
}
```

```
privateMessage          M2AP-ELEMENTARY-PROCEDURE ::= {
  INITIATING MESSAGE    PrivateMessage
  PROCEDURE CODE        id-privateMessage
  CRITICALITY           ignore
}

END
```

9.3.4 PDU Definitions

```
-- *****
--
-- PDU definitions for M2AP.
--
-- *****

M2AP-PDU-Contents {
  itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
  eps-Access (21) modules (3) m2ap (4) version1 (1) m2ap-PDU-Contents (1) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

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

IMPORTS

  Cause,
  CriticalityDiagnostics,
  ENB-MBMS-Configuration-data-Item,
  ENB-MBMS-Configuration-data-ConfigUpdate-Item,
  ENB-MBMS-M2AP-ID,
  ENBname,
  GlobalENB-ID,
  GlobalMCE-ID,
  MBSFN-Area-ID,
  MBMS-Service-Area,
  MBMS-Session-ID,
  MBMSsessionListPerPMCH-Item,
  MBMS-Service-associatedLogicalM2-ConnectionItem,
  MBSFN-Subframe-Configuration,
  MCCH-Update-Time,
  MCCHrelatedBCCH-ConfigPerMBSFNArea-Item,
  MCE-MBMS-M2AP-ID,
  MCename,
  PMCH-Configuration,
  Common-Subframe-Allocation-Period,
```

TimeToWait,
TMGI,
TNL-Information

FROM M2AP-IEs

PrivateIE-Container{},
ProtocolExtensionContainer{},
ProtocolIE-Container{},
ProtocolIE-ContainerList{},
ProtocolIE-ContainerPair{},
ProtocolIE-ContainerPairList{},
ProtocolIE-Single-Container{},
M2AP-PRIVATE-IES,
M2AP-PROTOCOL-EXTENSION,
M2AP-PROTOCOL-IES,
M2AP-PROTOCOL-IES-PAIR

FROM M2AP-Containers

id-MCE-MBMS-M2AP-ID,
id-ENB-MBMS-M2AP-ID,
id-TMGI,
id-MBMS-Session-ID,
id-MBMS-Service-Area,
id-TNL-Information,
id-CriticalityDiagnostics,
id-Cause,
id-MBSFN-Area-Configuration-List,
id-MBSFN-Subframe-Configuration-Item,
id-MBSFN-Subframe-Configuration-List,
id-MCCH-Update-Time,
id-PMCH-Configuration-List,
id-PMCH-Configuration-Item,
id-Common-Subframe-Allocation-Period,
id-GlobalENB-ID,
id-ENBname,
id-ENB-MBMS-Configuration-data-List,
id-ENB-MBMS-Configuration-data-Item,
id-GlobalMCE-ID,
id-MCEname,
id-MCCHrelatedBCCH-ConfigPerMBSFNArea,
id-MCCHrelatedBCCH-ConfigPerMBSFNArea-Item,
id-TimeToWait,
id-ENB-MBMS-Configuration-data-List-ConfigUpdate,
id-ENB-MBMS-Configuration-data-ConfigUpdate-Item,
id-MBSFN-Area-ID,
id-ResetType,
id-MBMS-Service-associatedLogicalM2-ConnectionItem,
id-MBMS-Service-associatedLogicalM2-ConnectionListResAck,
maxnoofMBSFN-Allocations,
maxnoofMBSFNareas,
maxnoofPMCHsperMBSFNarea,
maxnoofCells,
maxnoofMBMSServiceAreasPerCell,

```

    maxnoofSessionsPerPMCH,
    maxnooferrors,
    maxNrOfIndividualM2ConnectionsToReset

FROM M2AP-Constants;

-- *****
--
-- SESSION START REQUEST
--
-- *****

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

SessionStartRequest-IEs M2AP-PROTOCOL-IES ::= {
    { ID id-MCE-MBMS-M2AP-ID          CRITICALITY reject  TYPE MCE-MBMS-M2AP-ID          PRESENCE mandatory } |
    { ID id-TMGI                      CRITICALITY reject  TYPE TMGI                      PRESENCE mandatory } |
    { ID id-MBMS-Session-ID           CRITICALITY ignore  TYPE MBMS-Session-ID         PRESENCE optional } |
    { ID id-MBMS-Service-Area         CRITICALITY reject  TYPE MBMS-Service-Area       PRESENCE mandatory } |
    { ID id-TNL-Information            CRITICALITY reject  TYPE TNL-Information         PRESENCE mandatory } ,
    ...
}

-- *****
--
-- SESSION START RESPONSE
--
-- *****

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

SessionStartResponse-IEs M2AP-PROTOCOL-IES ::= {
    { ID id-MCE-MBMS-M2AP-ID          CRITICALITY ignore  TYPE MCE-MBMS-M2AP-ID          PRESENCE mandatory } |
    { ID id-ENB-MBMS-M2AP-ID         CRITICALITY ignore  TYPE ENB-MBMS-M2AP-ID         PRESENCE mandatory } |
    { ID id-CriticalityDiagnostics    CRITICALITY ignore  TYPE CriticalityDiagnostics    PRESENCE optional } ,
    ...
}

-- *****
--
-- SESSION START FAILURE
--
-- *****

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

```

```

}

SessionStartFailure-IEs M2AP-PROTOCOL-IES ::= {
  { ID id-MCE-MBMS-M2AP-ID          CRITICALITY ignore TYPE MCE-MBMS-M2AP-ID PRESENCE mandatory } |
  { ID id-Cause                     CRITICALITY ignore TYPE Cause           PRESENCE mandatory } |
  { ID id-CriticalityDiagnostics     CRITICALITY ignore TYPE CriticalityDiagnostics PRESENCE optional } ,
  ...
}

-- *****
--
-- SESSION STOP REQUEST
--
-- *****

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

SessionStopRequest-IEs M2AP-PROTOCOL-IES ::= {
  { ID id-MCE-MBMS-M2AP-ID          CRITICALITY reject TYPE MCE-MBMS-M2AP-ID PRESENCE mandatory } |
  { ID id-ENB-MBMS-M2AP-ID         CRITICALITY reject TYPE ENB-MBMS-M2AP-ID PRESENCE mandatory } ,
  ...
}

-- *****
--
-- SESSION STOP RESPONSE
--
-- *****

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

SessionStopResponse-IEs M2AP-PROTOCOL-IES ::= {
  { ID id-MCE-MBMS-M2AP-ID          CRITICALITY ignore TYPE MCE-MBMS-M2AP-ID PRESENCE mandatory } |
  { ID id-ENB-MBMS-M2AP-ID         CRITICALITY ignore TYPE ENB-MBMS-M2AP-ID PRESENCE mandatory } |
  { ID id-CriticalityDiagnostics     CRITICALITY ignore TYPE CriticalityDiagnostics PRESENCE optional } ,
  ...
}

-- *****
--
-- SESSION UPDATE REQUEST
--
-- *****

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

```

```

}

SessionUpdateRequest-IEs M2AP-PROTOCOL-IES ::= {
  { ID id-MCE-MBMS-M2AP-ID          CRITICALITY reject TYPE MCE-MBMS-M2AP-ID PRESENCE mandatory } |
  { ID id-ENB-MBMS-M2AP-ID          CRITICALITY reject TYPE ENB-MBMS-M2AP-ID PRESENCE mandatory } |
  { ID id-TMGI                       CRITICALITY reject TYPE TMGI PRESENCE mandatory } |
  { ID id-MBMS-Session-ID           CRITICALITY ignore TYPE MBMS-Session-ID PRESENCE optional } |
  { ID id-MBMS-Service-Area          CRITICALITY ignore TYPE MBMS-Service-Area PRESENCE optional } |
  { ID id-TNL-Information             CRITICALITY reject TYPE TNL-Information PRESENCE optional } ,
  ...
}

-- *****
--
-- SESSION UPDATE RESPONSE
--
-- *****

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

SessionUpdateResponse-IEs M2AP-PROTOCOL-IES ::= {
  { ID id-MCE-MBMS-M2AP-ID          CRITICALITY ignore TYPE MCE-MBMS-M2AP-ID PRESENCE mandatory } |
  { ID id-ENB-MBMS-M2AP-ID          CRITICALITY ignore TYPE ENB-MBMS-M2AP-ID PRESENCE mandatory } |
  { ID id-CriticalityDiagnostics     CRITICALITY ignore TYPE CriticalityDiagnostics PRESENCE optional } ,
  ...
}

-- *****
--
-- SESSION UPDATE FAILURE
--
-- *****

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

SessionUpdateFailure-IEs M2AP-PROTOCOL-IES ::= {
  { ID id-MCE-MBMS-M2AP-ID          CRITICALITY ignore TYPE MCE-MBMS-M2AP-ID PRESENCE mandatory } |
  { ID id-ENB-MBMS-M2AP-ID          CRITICALITY ignore TYPE ENB-MBMS-M2AP-ID PRESENCE mandatory } |
  { ID id-Cause                     CRITICALITY ignore TYPE Cause PRESENCE mandatory } |
  { ID id-CriticalityDiagnostics     CRITICALITY ignore TYPE CriticalityDiagnostics PRESENCE optional } ,
  ...
}

-- *****
--
-- MBMS SCHEDULING INFORMATION
--
-- *****

```

```

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

MbmsSchedulingInformation-IEs M2AP-PROTOCOL-IES ::= {
    { ID id-MCCH-Update-Time          CRITICALITY reject  TYPE MCCH-Update-Time          PRESENCE mandatory } |
    { ID id-MBSFN-Area-Configuration-List  CRITICALITY reject  TYPE MBSFN-Area-Configuration-List  PRESENCE mandatory } ,
    ...
}

MBSFN-Area-Configuration-List ::= SEQUENCE (SIZE(1.. maxnoofMBSFNareas)) OF ProtocolIE-Container { { MBSFN-Area-Configuration-Item } }

MBSFN-Area-Configuration-Item M2AP-PROTOCOL-IES ::= {
    { ID id-PMCH-Configuration-List          CRITICALITY reject  TYPE PMCH-Configuration-List          PRESENCE mandatory } |
    { ID id-MBSFN-Subframe-Configuration-List  CRITICALITY reject  TYPE MBSFN-Subframe-ConfigurationList  PRESENCE mandatory } |
    { ID id-Common-Subframe-Allocation-Period  CRITICALITY reject  TYPE Common-Subframe-Allocation-Period  PRESENCE mandatory } |
    { ID id-MBSFN-Area-ID                    CRITICALITY reject  TYPE MBSFN-Area-ID                    PRESENCE mandatory } ,
    ...
}

PMCH-Configuration-List ::= SEQUENCE (SIZE(0.. maxnoofPMCHsperMBSFNarea)) OF ProtocolIE-Single-Container { { PMCH-Configuration-ItemIEs } }

PMCH-Configuration-ItemIEs M2AP-PROTOCOL-IES ::= {
    { ID id-PMCH-Configuration-Item  CRITICALITY reject  TYPE PMCH-Configuration-Item  PRESENCE mandatory } ,
    ...
}

PMCH-Configuration-Item ::= SEQUENCE {
    pmch-Configuration          PMCH-Configuration,
    mbms-Session-List          MBMSsessionListPerPMCH-Item,
    iE-Extensions              ProtocolExtensionContainer { { PMCH-Configuration-ItemExtIEs } } OPTIONAL,
    ...
}

PMCH-Configuration-ItemExtIEs M2AP-PROTOCOL-EXTENSION ::= {
    ...
}

MBSFN-Subframe-ConfigurationList ::= SEQUENCE (SIZE(1.. maxnoofMBSFN-Allocations)) OF ProtocolIE-Single-Container { { MBSFN-Subframe-ConfigurationItem } }

MBSFN-Subframe-ConfigurationItem M2AP-PROTOCOL-IES ::= {
    { ID id-MBSFN-Subframe-Configuration-Item  CRITICALITY reject  TYPE MBSFN-Subframe-Configuration  PRESENCE mandatory } ,
    ...
}

-- *****
--
-- MBMS SCHEDULING INFORMATION RESPONSE
--
-- *****

```



```

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

MbmsSchedulingInformationResponse-IEs M2AP-PROTOCOL-IES ::= {
    { ID id-CriticalityDiagnostics          CRITICALITY ignore  TYPE CriticalityDiagnostics PRESENCE optional },
    ...
}

-- *****
--
-- M2 SETUP REQUEST
--
-- *****

M2SetupRequest ::= SEQUENCE {
    protocolIEs          ProtocolIE-Container    {{M2SetupRequest-IEs}},
    ...
}

M2SetupRequest-IEs M2AP-PROTOCOL-IES ::= {
    { ID id-GlobalENB-ID                    CRITICALITY reject  TYPE GlobalENB-ID          PRESENCE mandatory } |
    { ID id-ENBname                          CRITICALITY ignore  TYPE ENBname                PRESENCE optional } |
    { ID id-ENB-MBMS-Configuration-data-List CRITICALITY reject  TYPE ENB-MBMS-Configuration-data-List PRESENCE mandatory } ,
    ...
}

ENB-MBMS-Configuration-data-List ::= SEQUENCE (SIZE(1.. maxnoofCells)) OF ProtocolIE-Single-Container { { ENB-MBMS-Configuration-data-ItemIEs } }

ENB-MBMS-Configuration-data-ItemIEs M2AP-PROTOCOL-IES ::= {
    { ID id-ENB-MBMS-Configuration-data-Item CRITICALITY reject  TYPE ENB-MBMS-Configuration-data-Item PRESENCE mandatory },
    ...
}

-- *****
--
-- M2 SETUP RESPONSE
--
-- *****

M2SetupResponse ::= SEQUENCE {
    protocolIEs          ProtocolIE-Container    {{ M2SetupResponse-IEs}},
    ...
}

M2SetupResponse-IEs M2AP-PROTOCOL-IES ::= {
    { ID id-GlobalMCE-ID                    CRITICALITY reject  TYPE GlobalMCE-ID          PRESENCE mandatory } |
    { ID id-MCENAME                          CRITICALITY ignore  TYPE MCENAME                PRESENCE optional } |
    { ID id-MCCHrelatedBCCH-ConfigPerMBSFNarea CRITICALITY reject  TYPE MCCHrelatedBCCH-ConfigPerMBSFNarea PRESENCE mandatory } |
    { ID id-CriticalityDiagnostics          CRITICALITY ignore  TYPE CriticalityDiagnostics PRESENCE optional } ,
    ...
}

```

```

}

MCCHrelatedBCCH-ConfigPerMBSFNArea ::= SEQUENCE (SIZE(1.. maxnoofMBSFNAreas)) OF ProtocolIE-Single-Container { { MCCHrelatedBCCH-
ConfigPerMBSFNArea-ItemIEs } }

MCCHrelatedBCCH-ConfigPerMBSFNArea-ItemIEs M2AP-PROTOCOL-IES ::= {
  { ID id-MCCHrelatedBCCH-ConfigPerMBSFNArea-Item CRITICALITY reject TYPE MCCHrelatedBCCH-ConfigPerMBSFNArea-Item PRESENCE mandatory },
  ...
}

-- *****
--
-- M2 SETUP FAILURE
--
-- *****

M2SetupFailure ::= SEQUENCE {
  protocolIEs ProtocolIE-Container {{ M2SetupFailure-IEs}},
  ...
}

M2SetupFailure-IEs M2AP-PROTOCOL-IES ::= {
  { ID id-Cause CRITICALITY ignore TYPE Cause PRESENCE mandatory } |
  { ID id-TimeToWait CRITICALITY ignore TYPE TimeToWait PRESENCE optional } |
  { ID id-CriticalityDiagnostics CRITICALITY ignore TYPE CriticalityDiagnostics PRESENCE optional },
  ...
}

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

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

ENBConfigurationUpdate-IEs M2AP-PROTOCOL-IES ::= {
  { ID id-GlobalENB-ID CRITICALITY reject TYPE GlobalENB-ID PRESENCE optional } |
  { ID id-ENBname CRITICALITY ignore TYPE ENBname PRESENCE optional } |
  { ID id-ENB-MBMS-Configuration-data-List-ConfigUpdate CRITICALITY reject TYPE ENB-MBMS-Configuration-data-List-ConfigUpdate PRESENCE
optional } ,
  ...
}

ENB-MBMS-Configuration-data-List-ConfigUpdate ::= SEQUENCE (SIZE(1.. maxnoofCells)) OF ProtocolIE-Single-Container { { ENB-MBMS-Configuration-data-
ConfigUpdate-ItemIEs } }

ENB-MBMS-Configuration-data-ConfigUpdate-ItemIEs M2AP-PROTOCOL-IES ::= {
  { ID id-ENB-MBMS-Configuration-data-ConfigUpdate-Item CRITICALITY reject TYPE ENB-MBMS-Configuration-data-ConfigUpdate-Item PRESENCE
mandatory } ,
  ...
}

```

```

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

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

ENBConfigurationUpdateAcknowledge-IEs M2AP-PROTOCOL-IES ::= {
    { ID id-MCCHrelatedBCCH-ConfigPerMBSFNArea          CRITICALITY reject  TYPE MCCHrelatedBCCH-ConfigPerMBSFNArea  PRESENCE optional } |
    { ID id-CriticalityDiagnostics                      CRITICALITY ignore   TYPE CriticalityDiagnostics  PRESENCE optional },
    ...
}

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

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

ENBConfigurationUpdateFailure-IEs M2AP-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 },
    ...
}

-- *****
--
-- MCE CONFIGURATION UPDATE
--
-- *****

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

MCEConfigurationUpdate-IEs M2AP-PROTOCOL-IES ::= {
    { ID id-GlobalMCE-ID          CRITICALITY reject  TYPE GlobalMCE-ID          PRESENCE optional } |
    { ID id-MCENAME              CRITICALITY ignore  TYPE MCENAME              PRESENCE optional } |

```

```

    { ID id-MCCHrelatedBCCH-ConfigPerMBSFNArea
      ...
    }
  }
-- *****
--
-- MCE CONFIGURATION UPDATE ACKNOWLEDGE
--
-- *****

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

MCEConfigurationUpdateAcknowledge-IEs M2AP-PROTOCOL-IES ::= {
  { ID id-CriticalityDiagnostics
    CRITICALITY ignore TYPE CriticalityDiagnostics PRESENCE optional },
  ...
}

-- *****
--
-- MCE CONFIGURATION UPDATE FAILURE
--
-- *****

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

MCEConfigurationUpdateFailure-IEs M2AP-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 },
  ...
}

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

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

ErrorIndication-IEs M2AP-PROTOCOL-IES ::= {
  { ID id-MCE-MBMS-M2AP-ID
    CRITICALITY ignore TYPE MCE-MBMS-M2AP-ID PRESENCE optional } |

```

```

    { ID id-ENB-MBMS-M2AP-ID          CRITICALITY ignore TYPE ENB-MBMS-M2AP-ID          PRESENCE optional } |
    { ID id-Cause                     CRITICALITY ignore TYPE Cause                PRESENCE optional } |
    { ID id-CriticalityDiagnostics     CRITICALITY ignore TYPE CriticalityDiagnostics PRESENCE optional } ,
    ...
}

-- *****
--
-- RESET
--
-- *****

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

Reset-IEs M2AP-PROTOCOL-IES ::= {
    { ID id-Cause          CRITICALITY ignore TYPE Cause                PRESENCE mandatory } |
    { ID id-ResetType     CRITICALITY reject  TYPE ResetType           PRESENCE mandatory } ,
    ...
}

ResetType ::= CHOICE {
    m2-Interface          ResetAll,
    partOfM2-Interface   MBMS-Service-associatedLogicalM2-ConnectionListRes,
    ...
}

ResetAll ::= ENUMERATED {
    reset-all,
    ...
}

MBMS-Service-associatedLogicalM2-ConnectionListRes ::= SEQUENCE (SIZE(1.. maxNrOfIndividualM2ConnectionsToReset)) OF ProtocolIE-Single-Container {
    { MBMS-Service-associatedLogicalM2-ConnectionItemRes } }

MBMS-Service-associatedLogicalM2-ConnectionItemRes M2AP-PROTOCOL-IES ::= {
    { ID id-MBMS-Service-associatedLogicalM2-ConnectionItem CRITICALITY reject TYPE MBMS-Service-associatedLogicalM2-ConnectionItem PRESENCE
    mandatory } ,
    ...
}

-- *****
--
-- RESET ACKNOWLEDGE
--
-- *****

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

```

```

ResetAcknowledge-IEs M2AP-PROTOCOL-IES ::= {
  { ID id-MBMS-Service-associatedLogicalM2-ConnectionListResAck      CRITICALITY ignore  TYPE MBMS-Service-associatedLogicalM2-
ConnectionListResAck          PRESENCE optional  }|
  { ID id-CriticalityDiagnostics  CRITICALITY ignore  TYPE CriticalityDiagnostics          PRESENCE optional },
  ...
}

MBMS-Service-associatedLogicalM2-ConnectionListResAck ::= SEQUENCE (SIZE(1.. maxNrOfIndividualM2ConnectionsToReset)) OF ProtocolIE-Single-Container
{ { MBMS-Service-associatedLogicalM2-ConnectionItemResAck } }

MBMS-Service-associatedLogicalM2-ConnectionItemResAck M2AP-PROTOCOL-IES ::= {
  { ID id-MBMS-Service-associatedLogicalM2-ConnectionItem  CRITICALITY ignore      TYPE MBMS-Service-associatedLogicalM2-ConnectionItem  PRESENCE
mandatory },
  ...
}

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

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

PrivateMessage-IEs M2AP-PRIVATE-IES ::= {
  ...
}

END

```

9.3.5 Information Element definitions

```

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

M2AP-IEs {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (21) modules (3) m2ap (4) version1 (1) m2ap-IEs (2) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS

    maxnoofMBSFNareas,

```

```
maxnoofPMCHsperMBSFNarea,
maxnoofCells,
maxnoofMBMSServiceAreasPerCell,
maxnoofSessionsPerPMCH,
maxnooferrors

FROM M2AP-Constants

Criticality,
ProcedureCode,
ProtocolIE-ID,
TriggeringMessage
FROM M2AP-CommonDataTypes

ProtocolExtensionContainer{},
ProtocolIE-Single-Container{},
M2AP-PROTOCOL-EXTENSION,
M2AP-PROTOCOL-IES
FROM M2AP-Containers;

-- A

AllocatedSubframesEnd ::= INTEGER (0..1535)

-- B

-- C

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

CauseMisc ::= ENUMERATED {
    control-processing-overload,
    hardware-failure,
    om-intervention,
    unspecified,
    ...
}

CauseNAS ::= ENUMERATED {
    unspecified,
    ...
}

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

```

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

CauseRadioNetwork ::= ENUMERATED {
    unknown-or-already-allocated-MCE-MBMS-M2AP-ID,
    unknown-or-already-allocated-eNB-MBMS-M2AP-ID,
    unknown-or-inconsistent-pair-of-MBMS-M2AP-IDs,
    radio-resources-not-available,
    interaction-with-other-procedure,
    unspecified,
    ...
}

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

Cell-Information ::= SEQUENCE {
    eCGI ECGI,
    cellReservationInfo ENUMERATED {reservedCell, nonReservedCell, ...},
    iE-Extensions ProtocolExtensionContainer { { Cell-Information-ExtIEs } } OPTIONAL,
    ...
}

Cell-Information-ExtIEs M2AP-PROTOCOL-EXTENSION ::= {
    ...
}

Cell-Information-List ::= SEQUENCE (SIZE(1..maxnoofCells)) OF Cell-Information

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

CriticalityDiagnostics-ExtIEs M2AP-PROTOCOL-EXTENSION ::= {
    ...
}

CriticalityDiagnostics-IE-List ::= SEQUENCE (SIZE (1..maxnooferrors)) OF

```



```

SEQUENCE {
    iCriticality          Criticality,
    iE-ID                ProtocolIE-ID,
    typeOfError          TypeOfError,
    iE-Extensions        ProtocolExtensionContainer { {CriticalityDiagnostics-IE-List-ExtIEs} } OPTIONAL,
    ...
}

CriticalityDiagnostics-IE-List-ExtIEs M2AP-PROTOCOL-EXTENSION ::= {
    ...
}

-- D
-- E

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

ECGI-ExtIEs M2AP-PROTOCOL-EXTENSION ::= {
    ...
}

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

ENB-MBMS-Configuration-data-Item ::= SEQUENCE {
    eCGI                ECGI,
    mbsfnSynchronisationArea MBSFN-SynchronisationArea-ID,
    mbmsServiceAreaList  MBMS-Service-Area-ID-List,
    iE-Extensions        ProtocolExtensionContainer { { ENB-MBMS-Configuration-data-Item-ExtIEs } } OPTIONAL,
    ...
}

ENB-MBMS-Configuration-data-Item-ExtIEs M2AP-PROTOCOL-EXTENSION ::= {
    ...
}

ENB-MBMS-Configuration-data-ConfigUpdate-Item ::= CHOICE {
    mBMSConfigData      ENB-MBMS-Configuration-data-Item,
    eCGI                ECGI,
    ...
}

ENB-MBMS-M2AP-ID ::= INTEGER (0..65535)

ENBname ::= PrintableString (SIZE (1..150,...))

```

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

-- F
-- G

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

GlobalENB-ID-ExtIEs M2AP-PROTOCOL-EXTENSION ::= {
    ...
}

GlobalMCE-ID ::= SEQUENCE {
    pLMN-Identity      PLMN-Identity,
    mCE-ID             MCE-ID,
    iE-Extensions     ProtocolExtensionContainer { {GlobalMCE-ID-ExtIEs} } OPTIONAL,
    ...
}

GlobalMCE-ID-ExtIEs M2AP-PROTOCOL-EXTENSION ::= {
    ...
}

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

-- H
-- I

IPAddress                ::= OCTET STRING (SIZE(4..16))

-- J
-- K
-- L

LCID                    ::= INTEGER (0..28)

-- M

MBMS-Service-associatedLogicalM2-ConnectionItem ::= SEQUENCE {
    eNB-MBMS-M2AP-ID      ENB-MBMS-M2AP-ID OPTIONAL,
    mCE-MBMS-M2AP-ID      MCE-MBMS-M2AP-ID OPTIONAL,
    iE-Extensions         ProtocolExtensionContainer { { MBMS-Service-associatedLogicalM2-ConnectionItemExtIEs} } OPTIONAL,
    ...
}

MBMS-Service-associatedLogicalM2-ConnectionItemExtIEs M2AP-PROTOCOL-EXTENSION ::= {
    ...
}
```

```

}

MBMS-Service-Area          ::= OCTET STRING

MBMS-Service-Area-ID-List ::= SEQUENCE (SIZE(1..maxnoofMBMSServiceAreasPerCell)) OF MBMS-Service-Area

MBMS-Session-Duration ::= OCTET STRING (SIZE (3))

MBMS-Session-ID ::= OCTET STRING (SIZE (1))

MBMSSessionListPerPMCH-Item ::= SEQUENCE (SIZE(1..maxnoofSessionsPerPMCH)) OF SEQUENCE {
    tmgi                TMGI,
    lcid                LCID,
    iE-Extensions      ProtocolExtensionContainer { { MBMSSessionListPerPMCH-Item-ExtIEs } } OPTIONAL,
    ...
}

MBMSSessionListPerPMCH-Item-ExtIEs M2AP-PROTOCOL-EXTENSION ::= {
    ...
}

MBSFN-Area-ID             ::= INTEGER (0..255)

MBSFN-SynchronisationArea-ID ::= INTEGER (0..65535)

MBSFN-Subframe-Configuration ::= SEQUENCE {
    radioframeAllocationPeriod    ENUMERATED {n1, n2, n4, n8, n16, n32},
    radioframeAllocationOffset    INTEGER (0..7),
    subframeAllocation            CHOICE {
        oneFrame                BIT STRING (SIZE (6) ),
        fourFrames              BIT STRING (SIZE (24) ) },
    iE-Extensions                ProtocolExtensionContainer { { MBSFN-Subframe-Configuration-ExtIEs } } OPTIONAL,
    ...
}

MBSFN-Subframe-Configuration-ExtIEs M2AP-PROTOCOL-EXTENSION ::= {
    ...
}

MCCH-Update-Time         ::= INTEGER (0..255)

MCCHrelatedBCCH-ConfigPerMBSFNArea-Item ::= SEQUENCE {
    mbsfnArea                MBSFN-Area-ID,
    pdcchLength              ENUMERATED {s1, s2, ...},
    repetitionPeriod         ENUMERATED {rf32, rf64, rf128, rf256},
    offset                   INTEGER (0..10),
    modificationPeriod       ENUMERATED {rf512, rf1024},
    subframeAllocationInfo    BIT STRING (SIZE(6)),
    modulationAndCodingScheme ENUMERATED {n2, n7, n13, n19},
    cellInformationList       Cell-Information-List OPTIONAL,
    iE-Extensions            ProtocolExtensionContainer { { MCCHrelatedBCCH-ConfigPerMBSFNArea-Item-ExtIEs } } OPTIONAL,
    ...
}

```

```
MCCHrelatedBCCH-ConfigPerMBSFNArea-Item-ExtIEs M2AP-PROTOCOL-EXTENSION ::= {
    ...
}

MCE-ID ::= OCTET STRING (SIZE(2))

MCE-MBMS-M2AP-ID ::= INTEGER (0.. 16777215)

MCENAME ::= PrintableString (SIZE (1..150,...))

MCH-Scheduling-Period ::= ENUMERATED {rf8, rf16, rf32, rf64, rf128, rf256, rf512, rf1024}
-- N
-- O
-- P

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

PMCH-Configuration ::= SEQUENCE {
    allocatedSubframesEnd AllocatedSubframesEnd,
    dataMCS INTEGER (0..28),
    mchSchedulingPeriod MCH-Scheduling-Period,
    iE-Extensions ProtocolExtensionContainer { {PMCH-Configuration-ExtIEs} } OPTIONAL,
    ...
}

PMCH-Configuration-ExtIEs M2AP-PROTOCOL-EXTENSION ::= {
    ...
}

Common-Subframe-Allocation-Period ::= ENUMERATED {rf4, rf8, rf6, rf32, rf64, rf128, rf256}

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

-- Q
-- R
-- S
-- T

TimeToWait ::= ENUMERATED {v1s, v2s, v5s, v10s, v20s, v60s, ...}

TMGI ::= SEQUENCE {
    pLMNidentity PLMN-Identity,
    serviceID OCTET STRING (SIZE (3)),
    iE-Extensions ProtocolExtensionContainer { {TMGI-ExtIEs} } OPTIONAL,
    ...
}

TMGI-ExtIEs M2AP-PROTOCOL-EXTENSION ::= {
    ...
}

TNL-Information ::= SEQUENCE {
```

```

    iPMCAAddress          IPAddress,
    iPSourceAddress       IPAddress,
    gTP-TEID              GTP-TEID,
    iE-Extensions         ProtocolExtensionContainer { {TNL-Information-ExtIEs} } OPTIONAL,
    ...
}

TNL-Information-ExtIEs M2AP-PROTOCOL-EXTENSION ::= {
    ...
}

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

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

END

```

9.3.6 Common definitions

```

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

M2AP-CommonDataTypes {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (21) modules (3) m2ap (4) version1 (1) m2ap-CommonDataTypes (3) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

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

maxPrivateIEs          INTEGER ::= 65535
maxProtocolExtensions  INTEGER ::= 65535
maxProtocolsIEs        INTEGER ::= 65535

```

```

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

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

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

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

ProcedureCode    ::= INTEGER (0..255)

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

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

END

```

9.3.7 Constant definitions

```

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

M2AP-Constants {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (21) modules (3) m2ap (4) version1 (1) m2ap-Constants (4) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

IMPORTS
    ProcedureCode,
    ProtocolIE-ID
FROM M2AP-CommonDataTypes;

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

id-sessionStart                               ProcedureCode ::= 0

```

```

id-sessionStop                      ProcedureCode ::= 1
id-mbmsSchedulingInformation         ProcedureCode ::= 2
id-errorIndication                   ProcedureCode ::= 3
id-reset                             ProcedureCode ::= 4
id-m2Setup                           ProcedureCode ::= 5
id-eNBConfigurationUpdate           ProcedureCode ::= 6
id-mCEConfigurationUpdate           ProcedureCode ::= 7
id-privateMessage                    ProcedureCode ::= 8
id-sessionUpdate                     ProcedureCode ::= 9

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

maxnoofMBSFNAreas                    INTEGER ::= 256
maxnoofMBSFN-Allocations              INTEGER ::= 8
maxnoofPMCHsperMBSFNArea             INTEGER ::= 15
maxnoofCells                          INTEGER ::= 256
maxnoofMBMSServiceAreasPerCell       INTEGER ::= 256
maxnoofSessionsPerPMCH               INTEGER ::= 29
maxnooferrors                         INTEGER ::= 256
maxNrOfIndividualM2ConnectionsToReset INTEGER ::= 256

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

id-MCE-MBMS-M2AP-ID                  ProtocolIE-ID ::= 0
id-ENB-MBMS-M2AP-ID                  ProtocolIE-ID ::= 1
id-TMGI                              ProtocolIE-ID ::= 2
id-MBMS-Session-ID                   ProtocolIE-ID ::= 3
id-MBMS-Service-Area                 ProtocolIE-ID ::= 6
id-TNL-Information                   ProtocolIE-ID ::= 7
id-CriticalityDiagnostics            ProtocolIE-ID ::= 8
id-Cause                             ProtocolIE-ID ::= 9
id-MBSFN-Area-Configuration-List     ProtocolIE-ID ::= 10
id-PMCH-Configuration-List           ProtocolIE-ID ::= 11
id-PMCH-Configuration-Item           ProtocolIE-ID ::= 12
id-GlobalENB-ID                      ProtocolIE-ID ::= 13
id-ENBname                           ProtocolIE-ID ::= 14
id-ENB-MBMS-Configuration-data-List  ProtocolIE-ID ::= 15
id-ENB-MBMS-Configuration-data-Item  ProtocolIE-ID ::= 16
id-GlobalMCE-ID                      ProtocolIE-ID ::= 17
id-MCEname                           ProtocolIE-ID ::= 18
id-MCCHrelatedBCCH-ConfigPerMBSFNArea ProtocolIE-ID ::= 19
id-MCCHrelatedBCCH-ConfigPerMBSFNArea-Item ProtocolIE-ID ::= 20
id-TimeToWait                         ProtocolIE-ID ::= 21
id-MBSFN-Subframe-Configuration-List ProtocolIE-ID ::= 22
id-MBSFN-Subframe-Configuration-Item ProtocolIE-ID ::= 23

```

| | |
|--|----------------------|
| id-Common-Subframe-Allocation-Period | ProtocolIE-ID ::= 24 |
| id-MCCH-Update-Time | ProtocolIE-ID ::= 25 |
| id-ENB-MBMS-Configuration-data-List-ConfigUpdate | ProtocolIE-ID ::= 26 |
| id-ENB-MBMS-Configuration-data-ConfigUpdate-Item | ProtocolIE-ID ::= 27 |
| id-MBMS-Service-associatedLogicalM2-ConnectionItem | ProtocolIE-ID ::= 28 |
| id-MBSFN-Area-ID | ProtocolIE-ID ::= 29 |
| id-ResetType | ProtocolIE-ID ::= 30 |
| id-MBMS-Service-associatedLogicalM2-ConnectionListResAck | ProtocolIE-ID ::= 31 |

END

9.3.8 Container definitions

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

M2AP-Containers {
itu-t (0) identified-organization (4) etsi (0) mobileDomain (0)
eps-Access (21) modules (3) m2ap (4) version1 (1) m2ap-Containers (5) }

DEFINITIONS AUTOMATIC TAGS ::=

BEGIN

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

IMPORTS
    maxPrivateIEs,
    maxProtocolExtensions,
    maxProtocolIEs,
    Criticality,
    Presence,
    PrivateIE-ID,
    ProtocolIE-ID
FROM M2AP-CommonDataTypes;

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

M2AP-PROTOCOL-IES ::= CLASS {
    &id                ProtocolIE-ID                UNIQUE,
```



```

        &criticality    Criticality,
        &Value,
        &presence      Presence
    }
    WITH SYNTAX {
        ID              &id
        CRITICALITY    &criticality
        TYPE            &Value
        PRESENCE       &presence
    }

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

M2AP-PROTOCOL-IES-PAIR ::= CLASS {
    &id                ProtocolIE-ID        UNIQUE,
    &firstCriticality  Criticality,
    &FirstValue,
    &secondCriticality Criticality,
    &SecondValue,
    &presence          Presence
}
WITH SYNTAX {
    ID                &id
    FIRST CRITICALITY &firstCriticality
    FIRST TYPE        &FirstValue
    SECOND CRITICALITY &secondCriticality
    SECOND TYPE       &SecondValue
    PRESENCE          &presence
}

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

M2AP-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
--
-- *****
M2AP-PRIVATE-IES ::= CLASS {
    &id          PrivateIE-ID,
    &criticality Criticality,
    &Value,
    &presence    Presence
}
WITH SYNTAX {
    ID          &id
    CRITICALITY &criticality
    TYPE        &Value
    PRESENCE    &presence
}
-- *****
--
-- Container for Protocol IEs
--
-- *****
ProtocolIE-Container {M2AP-PROTOCOL-IES : IEsSetParam} ::=
    SEQUENCE (SIZE (0..maxProtocolIEs)) OF
        ProtocolIE-Field {{IEsSetParam}}

ProtocolIE-Single-Container {M2AP-PROTOCOL-IES : IEsSetParam} ::=
    ProtocolIE-Field {{IEsSetParam}}

ProtocolIE-Field {M2AP-PROTOCOL-IES : IEsSetParam} ::= SEQUENCE {
    id          M2AP-PROTOCOL-IES.&id          ({{IEsSetParam}}),
    criticality M2AP-PROTOCOL-IES.&criticality ({{IEsSetParam}}{@id}),
    value       M2AP-PROTOCOL-IES.&Value      ({{IEsSetParam}}{@id})
}
-- *****
--
-- Container for Protocol IE Pairs
--
-- *****
ProtocolIE-ContainerPair {M2AP-PROTOCOL-IES-PAIR : IEsSetParam} ::=
    SEQUENCE (SIZE (0..maxProtocolIEs)) OF
        ProtocolIE-FieldPair {{IEsSetParam}}

ProtocolIE-FieldPair {M2AP-PROTOCOL-IES-PAIR : IEsSetParam} ::= SEQUENCE {
    id          M2AP-PROTOCOL-IES-PAIR.&id          ({{IEsSetParam}}),
    firstCriticality M2AP-PROTOCOL-IES-PAIR.&firstCriticality ({{IEsSetParam}}{@id}),
    firstValue     M2AP-PROTOCOL-IES-PAIR.&FirstValue ({{IEsSetParam}}{@id}),
    secondCriticality M2AP-PROTOCOL-IES-PAIR.&secondCriticality ({{IEsSetParam}}{@id}),
    secondValue    M2AP-PROTOCOL-IES-PAIR.&SecondValue ({{IEsSetParam}}{@id})
}

```

```

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

ProtocolIE-ContainerList {INTEGER : lowerBound, INTEGER : upperBound, M2AP-PROTOCOL-IES : IEsSetParam} ::=
  SEQUENCE (SIZE (lowerBound..upperBound)) OF
    ProtocolIE-Container {{IEsSetParam}}

ProtocolIE-ContainerPairList {INTEGER : lowerBound, INTEGER : upperBound, M2AP-PROTOCOL-IES-PAIR : IEsSetParam} ::=
  SEQUENCE (SIZE (lowerBound..upperBound)) OF
    ProtocolIE-ContainerPair {{IEsSetParam}}

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

ProtocolExtensionContainer {M2AP-PROTOCOL-EXTENSION : ExtensionSetParam} ::=
  SEQUENCE (SIZE (1..maxProtocolExtensions)) OF
    ProtocolExtensionField {{ExtensionSetParam}}

ProtocolExtensionField {M2AP-PROTOCOL-EXTENSION : ExtensionSetParam} ::= SEQUENCE {
  id                M2AP-PROTOCOL-EXTENSION.&id                ({{ExtensionSetParam}}),
  criticality       M2AP-PROTOCOL-EXTENSION.&criticality       ({{ExtensionSetParam}}{@id}),
  extensionValue    M2AP-PROTOCOL-EXTENSION.&Extension         ({{ExtensionSetParam}}{@id})
}

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

PrivateIE-Container {M2AP-PRIVATE-IES : IEsSetParam} ::=
  SEQUENCE (SIZE (1..maxPrivateIEs)) OF
    PrivateIE-Field {{IEsSetParam}}

PrivateIE-Field {M2AP-PRIVATE-IES : IEsSetParam} ::= SEQUENCE {
  id                M2AP-PRIVATE-IES.&id                ({{IEsSetParam}}),
  criticality       M2AP-PRIVATE-IES.&criticality       ({{IEsSetParam}}{@id}),
  value             M2AP-PRIVATE-IES.&Value             ({{IEsSetParam}}{@id})
}

END

```

9.4 Message Transfer Syntax

M2AP shall use the ASN.1 Basic Packed Encoding Rules (BASIC-PER) Aligned Variant as transfer syntax as specified in ref. [5].

9.5 Timers

10 Handling of Unknown, Unforeseen and Erroneous Protocol Data

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

Annex A (informative): Change history

| TSG # | TSG Doc. | CR | Rev | Subject/Comment | New |
|---------|-----------|------|-----|---|--------|
| 2008-02 | | | | First draft | 0.0.0 |
| 2009-10 | | | | Second draft | 0.0.1 |
| 2009-10 | | | | Draft with first content | 0.0.2 |
| 2009-10 | | | | Including comments from RAN3#65bis | 0.0.3 |
| 2009-10 | | | | Preparing RAN3#66 | 0.0.4 |
| 2009-10 | | | | Submission to RAN3#66, based on received comments | 0.0.5 |
| 2009-11 | | | | Update following discussions at RAN3#66 | 0.0.6 |
| 2009-11 | | | | further revisions along RAN2 agreements, step to v100 | 1.0.0 |
| 2009-11 | | | | incorporating comments along email discussions before RAN#46 | 1.1.0 |
| 2009-12 | | | | stepping the version to 2.0.0 for approval at RAN#46 | 2.0.0 |
| 46 | RP-091200 | | | Approved at RAN#46 | 9.0.0 |
| 47 | RP-100226 | 0001 | 1 | Some minor description corrections for M2AP | 9.1.0 |
| 47 | RP-100226 | 0002 | 1 | Removal of QoS information in MBMS Session Start message | 9.1.0 |
| 47 | RP-100226 | 0003 | | Clarification of MCCH Update Time | 9.1.0 |
| 47 | RP-100226 | 0004 | | Correct the descripton of Error Indication and misspelt of BIT STRING | 9.1.0 |
| 47 | RP-100227 | 0005 | 1 | Some corrections to TS36.443 | 9.1.0 |
| 47 | RP-100226 | 0006 | 1 | MBSFN subframe configuration | 9.1.0 |
| 47 | RP-100227 | 0008 | 2 | MBSFN Area Configuration | 9.1.0 |
| 47 | RP-100227 | 0009 | 1 | Miscellaneous corrections to TS36.443 | 9.1.0 |
| 47 | RP-100227 | 0010 | 2 | Optional MBMS Session ID | 9.1.0 |
| 47 | RP-100227 | 0013 | 3 | Remove the MBMS Session Duration IE from the MBMS Session Start Request message | 9.1.0 |
| 47 | RP-100227 | 0015 | 3 | Misc corrections | 9.1.0 |
| 47 | RP-100227 | 0016 | 2 | Introduction of MBMS Session Update in M2AP | 9.1.0 |
| 47 | RP-100227 | 0019 | 3 | Rapporteur"s update for M2AP protocol | 9.1.0 |
| 49 | RP-100906 | 0027 | | Alignment of tabulars to agreed notation for TS36.413 and TS36.423 | 9.2.0 |
| 2010-12 | | | | Created Rel-10 version based on v. 9.2.0 | 10.0.0 |

History

| Document history | | |
|-------------------------|--------------|-------------|
| V10.0.0 | January 2011 | Publication |
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