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GLOBAL SYSTEM FOR
MOBILE COMMUNICATIONS

Digital cellular telecommunications system (Phase 1); Mobile radio interface layer 3 specification Part 1: Generic (GSM 04.08 version 3.14.0)

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Foreword

This Interim European Telecommunication Standard (I-ETS) has been produced by the Special Mobile Group (SMG) of the European Telecommunications Standards Institute (ETSI)) and is now submitted for the One-step Approval Procedure (OAP) of the ETSI standards approval process.

This I-ETS describes the mobile radio interface layer 3 specification for call control, mobility management and radio resource management procedures within digital cellular telecommunications system (**Phase 1**).

Reference is made within this I-ETS to the following GSM Phase1 Technical Specifications:

Specification	**Abbreviated title**
GSM 02.02	Bearer services supported by a GSM PLMN.
GSM 02.03	Teleservices supported by a GSM PLMN.
GSM 02.09	Security aspects.
GSM 02.17	Subscriber identity modules, functional characteristics.
GSM 03.01	Network functions.
GSM 03.03	Numbering addressing and identification.
GSM 03.13	Discontinuous reception (DRX) in the GSM system.
GSM 03.14	Support of DTMF via the GSM system.
GSM 03.20	Security related network functions.
GSM 04.02	GSM PLMN access reference configuration.
GSM 04.03	Mobile Station - Base Station System (MS-BSS) interface: Channel structures and access capabilities.
GSM 04.04	MS-BSS layer 1 - general requirements.
GSM 04.05	Mobile Station - Base Station System (MS-BSS) data link layer - general aspects.
GSM 04.06	MS-BSS data link layer specification.
GSM 04.07	Mobile radio interface signalling layer 3 - general aspects.
GSM 04.10	Mobile radio interface layer 3 - supplementary services specification - general aspects.
GSM 04.11	Point-to-point short message service support on mobile radio interface.
GSM 04.12	Cell broadcast short message service support on mobile radio interface.
GSM 05.02	Multiplexing and multiple access on the radio path.
GSM 05.03	Channel coding.
GSM 05.08	Radio subsystem link control.
GSM 07.01	General on terminal adaptation functions for mobile stations.
GSM 09.02	Mobile application part specification.
GSM 09.06	Interworking between a PLMN and a PSPDN/ISDN for support of packet switched data transmission services.
GSM 09.07	General requirements on interworking between the PLMN and the ISDN or PSTN.
GSM 11.10	Mobile station conformity specifications.

The above specifications, together with annexes B, C, F, G and H of this standard, are considered as normative. Annexes D and E are informative.

NOTE: Items in this draft indicated as not complete, or requiring further study or work, are not required for the Phase 1 implementation of GSM.

The specification from which this I-ETS has been derived was originally based on CEPT documentation, hence this ETS is not in accordance with the ETSI drafting rules or in the ETSI style of presentation.

Proposed announcement date	
Date of latest announcement of this I-ETS (doa):	3 months after ETSI publication

ETSI/GSM **Version 3.14.0**

RECOMMENDATION GSM 04.08

Title: Mobile Radio Interface Layer 3 Specification

Date: August 1997

List of Contents:

(detailed list of contents given on next pages)

Number of pages: 446

Detailed list of contents:

1 GENERAL

This Recommendation specifies the procedures used at the radio interface (Reference Point Um, see GSM Rec. 04.02) for call control, mobility management and Radio Resource management.

When the mention for "further study" or "FS" or "FFS" is present throughout this document this means this is not relevant for ETSI-GSM phase 1 standard.

These procedures are defined in terms of messages exchanged over the control channels of the radio interface. The control channels are described in Rec. GSM 04.03.

The structured functions and procedures of this protocol and the relationship with other layers and entities are described in general terms in Rec. GSM 04.07.

1.1 Scope of the Recommendation

The procedures currently described in this Recommendation are for the call control of circuit-switched connections, the control of packet-mode communication, mobility management and radio resource management. The transport of other message-based information flows is a subject for further study.

Procedures for supplementary services are contained in Recommendation GSM 04.10.

Note 1: The term "layer 3" is used for the functions and protocol described in this Recommendation.

The terms "data link layer" and "layer 2" are used interchangeably to refer to the layer immediately below layer 3.

1.2 Application to the interface structures

The layer 3 procedures apply to the interface structures defined in Rec. GSM 04.03. They use the functions and services provided by layer 2 defined in Rec. GSM 04.05 and 04.06.

1.3 Structure of layer 3 procedures

A building block method is used to describe the layer 3 procedures. The basic building blocks are "elementary procedures" provided by the protocol control entities of the three sublayers, i.e. radio resource management, mobility management and connection management sublayer.

Complete layer 3 transactions consist of specific sequences of elementary procedures. The term "structured procedure" is used for these sequences.

1.4 Test procedures

Test procedures of the GSM radio interface signalling are described in Recommendation GSM 11.10. These procedures are blocked in the normal operation of the Mobile Station and can only be enabled by using a specific test SIM.

1.5 Use of logical channels

The logical control channels are defined in Rec. GSM 05.02. In the following those control channels are considered which carry signalling information or specific types of user packet information:

i) Broadcast Control CHannel (BCCH): downlink only, used to broadcast Cell specific information;

ii) Synchronisation CHannel (SCH): downlink only, used to broadcast synchronisation and BSS identification information;

iii) Paging CHannel (PCH): downlink only, used to send page requests to Mobile Stations;

iv) Random Access CHannel (RACH): uplink only, used to request a Dedicated Control CHannel;

v) Access Grant CHannel (AGCH): downlink only, used to allocate a Dedicated Control CHANNEL;

vi) Stand Alone Dedicated Control CHannel (SDCCH): bidirectional;

vii) Fast Associated Control CHannel (FACCH): bidirectional, associated with a Traffic CHannel;

viii) Slow Associated Control CHannel (SACCH): bidirectional, associated with a SDCCH or a Traffic CHannel;

ix) Cell Broadcast CHannel (CBCH): downlink only used for general (not point to point) short message information.

Two service access points are defined on signalling layer 2 which are discriminated by their Service Access Point Identifiers (SAPI) (see Rec. GSM 04.06):

i) SAPI 0: supports the transfer of signalling information including user-user information;

ii) SAPI 3: supports the transfer of user short messages.

Layer 3 selects the service access point, the logical control channel and the mode of operation of layer 2 (acknowledged, unacknowledged or random access, see Rec. GSM 04.05 and 04.06) as required for each individual message.

2 Overview of control procedures

2.1 List of procedures

The following procedures are specified in this recommendation:

a) Section 3 specifies elementary procedures for radio resource management:
- system information broadcasting (section 3.2.2)
- radio resources connection establishment (section 3.3)
  * immediate assignment procedure (section 3.3.1)
  * paging procedure (section 3.3.2)
- radio resources connection transfer phase (section 3.4)
  * measurement report procedure (section 3.4.1.2)
  * intracell change of channels (section 3.4.3)
  * intercell change of channels (section 3.4.4)
  * frequency redefinition procedure (section 3.4.5)
  * transmission mode change procedure (section 3.4.6)
  * ciphering mode setting procedure (section 3.4.7)
  * additional channel assignment procedure (section 3.4.8)
  * partial channel release procedure (section 3.5)
- radio resources connection release (section 3.5)

b) Section 4 specifies elementary procedures for mobility management
- mobility management common procedures (section 4.3)
  * TMSI reallocation procedure (section 4.3.1)
  * authentication procedure (section 4.3.2)
  * identification procedure (section 4.3.3)
  * IMSI detach procedure (section 4.3.4)
- mobility management specific procedures (section 4.4)
  * location updating procedure (section 4.4.1)
  * periodic updating (section 4.4.2)
  * IMSI attach procedure (section 4.4.3)
  * generic location updating procedure (section 4.4)
- connection management sublayer service provision
  * mobility management connection establishment (section 4.5.1)
  * mobility management connection information transfer phase (section 4.5.2)
  * mobility management connection release (section 4.5.3)

c) Section 5 specifies elementary procedures for circuit switched call control comprising the following elementary procedures:
- mobile originating call establishment (section 5.2.1)
- mobile terminating call establishment (section 5.2.2)
- signalling procedures during the active state (section 5.3)
  * user notification procedure (section 5.3.1)
  * call rearrangements (section 5.3.2)
  * DTMF protocol control procedure (section 5.3.3)
  * in-call modification (section 5.3.4)
- call clearing initiated by the mobile station (section 5.4.3)
- call clearing initiated by the network (section 5.4.4)
- miscellaneous procedures
  * in-band tones and announcements (section 5.5.1)
  * status enquiry procedure (section 5.5.3)
  * call re-establishment procedure (section 5.5.4)

d) Section 6 specifies the procedures for supporting packet data services.

The elementary procedures can be combined to form structured procedures. Examples of such structured procedures are given in section 7. This part of the Recommendation is only provided for guidance to assist implementations.

Section 8 specifies actions to be taken on various error conditions.

Recommendation GSM 04.10 contains functional procedures for support of supplementary services.

Recommendation GSM 04.11 contains functional procedures for support of point-to-point short message services.

Recommendation GSM 04.12 contains functional procedures for the support of short message services - cell broadcast.

2.2 Procedure for Service Request and contention Resolution

Upon seizure of the assigned dedicated channel, the Mobile Station establishes the signalling link on this channel by sending a layer 2 SABM frame containing a layer 3 service request message. The data link layer will store this message to perform the contention resolution. The service request message will be returned by the network in the UA frame.

The data link layer in the Mobile Station compares the content of the information field (i.e. the layer 3 service request message) received in the UA frame with the stored message and leaves the channel in case they do not match. This procedure resolves contentions in the case where several Mobile Stations have accessed at the same random access slot and with the same random reference and one has succeeded due to capture. The full description of the procedure is given in Rec. GSM 04.06.

The purpose of the service request message is to indicate to the network which service the Mobile Station is requesting. This then allows the network to decide how to proceed (e.g. to authenticate or not).

The service request message must contain the identity of the Mobile Station and may include further information which can be sent without encryption.

The layer 3 service request message is typically one of the following :

- CM SERVICE REQUEST
- LOCATION UPDATING REQUEST
- IMSI DETACH
- PAGING RESPONSE
- CM REESTABLISHMENT REQUEST

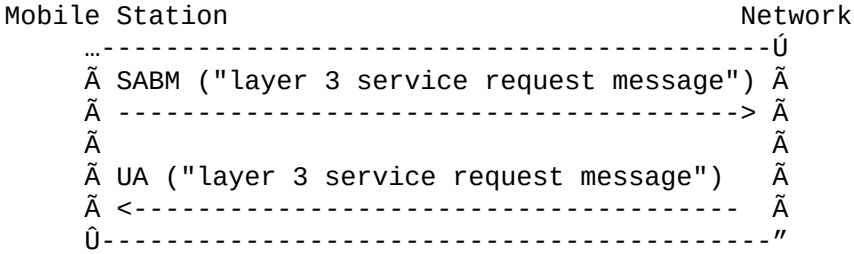


Fig. 2.1/GSM 04.08
Service request and contention resolution

2.3 General recovery procedures

2.3.1 Normal message flow

Essential request messages sent by a MM or a CM-entity have to be acknowledged by the peer entity and are supervised by a timer T in the requesting side. The timer T is described for each procedure in this Recommendation.
Upon receiving a request message, the answering side has to reply to this request, even if it has already acknowledged it before.

Note: The request timer value has to be chosen such that possible channel changes do not affect the expiry.

2.3.2 Expiration of the request timer T

The request timer T is started upon sending the request message. It is stopped at the receipt of the reply message or at the release of the transaction.

Since layer 2 provides a data link layer service (see Rec. GSM 04.06) protecting against frame loss, the request timer cannot expire because of a message loss on the radio interface. It may expire due to sporadic procedural errors in transitory states.

To allow the detection of such errors, the following actions shall be performed at the expiration of timer T :

a) the network is the requesting side :
In this case, the network should initiate the release of the channels according to the procedure described in section 3.5 of Rec. GSM 04.08.

b) the mobile station is the requesting side :
If the network does not react to the request message, then the mobile station should enter an error state, hold the channel, and indicate the state to the mobile user. The mobile station shall wait for further commands, in particular the channel release from the network. However, the mobile station can release the dedicated channels by a manual reset at any time.

The only exception is the call clearing, because of the charging of the existing call. If during call clearing, the mobile station does not receive any response from the network, it shall release the dedicated channel by a local end release.

2.3.3 Change of dedicated channels using SAPI=0

In case a change of dedicated channels is required using a dedicated assignment and handover procedure, respectively, the RR-sublayer will request the data link layer to suspend multiple frame operation before the mobile station leaves the old channel. When the channel change has been completed, layer 3 will request the data link layer to resume multiple frame operation again. The layer 2 suspend/resume procedures are described in Rec. GSM 04.05 and 04.06.

These procedures are specified in such a way that a loss of a layer 3 message cannot occur on the radio interface. However, MM and CM-messages sent from the MS to the network may be duplicated by the data link layer if a message has been transmitted but not yet completely acknowledged before the MS leaves the old channel (see Rec. GSM 04.06).

As the RR-sublayer is controlling the channel change, a duplication of RR-messages does not occur. However, there are some procedures for which a duplication is possible, e.g. DTMF procedures. For all MM and CM-procedures, the request messages sent by the mobile staiton contain a sequence number in order to allow the network to detect duplicated messages, which are then ignored by the network. The procedures for sequenced transmission on layer 3 are described in section 2.4.

2.3.4 Change of dedicated channels using other SAPIs than 0

The procedures described in sections 2.3.1 to 2.3.3 only apply to those using SAPI=0. For SAPIs other than 0, the data link procedures described in Rec. GSM 04.06 do not provide any guarantee against message loss or duplication.

Therefore, if an application uses a SAPI other than 0 and if this application is sensitive to message loss or duplication, then it has to define its own protection mechanism. No general protection mechanism is provided by the layer 3 defined in this Recommendation.

2.4 Sequenced message transfer operation

MM- and CM-messages sent from the mobile station to the network can be duplicated by the data link layer in the following case :

a channel change of dedicated channels is required (assignment or handover procedure) and the last layer 2 frame has not been acknowledged by the peer data link layer before the mobile station leaves the old channel.

In this case, the mobile station does not know whether the network has received the message correctly. Therefore, the mobile station has to send the message again after the new dedicated channel is established (see Rec. GSM 04.06).

The network must be able to detect the duplicated received message. Therefore, each MM- and CM-message must be marked with a send sequence number.

2.4.1 Variables and sequence numbers

2.4.1.1 Send state variable V(SD)

The RR-sublayer of the mobile station shall have one associated send state variable V(SD) ("Send Duplicated") for sending MM- and CM-messages. The send state variable denotes the sequence number of the next in-sequence MM- or CM-
message to be transmitted. The value of the send state variable shall be incremented by one with each MM- and CM- message transmission. Only duplication of a MM- or CM- message is possible, therefore the sequential number of message transfer is maintained by modulus 2. All numbers are incremented by this modulus.

2.4.1.2 Send sequence number N(SD)

Only MM- and CM-messages contain the send sequence number N(SD). At the time when a MM- or CM- message is designated for transmission, the value of N(SD) for the message to be transferred is set equal to the value of the send state variable V(SD).

2.4.2 Procedures for the setting, transfer and termination of sequenced message transfer operation

2.4.2.1 Setting

The sequenced message transfer operation is set by establishing a RR-connection. The send state variable V(SD) is set to 0.

2.4.2.2 Transfer

The network must compare the send sequence numbers of pairs of subsequent messages.
In case the send sequence numbers of two subsequent messages are not identical, no duplication has occured.
In case the send sequence numbers are identical, the network must ignore one of these messages.

2.4.2.3 Termination

The sequenced message transfer operation is terminated by the RR-connection release procedure.

3 RR MANAGEMENT PROCEDURES

3.1 Overview/General

3.1.1 General

Radio resource management procedures include the functions related to the management of the common transmission resources, e.g. the physical channels and the data link connections on control channels.

The general purpose of radio resource procedures is to establish, maintain and release RR-connections that allow a point-to-point dialog between the network and a Mobile Station. This includes the cell selection/reselection and the handover procedures. Moreover, radio resource management procedures include the establishment and maintaining of the one-way reception of BCCH and CCCH when no RR-connection is established. This includes the automatic cell selection/reselection.

Note: This chapter includes some procedures used for the Lm + Lm configuration which needs not be supported by simple Mobile Stations. These procedures and the information content relating to the Lm + Lm configuration in RR messages may need further elaboration.

3.1.2 Services provided to upper layers

3.1.2.1 Idle mode

The RR procedures include (on the MS side) the automatic cell selection/reselection. The RR entity indicates to upper layers the unavailability of a BCCH/CCCH and the cell change when decided by the RR entity. Upper layers are advised of the BCCH broadcast information when a new cell has been selected, or when a relevant part of this information changes.

3.1.2.2 Establishment and release of a RR-connection

A RR-connection includes a physical point-to-point bidirectionnal connection, a SAPI 0 data link connection in multiframe mode on the main DCCH.

The upper layer can require the establishment of a RR- connection. Only one RR-connection can be established for a MS at one time.

The upper layer can require the release of a RR-connection.

3.1.2.3 RR-connected mode

When a RR-connection is established, RR procedures provide the following services :

- transfer of messages on any data link layer connection;
- establishment/release of multiframe mode on data link layer connections other than SAPI 0, on the main DCCH or on the SACCH;
- indication of temporary unavailability of transmission (suspension, resuming);
- indication of loss of RR-connection;
- automatic cell reselection and handover to maintain the RR-connection;
- setting/change of the transmission mode on the physical channels, including change of type of channel, change of the coding/decoding/transcoding mode and setting of ciphering;
- allocation/release of an additional channel (for the Lm + Lm configuration).

3.1.3 Services required from data link and physical layers

The RR-sublayer uses the services provided by the data link layer as defined in Rec. GSM 04.05.

Moreover, the RR-sublayer uses directly services provided by the physical layer such as BCCH searching, as defined in Rec. GSM 04.04.

3.1.4 Terminology

The following terms are used in section 3 :

- Idle mode : in this mode, the MS is not allocated any dedicated channel; it listens to the CCCH and the BCCH;

- RR-connected mode : in this mode, the MS is allocated at least two dedicated channels, only one of them being a SACCH;

- Main DCCH : in MM-connected mode, only two channels are used as DCCH, one being a SACCH, the other being a SDCCH or a FACCH ; this last channel is called here "the main DCCH".

- A channel is activated if it can be used for transmission, in particular for signalling, at least with UI frames. On the SACCH, whenever activated, it must be ensured that a contiguous stream of layer 2 frames is sent.

- A TCH is connected if circuit mode user data can be transmitted. A TCH cannot be connected if it is not activated. A TCH which is activated but not connected is used only for signalling, i.e. as a DCCH.

- Data link of SAPI 0 on the main DCCH is called the main signalling link. Any message specified to be sent on the main signalling link is sent in acknowledged mode except when otherwise specified.

- The term "to establish" a link is a short form for "to establish the multiframe mode" on that data link. It is possible to send UI frames on a data link even if it is not established as soon as the corresponding channel is activated. Except when otherwise indicated, a data link layer establishment is done without information field.

3.2 Idle mode procedures

3.2.1 MS side

In idle mode, the MS listens to the BCCH and to the paging sub-channel for the paging group the MS belongs to (Cf. Rec. GSM 03.13); it measures the radio propagation for connection with other cells. Measurements are treated to assess the need of a cell change as specified in Rec. GSM 05.08. When a cell change is decided, the MS switches to the BCCH of the new cell. The broadcast information is then checked to verify the allowance to attach to this cell (cf. section 3.2.2). If allowed, the cell change is confirmed, and the broadcast information is then treated for mobility management actions (cf. section 4). Similarly, physical contexts are updated (list of neighbouring cells frequencies, thresholds for some actions, etc... cf. Rec. GSM 05.08 and section 3.2.2).

3.2.2 Network side

3.2.2.1 System information broadcasting

SYSTEM INFORMATION TYPE 1 to 4 messages are regularly broadcast by the network on the BCCH. Based on this information the Mobile Station is able to decide whether and how it may gain access to the system via the current cell.

Note: The exact order of sending SYSTEM INFORMATION messages on the BCCH is specified in Rec. GSM 05.02.

The same information is sent in SYSTEM INFORMATION TYPE 5 and 6 on the SACCH just after handover, and whenever there is no other use of that channel.

The information broadcast may be grouped in the following classes:

- information giving unique identification of the current network, location area and cell;

- information used for cell selection and candidate cell measurements for handover procedures;

- information describing the current control channel structure;

- information controlling the random access channel utilisation; and

- information defining different options supported within the cell.

3.2.2.2 Paging

The network is required to send valid layer 3 messages continuously on all paging subchannels.

3.3 RR-connection establishment

3.3.1 RR-connection establishment initiated by MS

The MS can initiate the establishment of a RR-connection by using the immediate assignment procedure.

The immediate assignment procedure is used to immediately transfer a MS requiring service by a random mode request to a dedicated channel, typically a SDCCH or a traffic channel.

The immediate assignment procedure contains:

- The activation of the new physical channels.

- The triggering of the establishment of data link connections on the main DCCH.

The immediate assignment procedure is initiated by the Mobile Station.

All mobiles are members of one out of 10 randomly allocated mobile populations refered by access classes 0 to 9. The population number is stored in the SIM. In addition, mobiles may be members of one or more out of 5 special categories (access class 11 to 15) (see Rec. GSM 02.11), this is also held on the SIM card.

On the BCCH is broadcast the list of authorized access classes in the system information messages, and whether emergency calls are allowed for all MSs or only to the special classes.

The access is then allowed only:

1) for mobiles members of one of the authorized classes among classes 0 to 9.

2) for mobiles members of at least one of the authorized classes among classes 11 to 15.

3) for emergency calls for all MSs if emergency call is allowed in the cell or only for MSs belonging to one of the classes 11 to 15 otherwise.

3.3.1.1 Request for resources by the Mobile Station

The mobile station will only initiate this procedure if the access control class indicates that access is allowed as defined above.

The MS initiates the procedure by scheduling the sending on the RACH. This is done by starting the timer T3120 with a value drawn as described below. At expiry of the timer, the CHANNEL REQUEST message is sent.

This message is sent on the RACH and thus does not follow the basic format. It carries :
- first, an indication of the reason for requesting a RR- connection establishment,
- second, a random reference.

The indication of the reason for the request may be used by the network to give some priority to particular events (e.g. for emergency calls).

After sending the initial CHANNEL REQUEST message, the MS starts the timer T3120 with a new value and listens to the full downlink CCCH (to be ready to receive the answer to the request which may arrive immediately) and to the BCCH (for ALOHA control, cf hereafter)

When timer T3120 expires and the number of repetitions does not exceed the "maximum retransmissions" received on the BCCH, the MS repeats the CHANNEL REQUEST message with a new value of the random reference and starts timer T3120 with a new value.

When timer T3120 expires and the maximum retransmissions has been reached the MS should let some time elapse to allow for the network to answer. The request attempt shall then be abandoned. The MS also performs a cell reselection according to Rec. GSM 05.08.

The timer T3120 is set to a value drawn randomly according to the following statistical law, parameterised by control data (cf. section 3.2.2):

Let t(o) be the time when T3120 is started. The value of T3120 is evaluated as follows. First a random integral value n between 0 and N-1 is drawn with equal probability for all values:

probability (n = i) = 1/N for all i in 0 ..N-1

N is defined as follows :
- for the initial access it is set to the maximum of 8 and the value of "Tx-integer" parameter of RACH control parameter information.
- for subsequent attempts it is set to the value of "Tx-integer".

Then T3120 is such that there are n RACH slots between t(o) + T1 seconds and the expiry of T3120.

T1 is set :
- before initial access: to 0
- after initial access, in case of non combined CCCH: to 0.25
- after initial access, in case of combined CCCH/SDCCH: to 0.35.

3.3.1.2 Answer from the network

3.3.1.2.1 On receipt of a CHANNEL REQUEST message, the network allocates a dedicated channel to the MS if possible, by sending an IMMEDIATE ASSIGNMENT message in unacknowledged mode on the CCCH. There is no restriction on what part of the downlink CCCH an IMMEDIATE ASSIGNMENT message can be sent. Basically, the assigned channel is a SDCCH ; it is possible to allocate directly a TCH (used as a DCCH: channel mode shall be set to signalling only) as a design choice of the network operator. Timer T3101 is then started on the network side.

Note: These are two types of IMMEDIATE ASSIGNMENT messages:
- IMMEDIATE ASSIGNMENT message, containing assignment information for one MS only;
- IMMEDIATE ASSIGNMENT EXTENDED message, containing assignment information for two MSs at the same time.

The IMMEDIATE ASSIGNMENT message contains the information field of the CHANNEL REQUEST message and the frame number of the frame in which the CHANNEL REQUEST message was received.
On receipt of an IMMEDIATE ASSIGNMENT message, corresponding to one of its [3] last channel requests, the MS stops T3120, switches to the assigned channels, sets the channel mode to signalling only and activates them. No ciphering using a user key is applied. It then establishes the main signalling link with an SABM containing information field (see sect. 2.2).

The IMMEDIATE ASSIGNMENT message contains the description of the new configuration and the initial timing advance (cf. Rec. GSM 04.04).
It contains optionally a starting time indication. In that case, the MS must wait for the indicated moment to begin any transmission on the new channel.

3.3.1.2.2 Assignment rejection

If no channel is available for assignment, the network may send to the MS an IMMEDIATE ASSIGNMENT REJECT message in unacknowledged mode on the CCCH. This message contains the request reference and a wait indication.

On receipt of a IMMEDIATE ASSIGNMENT REJECT message, corresponding to one of its [3] last channel requests, the MS stops T3120, starts timer T3122 with the indicated value, ("wait indication" information element) and returns to CCCH idle mode (listening to the paging channel). The MS is not allowed to make a new attempt to establish an RR-connection in the same cell until T3122 expires.

3.3.1.3 Assignment completion

The procedure is terminated on the network side when the main signalling link is established. Timer T3101 is stopped and the MM-sublayer on the network side is informed that an RR-connection exists.

On the mobile station side, the procedure is terminated when the establishment of the main signalling link is confirmed. The MM-sublayer is informed and the procedures that rendered necessary a channel allocation can then go on.

3.3.1.4 Abnormal cases

If a lower layer failure occurs on the MS side on the new channel before the successful establishment of the main signalling link, the allocated channels are released and the MS returns to idle mode. Transactions in progress are aborted and cell reselection then may take place.

On the network side, if timer T3101 elapses before the main signalling link is established, the newly allocated channels are released and the request forgotten. Note that the network has no means to distinguish repetitions of the same request from a MS.

3.3.2 RR-connection establishment initiated by the network

The network can initiate the establishment of a RR- connection by the paging procedure.

3.3.2.1 Paging initiation by the network

The network initiates the paging procedure by broadcasting a PAGING REQUEST message on the appropriate paging subchannel, and starts timer T3113. The paging subchannel is specified in Rec. GSM 05.02 and 03.13.

A PAGING REQUEST message may include more than one MS identification.

Three types of paging messages are possible. The choice of the message depends on the number of MSs to be paged and of the type of identities that are used. The maximum number of paged MSs per message is 4 when using only TMSIs for identification of the MSs.

The MS is required to receive and analyse the paging messsages on the paging subchannel corresponding to its paging subgroup, as specified in Rec. GSM 05.02.

The paging and immediate assignment type messages contain a page mode information element. This information element controls possible additional requirements on MSs belonging to the paging subgroup corresponding to the paging subchannel the message was sent on as follows:

a) no additional requirements (normal operation);

b) the MS is required to receive and analyse the next but one message on the PCH;

c) The MS shall receive all messages on the CCCH regardless of the BS-AG-BLKS-RES setting. It is required to receive all BCCH messages. When the MS receives the next paging message to its (possibly new) paging subgroup the subsequent action is defined in the page mode information element in that message.

d) No change of page mode from previous message on the paging subchannel.

> Note that a MS takes into account the page mode information only in messages of its own paging subchannel.

If a message in the paging subchannel is not received correctly, the message is ignored and the previous page mode is assumed.

3.3.2.2 Paging response

Upon receipt of a PAGING REQUEST message the addressed MS initiates the IMMEDIATE ASSIGNMENT procedure. The establishment of the main signalling link is then initiated by use of an SABM with information field containing the PAGING RESPONSE message (see sect. 2.2). The MM-sublayer in the MS is informed that an RR-connection exists.

Upon receipt of the PAGING RESPONSE message the network stops timer T3113. The MM-sublayer in the network is informed that an RR-connection exists.

3.3.2.3 Abnormal cases

Lower layer failure occuring during the IMMEDIATE ASSIGNMENT procedure is treated as specified for that procedure.

Lower layer failures occuring after the IMMEDIATE ASSIGNMENT procedure are treated following the rules specified in 3.5.2.

If the timer T3113 expires and PAGING RESPONSE message has not been received, the network may repeat the PAGING REQUEST message and start the timer T3113 again. The number of successive paging attempts and the time intervals are a network dependant choice.

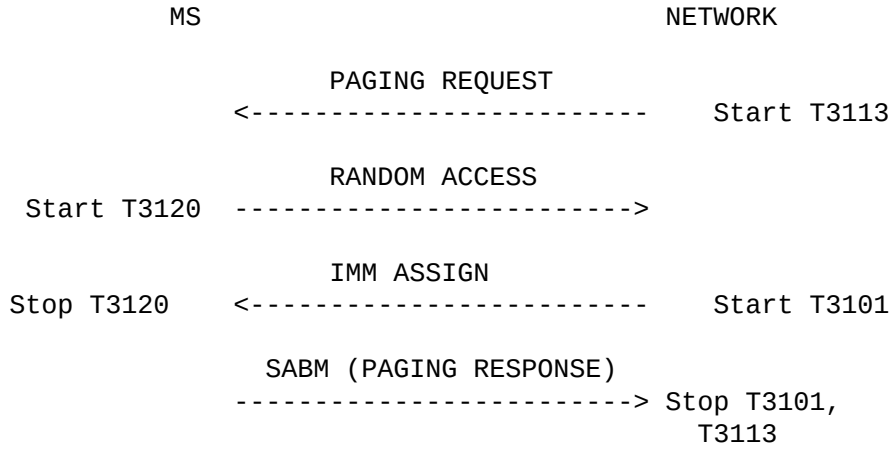


Fig. 3.1/GSM 04.08 Paging sequence

3.4 RR-connection transfer phase

3.4.1 SACCH procedures

3.4.1.1 General

In RR-connected mode, the SACCH is used in signalling layer at least for measurement results transmission from the MS.

The SACCH has the particularity that continuous transmission must occur in both directions. For that purpose, in the MS to network direction, measurement result messages are sent at each possible occasion when nothing else has to be sent (see section 3.4.1.2). Similarly, SYSTEM INFORMATION type 5 and 6 messages are sent in the network to MS direction in UI frames when nothing else has to be sent.

As specified in Rec. GSM 05.08, problems occuring in the reception of SACCH frames are interpreted as a loss of communication means and appropriate procedures are then triggered as specified in section 3.5.2.

3.4.1.2 Measurement report :

When in RR-connected mode, the MS sends regularly MEASUREMENT REPORT messages to the network. These messages contain measurements results about reception characteristics from the current cell and from neighbour cells. If neighbouring cell information for the serving cell is not available, the MS indicates this in the MEASUREMENT REPORT message. These measurement results are obtained as specified in Rec. GSM 05.08.

These messages are sent on the slow ACCH, in unacknowledged mode. If no other message is scheduled on the SACCH at the instant when a layer 2 frame is due to be sent, then the MS shall send a MEASUREMENT REPORT message in that frame. As for the use of the SACCH for other purposes than sending such messages, it shall be observed that the interval between two successive layer 2 frames containing MEASUREMENT REPORT messages shall not exceed one layer 2 frame.

3.4.2 Transfer of messages and link layer service provision

When a RR-connection is established, upper layers can send messages in multiframe or unacknowledged mode on SAPI 0.

Moreover, upper layers have access to the full link layer services for SAPIs other than 0, with the exception of the error indication and local end release that are directly treated by the RR-sublayer, as specified in ad'hoc places.

3.4.3 Intracell change of channel

An intracell change of channel can be requested by upper layers for changing the channel type, or decided by the RR- sublayer, e.g. for an internal handover. This change is performed through the dedicated channel assignment procedure.

The purpose of the dedicated channel assignment procedure is to completely modify the physical channel configuration of the MS while staying in the same cell. The new configuration is composed only of dedicated channels.

This procedure can be used only for changing between independent configurations, i.e. sharing no radio resource. An example of dependent channels is a full rate channel and one of the corresponding half rate channels. The only procedures provided for changing between dependent configurations are the additional assignment and the partial release procedures.

The channel assignment procedure happens only in RR- connected mode. This procedure cannot be used in the idle mode; in this case the immediate assignment procedure is used.

The channel assignment procedure includes:

- the suspension of normal operation except in RR management (layer 3).

- the disconnection of the main signalling link, and of the other data links via local end release (layer 2), and the disconnection of TCHs if any.

- the deactivation of previously assigned channels (layer 1)

- the activation of the new channels and their connection if applicable.

- The triggering of the establshiment of the data link connections for SAPI = 0.

The channel assignment procedure is always initiated by the network.

3.4.3.1 Channel assignment initiation

The network initiates the channel assignment procedure by sending an ASSIGNMENT COMMAND message to the Mobile Station on the main signalling link. It then starts timer T3107.

When sending this message on the network side, and when receiving it on the MS side, all transmission of signalling layer messages except for RR management is suspended until otherwise indicated.

Upon receipt of the ASSIGNMENT COMMAND message, the Mobile Station initiates a local end release of link layer connections, disconnects the physical channels, commands the switching to the assigned channels and initiates the establishment of lower layer connections (this includes the activation of the channels, their connection and the establishment of the data links).

The ASSIGNMENT COMMAND message contains the description of the new configuration, including for the Lm + Lm + ACCHs configuration, the exact ACCHs to be used and a power command. This power command shall be used by the MS as the initial power on the new channel(s). It shall not affect the power used on the old channel(s). It contains optionally a starting time indication. In that case, the MS must wait until the indicated time before it may begin any transmission on the new channels. It contains also optionaly a cell channel description (a cell allocation).

In case of hopping channel, the cell allocation if present in the message is used to decode the mobile allocation. If the cell allocation is not included, the MS uses its current cell allocation, the current CA is the last CA received on the BCCH. Afterward, the current CA is changed by any message sent on the main signalling link containing a CA (the possible messages are: ASSIGNMENT COMMAND, HANDOVER COMMAND and FREQUENCY REDEFINITION). Note that the there are cases in which the current CA is undefined, see section 3.4.3.3.

3.4.3.2 Assignment completion

After the main signalling link is successfully established, the MS returns an ASSIGNMENT COMPLETE message to the network on the main DCCH.

The sending of this message on the MS side and its receipt on the network side allow the resuming of the transmission of signalling layer messages other than belonging to RR- management.

At the receipt of the ASSIGNMENT COMPLETE message, the network releases the previously allocated resources and stops timer T3107.

3.4.3.3 Abnormal cases

If the MS has no current CA and if it needs a CA to analyse the ASSIGNMENT COMMAND message, it stays on the current channel(s) and sends an ASSIGNMENT FAILURE, cause "no cell allocation available"

On the MS side, if a lower layer failure happens on the new channel before the ASSIGNMENT COMPLETE message has been sent, the MS deactivates the new channels, reactivates the old channels, reconnects the TCHs if any and triggers the establishment of the main signalling link. It then sends a ASSIGNMENT FAILURE message on the main DCCH and resumes the normal operation, as if no assignment attempt had occurred.

When receiving the ASSIGNMENT FAILURE message, the network stops T3107.

If a lower layer failure happens while attempting to connect back to the old channels, the standard procedure is applied (see section 3.5.2).

On the network side, if timer T3107 elapses before either the ASSIGNMENT COMPLETE messsage has been received on the new channels, an ASSIGNMENT FAILURE message is received on the old channels or the MS has re-established the call, the old channels and the new channels are released and all contexts related to the connections with that MS are cleared.

On the network side, lower layer failure occurring on the old channels after the sending of the ASSIGNMENT COMMAND message are ignored. Lower layer failures occurring after the receipt of the SABM Frame on the new main signalling link are treated following the general rules (cf. section 3.5.2).

3.4.4 Handover procedure

The purpose of the hand-over procedure is to completely modify the channels allocated to the MS e.g. when the cell is changed. A change in the channel configuration nature is possible. This procedure is used only while in a RR- connected mode.

Note: The decision to do a hand-over and the choice of the new cell is out of the scope of this Recommendation.

The hand-over procedure includes:

- The disconnection of the main signalling link, and of the other links via local end release (layer 2), and the disconnection of the TCH(s) if any.

- The disconnection and the deactivation of previously assigned channels and their release.

- The activation of the new physical channels, and their connection if applicable.

- The triggering of the establishment of data link connection for SAPI = 0 on the new channels.

The hand-over procedure is always initiated by the network.

3.4.4.1 Hand-over initiation

The network initiates the hand-over procedure by sending an HAND-OVER COMMAND message to the Mobile Station on the main DCCH. It then starts timer T3103.

When sending this message on the network side, and when receiving it on the MS side, all transmission of signalling layer messages except for RR management is suspended until otherwise indicated.

Upon receipt of the HAND-OVER COMMAND message,the Mobile Station initiates the release of link layer connections, disconnects the physical channels, commands the switching to the assigned channels and initiates the establishment of lower layer connections (this includes the activation of the channels, their connection and the establishment of the data links).

The HAND-OVER COMMAND message contains:

- The characteristics of the new channels, including for the Lm + Lm + ACCHs configuration the exact ACCHs to be used.

- The characteristics of the new cell that are necessary to successfully communicate (e.g. frequency list in the case of slow frequency hopping), including the data that allows the MS to use the pre-knowledge about synchronization it acquires by the measurement process (i.e BSIC + BCCH frequency).

- A power command (cf. Rec. GSM 05.08). This power command shall be used by the MS as the initial power on the new channel(s). It shall not affect the power used on the old channel(s).

- An indication of the physical channel establishment procedure to be used.
  This indication depends whether the two cells are finely synchronized or not (cf. next section).

- A hand-over reference, used as specified in the following section. The choice of the handover reference by the network is not specified and left to the manufacturers.

- Optionally a starting time indication. In that case, the MS must wait for the indicated moment before beginning any transmission on the newly allocated channels.

3.4.4.2 Physical channel establishment

Two procedures are possible, depending upon whether or not the cells are synchronised.

3.4.4.2.1 Finely synchronized cell case

After having switched to the assigned channels, the MS sends in four successive slots on the main DCCH a HANDOVER ACCESS message. This message is sent in random mode and thus does not follow the basic format. Its content is reduced to the handover reference information element.
It then activates the channels in sending and receiving mode and connects the channels if need be.

If applicable, ciphering is immediately started . The access bursts are not ciphered.

3.4.4.2.2 Non synchronized cell case

After having switched to the assigned channels, the MS starts timer T3124, starts sending continuously on the main DCCH a HANDOVER ACCESS message. This message is sent in random mode and thus does not follow the basic format. Its content is reduced to the handover reference as single information element (see Rec. GSM 05.02, section 5.2.7 and Rec. GSM 05.03).
It then activates the channels in receiving mode and connects the channels if need be (only for reception).

If applicable, deciphering is immediately started . The access bursts are not ciphered.
When the network has the RF characteristics that are necessary, it sends in unacknowledged mode a PHYSICAL INFORMATION message to the MS on the main DCCH.

If applicable, ciphering and deciphering with the new key is immediately started (ie,before even the reception of a correct random burst), and the message is sent enciphered.

The PHYSICAL INFORMATION message contains various physical layer related informations, allowing a proper transmission by the MS.

When sending the PHYSICAL INFORMATION message, the network starts timer T3105. If this timer times out before the receipt of any correct frame from the MS, the network repeats the PHYSICAL INFORMATION message and restarts timer T3105. The maximum number of repetitions is Ny1. If the maximum number of repetitions is reached, the newly allocated channels are released, and the context related to the hand-over is abandonned.

When the MS receives a PHYSICAL INFORMATION message, it stops timer T3124, stops sending access bursts, activates the physical channels in sending and receiving mode and connects the channels if need be.

3.4.4.3 Hand-over completion

After lower layer connections are successfully established, the MS returns a HAND-OVER COMPLETE message to the network on the main DCCH.

The sending of this message on the MS side and its receipt on the network side allow the resuming of the transmission of signalling layer messages other than those of RF management.

When receiving the HAND-OVER COMPLETE message, the network stops timer T3103 and releases the old channels.

Note: BCCH information is sent on the SACCH (see section 3.4.1.1)

3.4.4.4 Abnormal cases

On the MS side, if timer T3124 times out (only in the non- synchronised case) or if a lower layer failure happens on the new channel before the HAND-OVER COMPLETE message has been sent, the MS deactivates the new channels, reactivates the old channels, reconnects the TCHs if any and triggers the establishment of the main signalling link. It then sends a HANDOVER FAILURE message on the main signalling link and resumes normal operation (including ciphering if applied) as if no handover attempt had occurred. This message may also indicate a possible loss of I frames.

The MS, then, establishes other signalling links that were established before receiving the HAND-OVER COMMAND message. When the HAND-OVER FAILURE message has been received, the network releases the new channels and stops timers T3105 and T3103 (in the non-synchronised case).

If a lower layer failure happens while attempting to connect back to the old channels, the standard rules are applied (cf section 3.5.2).

On the network side, if timer T3103 elapses before either the HAND-OVER COMPLETE message is received on the new channels, or a HAND-OVER FAILURE message is received on the old channels, or the MS has re-established the call, the old channels are released and all contexts related to the connections with that MS are cleared.

On the network side, lower layer failures occuring on the old channels after the sending of the HANDOVER COMMAND message are ignored. Lower layer failures occuring after the receipt of the SABM frame on the new main signalling link are treated following a general scheme (cf 3.5.2).

3.4.5 Frequency redefinition procedure

This procedure is used by the network to change the frequencies and hopping sequences of the allocated channels. This is meaningful only in the case of frequency hopping.

The network sends to the MS a FREQUENCY REDEFINITION message containing the new parameters together with a starting time indication.

When receiving such a message, the MS modifies the frequencies/hopping sequences it uses at the exact indicated time slot, i.e. the indicated time slot is the first with new parameters. All other functions are not disturbed by this change. New parameters can be the cell channel description, the mobile allocation and the MAIO. Other parameters describing the allocated channels must be identical to the current parameters.

3.4.5.1 Abnormal cases

There is no special treatment of abnormal cases for this procedure.

3.4.6 Transmission mode change

Higher layers can request change of channel mode.

The channel mode modify procedure allows the network to request the MS to change the channel mode for one channel. The channel mode covers the coding, decoding and transcoding mode used on the indicated channel.

This procedure is always initiated by the network.

3.4.6.1 Initiation

The network initiates the procedure by sending a CHANNEL MODE MODIFY message to the MS. This message contains the reference of the channel and the new mode to use.

3.4.6.2 Answer

When it has received the CHANNEL MODE MODIFY message, the MS changes the mode for the indicated channel and replies by a CHANNEL MODE MODIFY ACKNOWLEDGE message.

3.4.6.3 Abnormal cases

No specific treatment for a lower layer failure.

3.4.7 Ciphering mode setting

The ciphering mode setting is used by the network to trigger the start of the stream ciphering (described in Rec. GSM 03.20).

3.4.7.1 Ciphering mode setting initiation

The network initiates the ciphering mode setting procedure by sending a CIPHERING MODE COMMAND message to the Mobile Station on the main signalling link, indicating whether ciphering shall be used or not. In the case of ciphering, deciphering shall be started on the network side after the message has been sent.

3.4.7.2 Ciphering mode setting response by the Mobile Station

Upon receipt of the CIPHERING MODE COMMAND message indicating ciphering, the Mobile Station shall start enciphering and deciphering using the available key.

The appropriate action on the CIPHER MODE COMMAND has been taken when the Mobile Station sends back a CIPHERING MODE COMPLETE message. Upon receipt of the CIPHERING MODE COMPLETE message or any other correct layer 2 frame which was sent enciphered, the network starts enciphering.

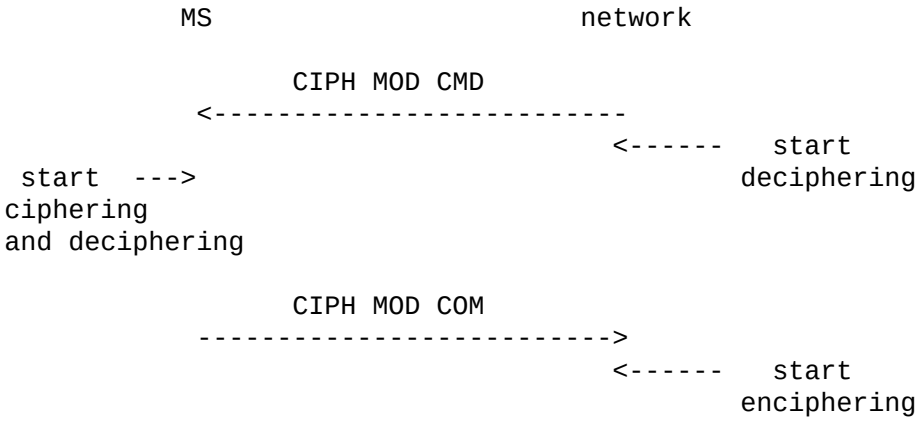


Figure 3.2/GSM 04.08
Ciphering mode setting sequence

3.4.8 Additional channel assignment

Note: In the present state of Rec. GSM 04.03, this procedure is only possible for the Lm + ACCHs to Lm + Lm + ACCHs transition. As a consequence it is not needed for simple mobile stations. The description of the procedure is in general terms to cope with possible evolution.

A change of channel configuration to include an additional channel can be requested by upper layers.

The purpose of the additional assignment procedure is to allocate an additional dedicated channel to a MS while keeping the previously allocated channels. In particular the main DCCH and the SACCH are not modified, and signalling exchanges are not interrupted.

The additional assignment procedure may happen only in RR-connected mode. It is used for instance for the transition from the Lm + ACCHs configuration to the Lm + Lm + ACCHs configuration.

The additional assignment procedure is always initiated by the network.

3.4.8.1 Additional assignment procedure initiation

The network initiates the procedure by sending an ADDITIONAL ASSIGNMENT message to the MS on the main DCCH.
The ADDITIONAL ASSIGNMENT message contains the description of the newly assigned channels.

On receipt of the message, the MS activates the new channel.

3.4.8.2 Additional assignment completion

The MS sends an ASSIGNMENT COMPLETE message to the network on the channel, on which it receives the ADDITIONAL ASSIGNMENT message.

3.4.8.3 Abnormal cases

A lower layer failure occuring during the procedure is treated according to the general case (see section 3.5.2).

The network considers the channel as allocated from the sending of the ADDITIONAL ASSIGNMENT message. As a consequence, if a re-establishment occurs, the network will consider the context as if the MS has received the message, and the new configuration allocated after the re-establishment may differ from the one the MS had before the re-establishment.

3.4.9 Partial channel release

A change of channel configuration to release one channel can be requested by upper layers.

The purpose of this procedure is to deactivate part of the dedicated channels in use. The channel configuration remains dedicated.

Note: In the present state of Rec. GSM 04.03, this procedure is only possible for the Lm + Lm + ACCHs to Lm + ACCHs transition. As a consequence it is not needed for simple mobile stations.

The partial release procedure is always initiated by the network.

3.4.9.1 Partial release initiation

The network initiates the partial release by sending a PARTIAL RELEASE message to the MS on the main DCCH.

On receipt of the PARTIAL RELEASE message the MS:

- Initiates the disconnection of all the link layer connections carried by the channel to be released;

- Simultaneously initiates the connection on remaining channels of the data link layer connections that have been released;

- Deactivates the physical channels to be released.

- Sends a PARTIAL RELEASE COMPLETE to the network on the (possibly new) main signalling link.

3.4.9.2 Abnormal cases

A lower layer failure is treated following the general rules as specified in section 3.5.2.

Moreover, on the network side, the channel configuration nature is set from the sending of the PARTIAL RELEASE message on. As a consequence, the new assignment after a re- establishment may concern a different channel configuration nature from the one known by the MS before the re- establishment.

3.4.10 Classmark change

This procedure allows the MS to indicate to the network a change in the classmark (e.g. due to addition of power amplification).

The MS sends a CLASSMARK CHANGE message to the network. This message contains the new mobile station classmark 2 information element. There is no acknowledgement from the network at layer 3.

3.5 RR-connection release

3.5.1 Normal release

The release of the RR-connection can be requested by upper layers.

The purpose of this procedure is to deactivate the dedicated channels in use. When the channels are released, the MS returns to the CCCH configuration, idle mode.
The channel release procedure can be used in a variety of cases, including TCH release after a call release, and DCCH release when a dedicated channel allocated for signalling is released.

The channel release procedure is always initiated by the network.

3.5.1.1 Channel release initiation

The network initiates the channel release by sending a CHANNEL RELEASE message to the MS on the main DCCH, starts timer T3109 and deactivates the SACCH.

On receipt of a CHANNEL RELEASE message the MS starts timer T3110 and disconnects the main signalling link.
When T3110 times out, or when the disconnection is confirmed, the MS deactivates all channels and gets back to CCCH idle mode

Note: Data Links other than the main signalling link are disconnected by local end link release.

On the network side, when the main signalling link is disconnected, the network stops timer T3109 and starts timer T3111. When timer T3111 times out, the network deactivates the channels, they are then free to be allocated to another connection.

Note: The sole purpose of timer T3111 is to let some time to acknowledge the disconnection and to protect the channel in case of loss of the acknowledge frame.

If timer T3109 times out, the network deactivates the channels; they are then free to be allocated to another connection.

The CHANNEL RELEASE message will include an RR-cause indication as follows :

#0 if it is a normal release, e.g. at the end of a call or at normal release of a DCCH.

#1 to indicate an unspecified abnormal release.

#2, #3 or #4 to indicate a specific release event.

#5 if the channel is assigned for servicing a high priority call (e.g. an emergency call)

#65 if a handover procedure is stopped because the call has been cleared.

3.5.1.2 Abnormal cases

Abnormal cases are taken into account in the main part of the description of the procedure.

3.5.2 Radio link failure

The main part of the description of the procedures concerns the "normal" cases, i.e. without any occurence of loss of communication means. A separate paragraph at the end of the description of each procedure treats the cases of loss of communication means, called a radio link failure.
In RR-connected mode, in most of the cases the reaction of the MS or the network is the same. Those reactions are described in this section to avoid repetitions.

A radio link failure can be detected by several ways. First, by analysis of reception at layer 1, as specified in Rec. GSM 05.08 and section 3.4.1.1. Second, by a data link layer failure, on any data link on a control channel, as specified in Rec. GSM 04.06. Third, in some cases where timers are started to detect the lack of answer from the other party, as described in section 3.
The two first cases are grouped in the following under the term "lower layer failure".

3.5.2.1 Mobile side

The more general reaction to a radio link failure on the MS side is to abort the RR-connection.

In case a radio link failure has been detected, an indication is passed to the upper mobility management sublayer on the MS side.

Note : upper layers may decide on a re-establishment (cf. section 5.5.4)

3.5.2.2 Network side

In RR-connected mode, the reaction of the network to a lower layer failure depends on the context. Except when otherwise specified, it is to release the connection either with the channel release procedure as specified in section 3.5.1, or with the following procedure. The network starts timer T3109 and deactivates the SACCH (and hence to stop transmission on the SACCH).

In case a radio link failure has been detected, an indication is passed to the upper mobility management sublayer on the network side.

When timer T3109 expires, the network can regard the channels to be released and free for allocation.

This procedure relies on the fact that if a MS does not receive the SACCH for some time, it completely releases the channels (cf Rec. GSM 05.08).

Note: The network should maintain for some time the transaction context in order to allow call re-establishment. The timer value is for further study.

3.6 Receiving a RR-STATUS message by a RR-entity.

If the RR-entity of the Mobile Station receives a RR-STATUS message no transition and no specific action shall be taken as seen from the radio interrface, i.e. local actions are possible

The actions to be taken on receiving a RR-STATUS message in the network are an implementation dependent option.

4 ELEMENTARY PROCEDURES FOR MOBILITY MANAGEMENT

4.1 General

This section describes the procedures used for mobility management at the radio interface (Reference Point Um).

The main function of the Mobility management sublayer is to support the mobility of user terminals, such as informing the network of its present location and providing user identity confidentiality.

A further function of the MM-sublayer is to provide connection management services to the different entities of the upper Connection Management (CM-) sublayer (see Rec. GSM 04.07).

All the MM-procedures described in this section can only be performed if a RR-connection has been established between the mobile station and the network. Else the MM-sublayer has to initiate the establishment of a RR-connection according to the procedures specified in section 3.3.

4.1.2 MM-sublayer states

4.1.2.1 MM-sublayer states in the Mobile Station

0. NULL The mobile station is inactive (e.g. power down). Important parameters are stored. Only manual action by the user may transfer the MM-sublayer to another state.

1. IDLE, UPDATED
   The Mobile Station has performed a successful location updating procedure in the current location area. The CM-layer entities may initiate MM-connection establishment.

2. IDLE, NOT UPDATED
   The Mobile Station is not updated in the current location area. Requests from the CM-layer entities trigger the location updating procedure.

3. LOCATION UPDATING INITIATED
   A location updating procedure has been started and the MM awaits a response from the network. The timer T3210 is running.

5. WAIT FOR OUTGOING MM-CONNECTION
   The MM-connection establishment has been started, and the MM awaits a response from the network. The timer T3230 is running.

6. MM-CONNECTION ACTIVE
   The MM-sublayer has a RR-connection to its peer entity on the network side. One or more MM-connections are active.

7. IMSI DETACH INITIATED
   The IMSI detach procedure has been started. The timer T3220 is running.

9. WAIT FOR NETWORK COMMAND
   The MM-sublayer has a RR-connection to its peer entity in the network, but no MM-connection is established. The Mobile Station is passive, awaiting further commands from the network.

10. LOCATION UPDATE REJECTED
    A location updating procedure has been rejected and RR-connection release is awaited.

11. IDLE, ROAMING NOT ALLOWED
    The Mobile Station has received a roaming not allowed indication in the current location area. Only emergency services are offered to the CM-layer.

12. IDLE, NO IMSI
    The Mobile Station is powered up, but no SIM-module is connected, or the IMSI included is not approved by the network. Only emergency services are offered to the CM-layer.

13. WAIT FOR RR-CONNECTION (LOCATION UPDATING)
    The MM-sublayer has requested RR-connection establishment for starting the location updating procedure.

14. WAIT FOR RR-CONNECTION (MM-CONNECTION)
    The MM-sublayer has requested RR-connection establishment for starting the MM-connection establishment.

15. WAIT FOR RR-CONNECTION (IMSI DETACH)
    The MM-sublayer has requested RR-connection establishment for starting the IMSI detach procedure.

17. WAIT FOR REESTABLISH
    An RR-connection is aborted and reestablishment may be performed from the disturbed CM-layer entities.

18. WAIT FOR RR-ACTIVE
    The MM-sublayer has requested activation of the RR-sublayer.

4.1.2.2 MM-sublayer states on the network side

1. IDLE The MM-sublayer is not active.

2. WAIT FOR RR-CONNECTION
   The MM-sublayer has received a request for MM-connection establishment from the CM-layer. A RR-connection to the Mobile Station is requested from the RR-sublayer (i.e. paging is performed).

3. MM-CONNECTION ACTIVE
   The MM-sublayer has a RR-connection to an identified and approved Mobile Station. One or more MM-connections are active.

4. IDENTIFICATION INITIATED
   The identification procedure has been started by the network. The timer T3270 is running.

5. AUTHENTICATION INITIATED
   The authentication procedure has been started by the network. The timer T3260 is running.

6. TMSI REALLOCATION INITIATED
   The TMSI reallocation procedure has been started by the network. The timer T3250 is running.

7. CIPHERING MODE INITIATED
   The cipher mode setting procedure has been requested by a RR-SYNC-REQUEST primitive to the RR-sublayer.

8. WAIT FOR MOBILE ORIGINATED MM-CONNECTION
   A CM-SERVICE REQUEST message is received and processed, and the MM-sublayer awaits the "opening message" of the MM-connection.

9. WAIT FOR REESTABLISHMENT
   The RR-connection to a Mobile Station with one or more active MM-connection has been lost. The network awaits a possible reestablishment request from the Mobile Station.

4.2 Type of MM-procedures

Depending on how they can be initiated, three types of MM- procedures can be distinguished :

(i) MM common procedures :

A MM common procedure can always be initiated whilst a RR-connection exists. The procedures belonging to this type are:
Initiated by the network :

- TMSI reallocation procedure
- authentication procedure
- identification procedure

Initiated by the Mobile station :

- IMSI detach procedure
  (with the exceptions specified in section 4.3.4)

(ii) MM specific procedures :

A MM specific procedure can only be initiated if no other MM specific procedure is running or no MM-connection exists.
The procedures belonging to this type are :

- location updating procedure
- periodic updating procedure
- IMSI attach procedure

(iii) MM-connection management procedures :

These procedures are used to establish, maintain and release a MM-connection between the mobile station and the network, over which an entity of the upper CM-layer can exchange information with its peer. A MM-connection establishment can only be performed if no MM specific procedure is running. More than one MM-connection may be active at the same time.

4.3 MM common procedures

As described above, a MM common procedure can be initiated at any time whilst a RR-connection exists between the network an the mobile station.

4.3.1 TMSI reallocation procedure

The purpose of the TMSI reallocation procedure is to provide identity confidentiality , i.e. to protect a user against being identified and located by an intruder (see Rec. GSM 02.09 and 03.20).

If the identity confidentiality service is active for an IMSI, a Temporary Mobile Subscriber Identity (TMSI) shall be used for identification within the radio interface signalling procedures.

The structure of the TMSI is specified in Rec. GSM 03.03.
The TMSI has only local significance within a location area.
Outside the location area it has to be combined with the Location Area Identifier (LAI) to provide for an unambiguous identity.

The TMSI reallocation procedure must be performed at least at each change of a location area. (Reallocation in other cases is left to the network operator).

The reallocation of a TMSI can be performed either by a unique procedure defined in this section or implicitely by the procedure using the TMSI. The implicit reallocation of a TMSI within a procedure is described together with that procedure.

If a TMSI provided by a Mobile Station is unknown in the network e.g. due to a data base failure, the Mobile Station has to provide its International Mobile Subscriber Identity (IMSI) on request from the network. In this case the identification procedure (see section 4.3.3) should be used before the TMSI reallocation procedure may be initiated.

The TMSI reallocation procedure can be initiated by the network at any time whilst a ciphered RR-connection exists between the network and the mobile station.

Note: Normally the TMSI reallocation will take place in conjunction with another procedure, e.g. at location updating or at call setup (see Rec. GSM 09.02).

4.3.1.1 TMSI reallocation initiation by the network

The network initiates the TMSI reallocation procedure by sending a TMSI REALLOCATION COMMAND message to the Mobile Station and starts the timer T3250.

The TMSI REALLOCATION COMMAND message contains a new combination of TMSI and LAI allocated by the network.. The TMSI-REALLOCATION COMMAND message is sent to the Mobile Station using a RR- connection in ciphered mode (see Rec. GSM 03.20).

4.3.1.2 TMSI reallocation completion by the Mobile Station

Upon receipt of the TMSI REALLOCATION COMMAND message the Mobile Station stores the received TMSI and Location Area Identifier (LAI) in its non-volatile memory, and sends a TMSI REALLOCATION COMPLETE message to the network.

4.3.1.3 TMSI reallocation completion in the network.

Upon receipt of the TMSI REALLOCATION COMPLETE message, the network stops the timer T3250 and considers the new TMSI as valid.

If the RR-connection is no more needed, then the network will request the RR-sublayer to release it (see section 3.5).

4.3.1.4 Abnormal cases

Mobile Station side:

The Mobile Station should consider the new TMSI as valid as soon as a TMSI REALLOCATION COMMAND or another message containing a new TMSI (e.g. LOCATION UPDATING ACCEPT) is correctly received. Any RR-connection failure at a later stage should not have any impact on the TMSI storage.

Network side:

(a) RR-connection failure :

If the RR-connection is lost before the TMSI REALLOCATION COMPLETE message is received, all MM-connections (if any) shall be released and both the old and the new TMSIs should be considered as occupied for a certain recovery time.
During this period the network may:

- use the IMSI for paging in the case of network originated transactions on the CM-layer. Upon response from the Mobile Station the TMSI reallocation is restarted.

- consider the new TMSI as valid if it is used by the Mobile Station in mobile originated requests for RR-connection.

- use the Identification procedure followed by a new TMSI reallocation if the Mobile Station uses the old TMSI or other invalid identification.

Other implementations are possible.

(b) Expiry of timer T3250 :

The TMSI reallocation is supervised by the timer T3250 in the network. At the first expiry of timer T3250 (while the RR-connection still is available) the network retransmits the message containing the TMSI (e.g. the TMSI REALLOCATION COMMAND or LOCATION UPDATING ACCEPT). If the timer T3250 expires a second time, the network shall abort the reallocation procedure, request the release of the RR-connection, release all MM-connections if any, and follow the rules described for RR-connection failure above.

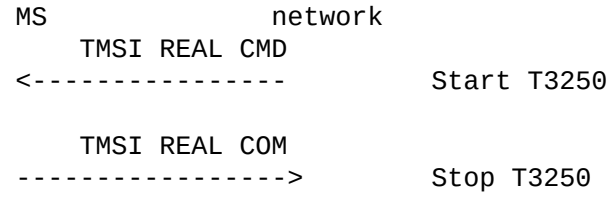


Fig. 4.1/GSM 04.08
TMSI reallocation sequence

4.3.2 Authentication procedure

The purpose of the authentication procedure is twofold:

First to check whether the identity provided by the Mobile Station is a true one or not (see Rec. GSM 03.20).

Second to provide a new ciphering key to the Mobile Station.

The cases where the authentication procedure should be used are defined in Rec. GSM 02.09.

The authentication procedure is always initiated and controlled by the network.

4.3.2.1 Authentication request by the network

The network initiates the authentication procedure by transferring an AUTHENTICATION REQUEST message across the radio interface and starts the timer T3260. The AUTHENTICATION REQUEST message contains the parameters necessary to calculate the response parameters (see Rec. GSM 03.20). It also contains the ciphering key sequence number allocated to the key which may be computed from the given parameters.

4.3.2.2 Authentication response by the Mobile Station

The Mobile Station should be ready to respond upon an AUTHENTICATION REQUEST message at any time whilst a RR- connection exists. It shall process the challenge information and send back an AUTHENTICATION RESPONSE message to the network. The new ciphering key calculated from the challenge information shall be stored and be used in the next ciphering mode setting procedures. The ciphering key sequence number shall be stored together with the calculated key.

4.3.2.3 Authentication processing in the network

Upon receipt of the AUTHENTICATION RESPONSE message, the network stops the timer T3260 and checks the validity of the response (see rec. GSM 03.20). The algorithm used for authentication is described in Rec. GSM 03.21.

4.3.2.4. Ciphering key sequence number

The security parameters for authentication and ciphering are tied together in sets, i.e. from a challenge parameter RAND both the authentication response SRES and the ciphering key can be computed given the secret key associated to the IMSI.

In order to allow start of ciphering on a RR-connection without authentication, the ciphering key sequence numbers are introduced. The sequence number is managed by the network in the way that the AUTHENTICATION REQUEST message contains the sequence number allocated to the key which may be computed from the RAND parameter carried in that message.

The Mobile Station stores this number, and indicates to the network in the first message (LOCATION UPDATING REQUEST, CM-SERVICE REQUEST, PAGING RESPONSE) which sequence number the stored key has.

The network may choose to start ciphering with the stored key (under the restrictions given in Rec. GSM 02.09) if the stored sequence number and the one given from the Mobile Station are equal.

4.3.2.5 Unsuccessful authentication

If authentication fails, i.e. if the response is not valid, the network may distinguish between the two different ways of identification used by the Mobile Station:

- the TMSI was used
- the IMSI was used

If the TMSI has been used, the network may decide to initiate the identification procedure. If the IMSI given by the Mobile Station then differs from the one the network had associated with the TMSI, the authentication should be restarted with the correct parameters. If the IMSI provided by the Mobile Station is the expected one (i.e. authentication has really failed), the network should proceed as described below.

If the IMSI has been used, or the network decides not to try the identification procedure, an AUTHENTICATION REJECT message should be transferred to the Mobile Station.
After having sent this message, all MM-connections in progress (if any) are released and the network should initiate the RR-connection release procedure described in section 3.5.

Upon receipt of an AUTHENTICATION REJECT message, the Mobile Station shall set a flag "Authentication failure" and remain in its current state waiting for the release of the RR-connection by the network. When the RR-connection is released, the Mobile Station shall delete its TMSI, LAI, Cipher Key and Cipher Key Sequence Number and return to the IDLE no IMSI state. In this state the Mobile Station only performs default cell selection (see section 3.2 and GSM rec 05.08), and only emergency calls are permitted.

4.3.2.6 Abnormal cases

(a) RR-connection failure :

Upon detection of a RR-connection failure before the AUTHENTICATION RESPONSE is received, the network shall release all MM-connections (if any) and abort any ongoing MM specific procedure.

(b) Expiry of timer T3260 :

The authentication procedure is supervised on the network side by the timer T3260. At the first expiry of this timer the network retransmits the AUTHENTICATION REQUEST message with the same information content. The Mobile Station shall respond to each authentication request message received.

If the timer T3260 expires a second time, the network shall abort the authentication procedure and any ongoing MM specific procedure, release all MM-connections in progress and initiate the RR-connection release procedure described in section 3.5.

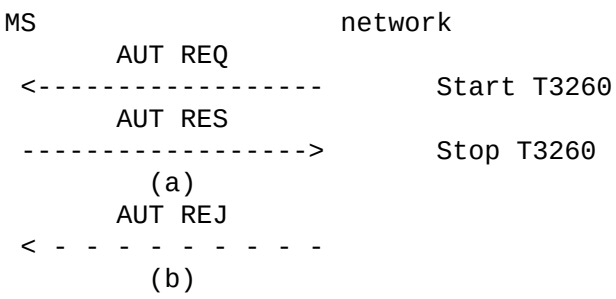


Fig. 4.2/GSM 04.08
Authentication sequence :
(a) authentication;
(b) authentication rejection.

4.3.3 Identification procedure

The identification procedure is used by the network to request a Mobile Station to provide specific identification parameters to the network e.g. International Mobile Subscriber Identity, International Mobile Equipment Identity (cf. Rec. GSM 03.03). For the presentation of the IMEI, the requirements of Rec. GSM 02.09 apply.

4.3.3.1 Identity request by the network

The network initiates the identification procedure by transferring an IDENTITY REQUEST message to the Mobile Station and starts the timer T3270. The IDENTITY REQUEST message specifies the requested identification parameters in the identity type information element.

4.3.3.2 Identification response by the Mobile Station

The mobile station should be ready to respond to an Identity Request message at any time whilst a RR-connection exists.

Upon receipt of the IDENTITY REQUEST message the Mobile Station sends back an IDENTITY RESPONSE message. The IDENTITY RESPONSE message contains the identification parameters as requested by the network.

Upon receipt of the IDENTITY RESPONSE the network shall stop timer T3270.

4.3.3.3 Abnormal cases

(a) RR-connection failure :

Upon detection of a RR-connection failure before the IDENTITY RESPONSE is received, the network shall release all MM-connections (if any) and abort any ongoing MM specific procedure.

(b) Expiry of timer T3270 :

The identification procedure is supervised by the network by the timer T3270. At the first expiry on the timer T3270, the network restarts the identification procedure. The IDENTITY REQUEST message is retransmitted and the timer is restarted. If the timer expires a second time the identification procedure and any ongoing MM specific procedure are aborted, all MM-connections (if any) are released and the network shall initiate RR-connection release as described in section 3.5.

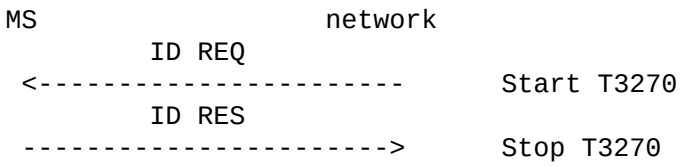


Fig. 4.3/GSM 04.08
Identification sequence

4.3.4 IMSI detach procedure

The IMSI detach procedure may be invoked by a Mobile Station if the Mobile Station is deactivated or if the Subscriber Identity Module (see Rec. GSM 02.17) is detached from the Mobile Station. A flag (ATT) broadcasted in the SYSTEM INFORMATION TYPE 3 message on the BCCH (and sent in the SYSTEM INFORMATION TYPE 8 message on the SACCH) is used by the network to indicate whether the detach procedure is required.

The procedure causes the Mobile Station to be indicated as inactive in the network.

4.3.4.1 IMSI detach initiation by the Mobile Station

The IMSI detach procedure consists only of the IMSI DETACH INDICATION message sent from the Mobile Station to the network. The Mobile Station then starts timer T3220.

If no RR-connection exists, the MM-sublayer within the mobile station will request the RR-sublayer to establish a RR-connection. If a RR-connection exists, the MM sublayer will release locally any ongoing MM-connections before the IMSI DETACH INDICATION message is sent.

The IMSI detach procedure may not be started if a MM specific procedure is active. If possible, the IMSI detach procedure is then delayed until the MM specific procedure is finished, else the IMSI detach is omitted.

4.3.4.2 IMSI detach procedure in the network

When receiving an IMSI DETACH INDICATION message, the network may set an inactive indication for the IMSI. No response is returned to the Mobile Station. After reception of the IMSI DETACH INDICATION message the network shall release locally any ongoing MM-connections, and start the normal RR-connection release procedure (see section 3.5).

4.3.4.3 IMSI detach completion by the Mobile Station

The Mobile Station should, if possible, delay the local release of the channel to allow a normal release from the network side until T3220 timeout. If this is not possible (e.g. detach at power down) the RR sublayer on the Mobile Station side should be aborted.

4.3.4.4 Abnormal cases

If establishment of an RR-connection is not possible, or the RR-connection is lost, the IMSI detach is aborted by the Mobile Station.

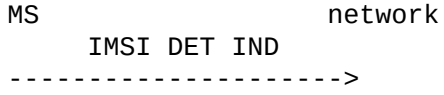


Fig. 4.4/GSM 04.08
IMSI detach sequence

4.4 MM specific procedures

A MM specific procedure can only be started if no other MM specific procedure is running or no MM connection exists between the network and the mobile station. The end of the running MM specific procedure or the release of all MM- connections have to be awaited before a new MM specific procedure can be started.

During the lifetime of a MM specific procedure, if a MM- connection establishment is requested by a CM-entity, this request will either be rejected or be delayed until the running MM specific procedure is terminated (this depends on the implementation).

Any MM common procedure (except IMSI detach) may be initiated during a MM specific procedure.

The Mobile Station side should await the release of the RR- connection used for a MM specific procedure before a new MM specific procedure or MM-connection establishment is started.

Note: The network side may use the same RR-connection for MM-connection management. Further study is required on this matter.

4.4.1 Location updating procedure

The location updating procedure is a general procedure which is used for the following purposes:

- normal location updating (described in this section);
- periodic updating (see section 4.4.2);
- IMSI attach (see section 4.4.3).

The normal location updating procedure is used to update the registration of the actual Location Area of a Mobile Station in the network. The location updating type information element in the LOCATION UPDATING REQUEST message shall indicate normal location updating. The location updating procedure is only performed if a subscriber identity module is available in the Mobile Station. It is initiated when the Location Area Identification received on the BCCH of the current serving cell (chosen as specified in Rec. GSM 05.08) differs from the value stored , e.g. if:

i) the Mobile Station has been switched on in a Location Area different from the one stored in a non volatile memory or when there is no stored Location Area Identification;

ii) the Mobile Station moves across the boundaries of a Location Area while being in the "idle" state;

The location updating procedure is also started if the network indicates that the Mobile Station is unknown in the VLR as a response to MM-connection establishment request.

To limit the number of location updating attempts made, where location updating is unsuccessful, an attempt counter is used. The attempt counter is reset when a Mobile Station is switched on or a SIM card is inserted.

Upon successful location updating the Mobile Station stores the received Location Area Identification in a non-volatile memory and the attempt counter shall be reset.

The detailed handling of the attempt counter is described in 4.4.4.5 to 4.4.4.8.

The cell selection processes in the different states are described in Rec. GSM 05.08.

The location updating procedure is always initiated by the Mobile Station.

4.4.2 Periodic updating

Periodic updating may be used to notify periodically the availability of the Mobile Station to the network. Periodic updating is performed by using the location updating procedure. The location updating type information element in the LOCATION UPDATING REQUEST message shall indicate periodic updating.

The procedure is controlled by the timer T3212 in the Mobile Station. The timer is started each time The Mobile Station enters the "Idle, updated" state or "idle not updated" if applicable.
The timer is reset to 0 when :

- a generic location updating procedure for normal location updating or IMSI attach is started;
- the first MM-message is received, or ciphering mode setting is completed in the case of MM-connection establishment;
- the MS has responded to paging;
- the timer has expired.

When the MS is deactivated (i.e. equipment powered down or SIM removed), the current timer value is stored in the non- volatile memory.
At timer expiry (see below), the location updating procedure is started.
If the Mobile Station is not camped on a cell (see Rec. GSM 05.08) when the timer expires the location updating procedure is delayed until the Mobile Station has succeeded to camp on a cell. In case the received LAI of the current serving cell differs from the stored LAI a normal location updating procedure (see section 4.4.1) is invoked.
The (periodic) location updating procedure is not started if the BCCH information at the time the procedure is triggered indicates that periodic location shall not be used.
The timeout value is broadcasted in the SYSTEM INFORMATION TYPE 3 message on the BCCH, see section 10.5.2.8.

The timer should run in such a way that :

a) periodic location updatings of different mobile stations are spread out in time after a change of the T3212 timeout value (espescially when the T3212 timeout value is changed from a high to a small value);
b) when there has been a change of the T3212 timeout value, the MS T3212 timer should not run for more than the new value after the change has been performed.

4.4.3 IMSI attach procedure

The IMSI attach procedure is the complement of the IMSI detach procedure (see section 4.3.4). It is used to indicate the IMSI as active in the network. A flag (ATT) is broadcast in the SYSTEM INFORMATION TYPE 3 message. It indicates whether the attach and detach procedures are required to be used or not.

The IMSI attach procedure is invoked if the detach/attach procedures are required by the network and an IMSI is activated in a Mobile Station (i.e. activation of a Mobile Station with plug-in SIM, insertion of a card in a card- operated Mobile Station etc.) within coverage area from the network or a Mobile Station with an IMSI activated outside the coverage area enters the coverage area. The IMSI attach procedure is used only if the IMSI was deactivated while the MS was in "idle updated" state and the stored Location Area Identification is the same as the one which is actually broadcasted on the BCCH of the current serving cell. In the case of difference between the stored LAI and the one received on the BCCH of the current serving cell, a normal location updating procedure (see section 4.4.1) is invoked independently of the ATT flag indication.

IMSI attach is performed by using the location updating procedure. The location updating type information element in the LOCATION UPDATING REQUEST message shall in this case indicate IMSI attach.

4.4.4 Generic Location Updating procedure

4.4.4.1 Location updating initiation by the Mobile Station

The Mobile Station initiates the location updating procedure by sending a LOCATION UPDATING REQUEST message to the network and starts the timer T3210. The location updating type information element shall indicate what kind of updating is requested. .

As no RR-connection exists at the time when the location updating procedure has to be started, the MM-sublayer within the mobile station will request the RR-sublayer to establish a RR-connection. The procedure for establishing a RR- connection is described in section 3.3.

4.4.4.2 Identification request from the network

The network may initiate the identification procedure, e.g.if the network is unable to get the IMSI based on the TMSI and LAI used as identification by the Mobile Station (see section 4.3.3).

4.4.4.3 Authentication by the network

The authentication procedure (see section 4.3.2) is initiated by the network upon receipt of the LOCATION UPDATING REQUEST message from the Mobile Station in the cases defined in Rec. GSM 02.09.

4.4.4.4 Ciphering mode setting by the network

The ciphering mode setting procedure (see section 3.4.7) is initiated by the network, if a new TMSI has to be allocated.

4.4.4.5 Location updating accepted by the network

If the location updating is accepted by the network a LOCATION UPDATING ACCEPT message is transferred to the Mobile Station.

In case the identity confidentiality service is active (see section 4.3.1 and 4.4.4.4), the TMSI reallocation may be part of the location updating procedure. The TMSI allocated is then contained in the LOCATION UPDATING ACCEPT message together with the location area identifier LAI. The network shall in this case start the supervision timer T3250 as described in section 4.3.1.

The mobile station receiving a LOCATION UPDATING ACCEPT message shall store the received location area identification LAI, stop timer T3210, reset the attempt counter and set the update status to "updated". If the message contains an IMSI, the mobile station shall delete any TMSI. If the message contains a TMSI, the mobile station shall store the TMSI and a TMSI REALLOCATION COMPLETE shall be returned to the network. If neither IMSI nor TMSI is received in the LOCATION UPDATING ACCEPT message, the old TMSI if any available shall be kept.
After that, the mobile station shall wait for the network to release the RR-connection, see section 4.4.4.7.
In normal cases, the mobile station will enter the "idle, updated" state after the release of the RR-connection. In this state it shall :

- perform normal location updating when a new location area is entered
- perform periodic updating
- perform IMSI detach
- perform IMSI attach if activated in the same location area
- support requests from the CM layer
- respond to paging

4.4.4.6 Location updating not accepted by the network

If the location updating cannot be accepted the network sends a LOCATION UPDATING REJECT message to the Mobile Station.
The Mobile Station receiving a LOCATION UPDATING REJECT message shall stop the timer T3210, store the reject cause, start T3240 and enter the location updating rejected state awaiting the release of the RR-connection triggered by the network. Upon the release of the RR-connection the MS shall take the following actions depending on the stored reject cause:

2 (IMSI unknown in HLR), or
3 (Illegal MS):
For the Mobile Station this corresponds to authentication failure. The Mobile Station shall delete any TMSI, stored LAI, cipher key and cipher key sequence number and enter the "idle, no IMSI" state. In this state the Mobile Station shall act in the following way:

- not start any normal location updating attempt
- not perform periodic updating
- not perform IMSI detach if powered down
- reject any requests from CM entities for MM-connections except emergency calls
- not respond to paging

11 (PLMN not allowed):
12 (Location Area not allowed):
The Mobile Station shall delete any TMSI, cipher key and cipher key sequence number, reset the attempt counter and in the case of normal location updating, store the LAI received on the BCCH that triggered the location updating request, and then enter the "idle, roaming not allowed" state and memorize which of the above mentioned causes has been received. In this state, it shall in case of "Location Area not allowed":

- perform normal location updating when a new location area is entered
- not perform periodic updating
- not perform IMSI detach
- not perform IMSI attach if activated in the same location area
- reject any requests from CM entities for MM-connections except emergency calls
- respond to paging (with IMSI) when roaming not allowed in this area.

In case of "PLMN not allowed", it shall:

- perform normal location updating when a new PLMN is entered
- not perform periodic updating
- not perform IMSI detach
- not perform IMSI attach if activated in the same location area
- reject any requests from CM entities for MM connections except emergency calls, and
- it may respond to paging (with IMSI).

Other values are considered as abnormal cases and the specification of the MS behaviour in those cases is given in section 4.4.4.8.

4.4.4.7 Release of RR-connection after location updating

When the Location updating procedure is finished (see sections 4.4.4.5 and 4.4.4.6) the Mobile Station shall set timer T3240 and enter the state "Wait for network command", expecting the release of the RR-connection.

The release of the RR-connection shall be initiated by the network according to section 3.5.
If the RR-connection is not released within a given time controlled by the timer T3240, the Mobile station shall abort the RR-connection. In both cases, either after a RR-connection release triggered from the network side or after a RR-connection abort requested by the MS-side, the MS shall return to its appropriate "Idle" state depending on the current update status.

NOTE: The network may decide to keep the RR-connection for network initiated establishment of a MM- connection.

4.4.4.8 Abnormal cases on the Mobile Station side

The different abnormal cases that can be identified are the following:

a) Access barred because of access class control
The location updating procedure is not started. The MS stays in the current serving cell and applies normal cell reselection process. The procedure is started as soon as possible and if still necessary (when the barred state is ended or because of a cell change)

b) The random access is delayed (reception of an IMMEDIATE ASSIGNMENT REJECT message)
The location updating is not started. The MS stays in the chosen cell and applies normal cell selection process. The waiting timer T3122 is reset when a cell change occurs. The procedure is started as soon as possible after T3122 timeout if still necessary.

c) The random access fails
Timer T3213 is started. When it expires the procedure is attempted again if still necessary

Note: As specified in Rec. GSM 05.08, a cell reselection then takes place, with return to the cell inhibited for 5 seconds. Typically the selection process will take the MS back to the cell where the random access failed after 5 seconds.

d) RR-connection failure
The procedure is aborted and the MS proceeds as specified below.

e) T3210 timeout
The procedure is aborted, the RR-connection is aborted and the MS proceeds as specified below.

f) RR release before the normal end of procedure
The procedure is aborted and the MS proceeds as specified below.

g) Location updating reject, other causes than those treated in section 4.4.4.6
The MS waits for release of the RR-connection as specified in section 4.4.4.7, and then proceeds as specified below.

In cases d) to g) above the MS proceeds as follows. Timer T3210 is stopped if still running. The attempt counter is incremented. The next actions depend on the Location Area Identities (stored and received from the BCCH of the current serving cell) and the value of the attempt counter.

- the stored LAI is equal to the one received on the BCCH from the current serving cell and the attempt counter is smaller than 4
  The MS enters the "idle, updated" state and starts timer T3211. Timer T3211 is stopped when a MM-connection is successfully established or when entering a new location area. When timer T3211 expires, the procedure (either periodic location updating or IMSI attach) is triggered again.

- either there is no stored LAI or the stored LAI is different from the one received on the BCCH from the current serving cell, or the attempt counter is greater or equal to 4
  The MS shall erase any stored LAI, TMSI, Kc and Kc sequence number, shall enter the "idle, not updated" state. If the attempt counter is smaller than 4, the MS shall start timer T3211, otherwise it shall start timer T3212 if applicable. Timer T3211 is stopped if a new location updating procedure is triggered. When timer T3211 expires, a normal location procedure is triggered again.

In the "idle, not updated" state, the MS shall:
- perform normal location updating when a new cell is entered or the location area identification of the serving cell is changed;
- perform periodic updating
- not perform IMSI detach
- not perform IMSI attached if activated in the same location area
- support request for emergency calls
- use other request from CM layer as triggering of a normal location updating procedure (if the location updating procedure is successful, then the request for MM-connection is accepted, see section 4.5.1)
- respond to paging (with IMSI)

In the "idle, not updated" state, the attempt counter shall be reset when:
- a new location area is entered,
- at expiry of timer T3212;
- location updating is triggered by request from CM layer
- the IMSI is activated (see section 4.4.3)

Note: there is no need to store the attempt counter value in the SIM.

4.4.4.9 Abnormal cases on the network side:

a) RR-connection failure

If a RR-connection failure occurs during a common procedure integrated with the location updating procedure, the behaviour of the network should be according to the description of that common procedure.

If a RR-connection failure occurs when a common procedure does not exist, the location updating procedure towards the Mobile Station should be aborted.

b) protocol error

If the LOCATION UPDATING REQUEST message is received with a protocol error, the network should, if possible, return a LOCATION UPDATING REJECT message with one of the following Reject causes:

#96: Mandatory information element error
#99: Information element non-existent or not implemented
#100: Invalid information element content
#111: Protocol error, unspecified

Having sent the response, the network should start the channel release procedure (see section 3.5).

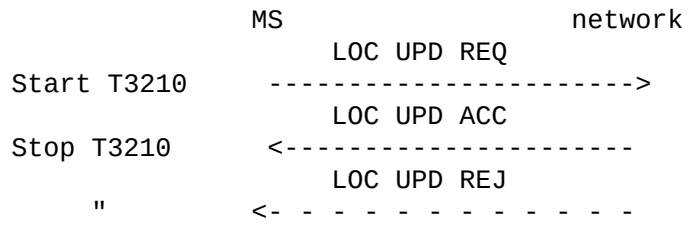


Fig. 4.5/GSM 04.08
Location updating sequence

4.5 Connection management sublayer service provision

The Mobility Management (MM-) sublayer is providing connection management services to the different entities of the upper Connection management (CM-) sublayer (see Rec. GSM 04.07). It offers to the CM-entities the possibility to use a MM-connection for the exchange of information with its peer. This MM-connection is established and released at request from a CM-entity.

In the following sections, the procedures needed for establishing, maintaining and releasing a MM-connection are described.

The CM-sublayer service provision is described separately for the Mobile Station and the network side.

4.5.1 MM-connection establishment

4.5.1.1 MM-connection establishment initiated by the Mobile Station

A MM-connection requiring the establishment of a RR-connection may only be established when the Mobile Station has performed a successful location updating in the current location area. An exception from this general rule exists for emergency calls which may be established at any time (see section 4.5.1.4).

If a MM specific procedure running at the time the request from the CM-layer is received, the request will either be rejected or delayed, depending on implementation, until the MM specific procedure is finished and the RR-connection is released.

One RR-connection may be used to support several MM- connections. If no RR-connection exists when the request for MM-connection is received, the MM-sublayer will request the establishment of a RR-connection to the RR-sublayer.

When a RR-connection is available, a CM-SERVICE REQUEST message is sent to network and timer T 3230 is started. The message contains the mobile identity, classmark information, ciphering key sequence number and identification of the requested type of transaction (e.g. outgoing call establishment, short message transfer, supplementary service activation/registration etc.). The mobile station can only have one pending MM-connection request, i.e. a new CM-SERVICE REQUEST message is not sent before a response is received on the pending one.

Upon receiving a CM-SERVICE REQUEST message, the network shall analyse its content. Depending on the type of request and the current status of the RR-connection, the network may start any of the MM common procedures.

The identification procedure (see section 4.3.3) may be invoked for instance if a TMSI provided by the Mobile Station is not recognized.

The network may invoke the authentication procedure (see section 4.3.2) depending on the CM-service type.

The network decides also if the ciphering mode setting procedure shall be invoked (see section 3.4.7).

An indication from the RR-sublayer that the ciphering mode setting is completed, or reception of a CM-SERVICE- ACCEPT message, shall be treated as a service acceptance indication by the Mobile Station. Timer T3230 shall be stopped, and the CM-entity requesting a MM-connection shall be informed.

If the service request cannot be accepted, the network returns a CM-SERVICE-REJECT message to the Mobile Station.

The reject Cause information element (see 10.5.3.6 and Annex G) indicates the reason for rejection. The following cause values may apply:

```
 #4 : IMSI unknown in VLR
#17 : Network failure
#22 : Congestion
#32 : Service option not supported
#33 : Requested service option not subscribed
#34 : Service option temporarily out of order
#38 : Call cannot be identified
```

If no other MM-connection is active, the network starts the RR-connection release (see section 3.5) when the CM-SERVICE REJECT message is sent.

If a CM-SERVICE-REJECT message is received by the Mobile Station, the timer T3230 shall be stopped, the requesting CM-sublayer entity is informed and the MM-sublayer returns to the previous state (the state where the request was received). If cause value #4 is received, the mobile station aborts any MM-connection, deletes any TMSI, LAI, cipher key and cipher key sequence number, changes the update status to "not updated" and waits for the network to release the RR-connection - see section 4.5.3.1 (this will force the mobile station to initiate a normal location updating). Whether the CM- request shall be memorized during the location updating procedure, is a choice of implementation.

Other MM-connections should not be affected by the CM- SERVICE REJECT message, except for the case of cause value number 4 as described above.

4.5.1.2 Abnormal cases

Mobile Station side:

a) RR-connection failure

If a RR connection failure occurs, the MM-connection establishment is aborted (timer T3230 is stopped), and an indication is given to the CM-layer. This will be treated as a reject for establishment of the new MM- connection and release of any ongoing MM-connections.

b) T3230 expiry

If T3230 expires (i.e. no response is given but a RR-connection is available) the MM-connection establishment is aborted and the requesting CM- sublayer is informed. Other ongoing MM-connections (if any) shall not be affected.

c) Reject causes #96, #97, #99, #100, #111 received

The same actions as on timer expiry shall be taken by the Mobile station.

Network side:

a) RR-connection failure

The actions to be taken upon RR-connection failure within a MM common procedure are described together with that procedure. A RR-connection failure occuring outside such MM common procedures, shall trigger the release of all active MM-connections if any.

b) Invalid message or message content

Upon reception of an invalid initial message or a CM- SERVICE REQUEST message with invalid content, a CM- SERVICE REJECT message shall be returned with one of the following appropriate Reject cause indications:

#96 : Mandatory information element error
#97 : Message type non-existent or not implemented
#99 : Information element non-existent or not implemented
#100 : Invalid information element content
#111 : Protocol error, unspecified

When the CM-SERVICE REJECT message has been sent, the network should start RR-connection release if no other MM- connections exist or if the abnormal condition also has influence on the other MM-connections.

4.5.1.3 MM-connection establishment initiated by the network

When a CM-sublayer entity in the network requests the MM- sublayer to establish a MM-connection, the MM-sublayer will request the establishment of a RR-connection to the RR- sublayer if no RR-connection to the desired Mobile Station exists.

No specific CM-sublayer service provision messages are transferred in this case. The MM-sublayer is informed when the paging procedure is finished (see section 3.3.2).

When a RR-connection is established (or if it already exists at the time the request is received), the MM-sublayer may initiate any of the MM common procedures (except IMSI detach) and request ciphering mode setting by the RR- sublayer if needed.

After the completion of any required MM common procedures and/or ciphering mode setting, the MM-sublayer will inform the requesting CM-sublayer entity on the success of the MM- connection establishment.

If the establishment of a RR-connection is unsuccessful, or if any of the MM common procedures or the ciphering mode setting fail, this is indicated to the CM-layer with an appropriate error cause.

If a RR-connection used for a MM-specific procedure exist to the Mobile Station, the CM-request may be rejected or deleayed depending on implementation.

NOTE: The possibility of using the same RR-connection after the MM specific procedure is finished for MM-connection establishment is for further study.

4.5.1.4 Abnormal cases

The behaviour upon abnormal events is described together with the relevant RR procedure or MM common procedure.

4.5.1.5 MM-connection establishment for emergency calls

The emergency call request will be permitted in all states of the mobility management sublayer which allow a normal originating call establishment. However, as a network dependent option, an emergency call request may in addition be served in the following Mobility management states:

i) location updating failure;
ii) idle, roaming not allowed;
iii) idle, no IMSI.

When a user requests an emergency call establishment the Mobile station will send a CM-SERVICE REQUEST message to the network with a CM-service type information element indicating emergency call establishment. If the network does not accept the emergency call request e.g. because it may have received the request in one of the states i) to iii) mentioned above and this capability is not supported by the network, the network will reject the request by returning a CM-SERVICE REJECT message to the Mobile Station.

The appropriate reject causes will be :

case i) #4 "IMSI unknown in VLR"
case ii) #4 "IMSI unknown in VLR"
case iii) #5 "IMEI not accepted"

Other causes that may be received are :

#3 "Illegal MS"
#17 "Network failure"
#22 "Congestion"
#32 "Service option not supported"
#34 "Service option temporarily out of order"

When receiving a reject cause, the procedures of section 4.5.1.1 should be followed.

Note: Normally, the mobile station will be identified by an IMSI or a TMSI. However, if none of these identifiers is available in the mobile station, then the mobile station will use the IMEI for identification purposes.
The network may reject the request by returning a CM-SERVICE REJECT message with MM cause :
#5 "IMEI not accepted".

4.5.1.6 Call re-establishment

The re-establishment procedure allows a MS to resume connection in progress after a lower layer failure, possibly in a new cell. The conditions in which to attempt call re-establishment or not depend on the call control state, see section 5.5.4.

The re-establishment takes place when a lower layer failure occurs while the MM-connection is active.

Call re-establishment is done by using the procedure of section 4.5.1.1 where the CM-SERVICE REQUEST message is replaced by CM-REESTABLISHMENT REQUEST message. The CM-REESTABLISHMENT REQUEST message contains the mobile identity (IMSI or TMSI).

The following additional procedure must be observed :

If the network cannot associate the re-establishment request with any existing call for that MS, a CM-SERVICE REJECT message is returned with the reject cause :

#38 "call cannot be identified"

The network shall also release the RR-connection.

If call re-establishment cannot be performed for other reasons, the appropriate reject cause could be either of the following (see annex G):

#17 "network failure"
#22 "congestion"
#32 "service option not supported"
#34 "service option temporarily out of order"

4.5.2 MM-connection information transfer phase

After the MM-connection has been established, it can be used by the CM-sublayer entity for information transfer.
According to the protocol architecture described in Rec. GSM 04.07, each CM-entity will have its own MM-connection. These different MM-connections are identified by the protocol discriminator PD and, additionally, by the transaction identifier TI.

All MM common procedures may be initiated at any time while MM-connections are active. Except from Short Message Control which uses a separate layer 2 low priority channel, no priority mechanism is defined between the CM, MM and RR sublayer messages.

4.5.2.1 Sending CM-messages

A CM-sublayer entity, after having been advised that a MM- connection has been established, can request the transfer of CM-messages. The CM-messages passed to the MM-sublayer are then sent to the other side of the interface with the PD (and TI for the case of a CC- or SMC-entity) set according to the source entity.

4.5.2.2 Receiving CM-messages

Upon receiving a CM-message, the MM-sublayer will distribute it to the relevant CM-entity according to the PD-value (and TI-value for the case of a CC- or SMC-entity). However, if the received CM-message is the first for the MM-connection (identified by PD and additionally by TI in the case of CC and SMC), the MM-sublayer will in addition indicate to the CM-entity that a new MM-connection has been established.

4.5.2.3 Abnormal cases

RR-connection failure:

In case of RR-connection failure, the MM sublayer should locally release all ongoing MM-connections. If the RR- connection failure occurs during a RR or MM common procedure, the consequent actions are described together with that procedure.

4.5.3 MM-connection release

An established MM-connection can be released by the local CM-entity. The release of the CM-connection will then be done locally in the MM-sublayer, i.e. no MM-message are sent over the air interface for this purpose.

4.5.3.1 Release of associated RR-connection

If all MM-connections are released by their CM-entities, the Mobile station shall set timer T3240 and enter the state "wait for network command", expecting the release of the RR-connection.

In the network, if the last MM-connection is released by its user, the MM-sublayer may decide to release the RR- connection by requesting the RR-sublayer according to section 3.5.

If the RR-connection is not released within a given time controlled by the timer T3240, the mobile station shall abort the RR-connection. In both cases, either after a RR-connection release triggered from the network side or after a RR-connection abort requested by the MS-side, the MS shall return to its appropriate "Idle" state depending on the current update status.

4.6 Receiving a MM-STATUS message by a MM-entity.

If the MM-entity of the Mobile Station receives a MM-STATUS message no state transition and no specific action shall be taken as seen from the radio interface, i.e. local actions are possible.

The actions to be taken on receiving a MM-STATUS message in the network are an implementation dependant option.

5 ELEMENTARY PROCEDURES FOR CIRCUIT-SWITCHED CALL CONTROL

5.1 Overview

5.1.1 General

This section describes a set of procedures combined in one entity, the so called Call Control (CC) entity. The CC- entity is one of several entities of the connection Management (CM) sublayer.

Each entity of the CM-sublayer is independent from each other and may communicate with the correspondant peer entity using its own MM-connection.

More than one MM-connection may be established at the same time to allow parallel transactions.

Since more than one CC-entity are defined in the CM- sublayer, parallel calls can be handled on different MM- connections.

The following section does not deal further on with any parallel aspects of a call. It will describe the Call Control by means of procedures with regard to just one single transaction.

The terms "mobile originating" and "mobile terminating" are used to describe the call as viewed by the Mobile Station side of the interface.

Fig. 5.1a/GSM 04.08 gives an overview of the main states and transitions on the MS side.

Fig. 5.1b/GSM 04.08 gives an overview of the main states and transitions on the network side.

Detailed description of the procedures for call control are given in this section in terms of: (a) the sequence of messages defined which are transferred across the radio interface; and (b) the information processing and actions that take place at the Mobile Station side and the network side.

FIGURE 5.1a/GSM 04.08
Overview call control protocol/MS side

FIGURE 5.1b/GSM 04.08
Overview call control protocol/Network side

5.1.2 Call Control States

5.1.2.1 Call states at the Mobile Station side of the interface

The states which may exist on the Mobile Station side of the radio interface are defined in this section.

Note: All states are CCITT defined states except states which are GSM PLMN specific states.

5.1.2.1.1 Null (State U0)

No call exists.

5.1.2.1.2 MM-Connection pending (U0.1)

This state exists for a mobile originating call, when the Mobile Station requests the establishment of a MM- connection.

5.1.2.1.3 Call initiated (U1)

This state exists for a mobile originating call, when the Mobile Station requests call establishment from the network.

5.1.2.1.4 Mobile originating call proceeding (U3)

This state exists for a mobile originating call when the Mobile Station has received acknowledgement that the network has received all call information necessary to effect call establishment.

5.1.2.1.5 Call delivered (U4)

This state exists for a mobile originating call, when the calling Mobile Station has received an indication that remote user alerting has been initiated.

5.1.2.1.6 Call present (U6)

This state exists for a mobile terminating call when the Mobile Station has received a call establishment request but has not yet responded.

5.1.2.1.7 Call received (U7)

This state exists for a mobile terminating call when the Mobile Station has indicated alerting but has not yet answered.

5.1.2.1.8 Connect Request (U8)

This state exists for a mobile terminating call, when the Mobile Station has answered the call and is awaiting to be awarded the call.

5.1.2.1.9 Mobile terminating call confirmed (U9)

This state exists for a mobile terminating call when the Mobile Station has sent acknowledgement that the Mobile Station has received all call information necessary to effect call establishment.

5.1.2.1.10 Active (U10)

This state exists for a mobile terminating call when the Mobile Station has answered the call.This state exists for a mobile originating call when the Mobile Station has received an indication that the remote user has answered the call.

5.1.2.1.11 Disconnect request (U11)

This state exists when the Mobile Station has requested the network to clear the end-to-end connection (if any) and is waiting for a response.

5.1.2.1.12 Disconnect indication (U12)

This state exists when the Mobile Station has received an invitation to disconnect because the network has disconnected the end-to-end connection (if any).

5.1.2.1.13 Release request (U19)

This state exists when the Mobile Station has requested the net-work to release and is waiting for a response.

5.1.2.1.14 Mobile originating modify (U26)

This state exists when the mobile station has sent a request to the network for a new mode but has not yet received an answer.

5.1.2.1.15 Mobile terminating modify (U27)

This state exists when the mobile station has received a request from the network for a new mode and has sent a response and awaits a channel Mode Modify or assignment indication from the network.

5.1.2.2 Network call states

Note: All states are CCITT defined states except states which are GSM PLMN specific states.

The call states that may exist on the network side of the radio interface are defined in this section.

5.1.2.2.1 Null (State N0)

No call exists.

5.1.2.2.2 MM-connection pending (N0.1)

This state exists for a mobile terminating call, when the network requests the establishment of a MM-connection.

5.1.2.2.3 Call initiated (N1)

This state exists for a mobile originating call when the network has received a call establishment request but has not yet responded.

5.1.2.2.4 Mobile originating call proceeding (N3)

This state exists for a mobile originating call when the network has sent acknowledgement that the network has received all call information necessary to effect call establishment.

5.1.2.2.5 Call delivered (N4)

This state exists for a mobile originating call when the network has indicated that remote user alerting has been initiated.

5.1.2.2.6 Call present (N6)

This state exists for a mobile terminating call when the network has sent a call establishment request but has not yet received a satisfactory response.

5.1.2.2.7 Call received (N7)

This state exists for a mobile terminating call when the network has received an indication that the Mobile Station is alerting but has not yet received an answer.

5.1.2.2.8 Connect request (N8)

This state exists for a mobile terminating call when the network has received an answer but the network has not yet awarded the call.

5.1.2.2.9 Mobile terminating call confirmed (N9)

This state exists for a mobile terminating call when the network has received acknowledgement that the Mobile Station has received all call information necessary to effect call establishment.

5.1.2.2.10 Active (N10)

This state exists for a mobile terminating call when the network has awarded the call to the called Mobile Station. This state exists for a mobile originating call when the network has indicated that the remote user has answered the call.

5.1.2.2.11 Disconnect request (N11)

This state exists when the network has received a request from the Mobile Station to clear the end-to-end connection (if any).

5.1.2.2.12 Disconnect indication (N12)

This state exists when the network has disconnected the end- to-end connection (if any) and has sent an invitation to disconnect the Mobile Station network connection.

5.1.2.2.13 Release request (N19)

This state exists when the network has requested the Mobile Station to release and is waiting for a response.

5.1.2.2.14 Mobile originating modify (N26)

This state exists when the network has received a request from the mobile station for a new mode but has not yet sent a response.

5.1.2.2.15 Mobile terminating modify (N27)

This state exists when the network has sent a request to the mobile station for a new mode but has not yet received an answer.

5.1.2.2.16 Connect Indication (N28)

This state exists for a mobile originating call when the network has indicated that the remote user has answered the call and the network is waiting for acknowledgement by the the Mobile Station.

5.1.2.2.17 Assignment pending (N3a, N4a, N7a, N9a)

This state exists as an intermediate wait state after having left a specific call state such as N3, N4, N7, N9 when the network requests the assignment of a traffic channel. Upon completion of the assignment, the network shall return to its previous call state.

5.1.3 Circuit-switched call control procedures

The call states referred to cover the states perceived by the network, states perceived by the Mobile Station and states which are common to both Mobile Station and network.

All messages in this Recommendation contain functional information elements. Functional information elements are characterized as requiring a degree of intelligent processing by the terminal in either their generation or analysis.

The procedures needed for call control are:

- call establishment procedures
- call clearing procedures
- call information phase procedures
- miscellaneous procedures.

Note: The contents of the specific messages are only given for better understanding. A complete description of the messages and their contents is given in section 9.

Note: Whenever the Mobile Station has to attach the user connection, and the appropriate channel is not available, then it shall delay the throughconnection until a compatible radio resource is available; if in the meantime a new order to attach is received, the new order shall supersede the previous one. This note applies implicitly throughout this recommendation.

5.2 Call establishment procedures

5.2.1 Mobile originating call establishemnt

Before call establishment can be initiated the peer to peer connection between the Mobility Management sublayers in the Mobile Station and in the Network (MM-connection) must be established.

The Call Control entity of the Mobile Station requests the MM-sublayer to establish a mobile originating MM-connection enters the "MM-connection pending" state. This request shall contain a parameter to specify whether the call is a basic or an emergency call. This will lead to specific qualities of services to be provided by the MM-sublayers. Timer T303 is started when the CM-SERVICE-REQUEST message is sent.

After completion of the establishment of the MM-connection, a confirmation is given to indicate that MM is ready for data transfer and could be used to send the first call control message (SETUP) to the network.

The MM-connection establishment is indicated to call control at the network side when the first call control message has been received.

5.2.1.1 Basic call establishment

The Call Control entity of the Mobile Station requests the establishment of a MM-connection indicating that the call will be a basic call. This will lead to a specific quality of service required from the MM-sublayer : the originating Mobile Station must be registered and the cipher mode must be set before the MM-connection establishment can be confirmed.

5.2.1.1.1 Basic call request

Upon MM-connection establishment, the call control entity of the Mobile Station initiates call establishment by transferring a SETUP message across the radio interface. Following the transmission of the SETUP message, the call shall be considered by the Mobile Station to be in the "call initiated" state. This state is supervised by timer T303, which has already been started when entering the MM-connection pending state.

The SETUP message shall contain all the information required by the network to process the call and in particular, the called party address information.

When the Mobile Station is in the "call initiated" state and if it receives:

i) a CALL PROCEEDING message, the Mobile Station shall proceed as described in section 5.2.1.1.3;

ii) an ALERTING message, the Mobile Station shall proceed as described in section 5.2.1.1.5;

iii) a CONNECT message, the Mobile Station shall proceed as described in section 5.2.1.1.6;

iv) a RELEASE COMPLETE message the Mobile Station shall proceed as described in section 5.2.1.1.2.

Abnormal case:
Since timer T303 is used to supervise the two consecutive states MM-connection pending and Call initiated, the expiry of timer T303 leads to different actions depending on the respective state:
If timer elapses in the MM-connection pending state, the MM-connection in progress shall be aborted and the user shall be informed about the rejection of the call
If timer T303 elapses in the "call initiated" state before any of the CALL PROCEEDING, ALERTING, CONNECT or RELEASE COMPLETE messages has been received, the clearing procedure described in section 5.4 is performed.

5.2.1.1.2 Invalid call information

If, following the receipt of SETUP message, the network determined that the call information received from the Mobile Station is invalid (e.g. invalid number), then the network shall initiate call clearing as defined in sect. 5.4 with a cause such as one of the following:

1 "unassigned (unallocated) number"
3 "no route to destination"
22 " number changed"
28 "invalid number format (incomplete number)"

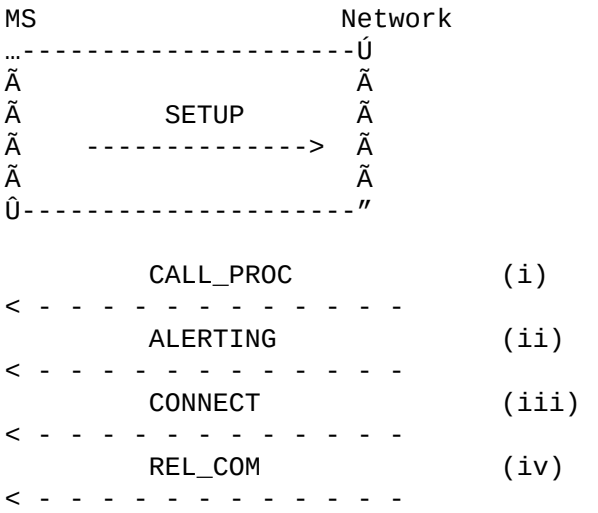


Fig. 5.2/GSM 04.08
Mobile originated Call initiation
and possible subsequent responses.

5.2.1.1.3 Call proceeding

Note: Overlap sending is not supported.

As en-bloc sending is used (i.e. the network can determine that the SETUP message contains all the information required from the Mobile Station to establish the call) the network shall: send a CALL PROCEEDING message to the Mobile Station to indicate that the call is being processed; and enter the "mobile originating call proceeding" state.

Note: The possibility of the network immediately sending a CONNECT message or ALERTING message (thereby suppressing the CALL PROCEEDING message) is for further study. Nevertheless the Mobile Station shall treat these messages as described in section 5.2.1.1.1.

The network may insert bearer capability information element(s) to select options presented by the mobile station in the Bearer Capability information element(s) of the SETUP message. The bearer capabiltiy information element(s) shall contain the same parameters as received in the SETUP except those presenting a choice. In this state the network may initiate the assignment of a traffic channel according to section 5.2.1.1.9 (early assignment).
When the Mobile Station receives the CALL PROCEEDING message, the Mobile Station shall stop timer T303; start timer T310; enter the "mobile originating call proceeding" state.

Similarly, if the network determines that a requested service is not authorized or is not available, the network shall initiate call clearing in accordance with sect. 5.2.4 with one of the following causes:

57 "bearer capability not authorized"
58 "bearer capability not presently available"
63 "service or option not available, unspecified" or # 65 "bearer service not implemented".

Abnormal case:
If timer T310 elapses before any of the ALERTING, CONNECT or DISCONNECT messages has been received, the mobile station shall perform the clearing procedure described in section 5.2.4.

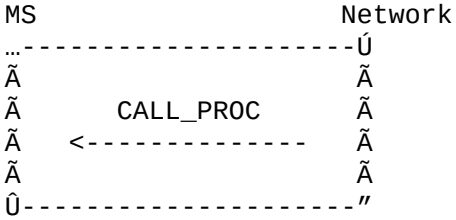


Fig. 5.3/GSM 04.08
Call proceeding sequence at mobile originating call establishment

5.2.1.1.4 Notification of interworking in connection with mobile originated call establishment.

Note: In this section, the term "interworking" is used only in the meaning of interworking with a network other than PLMN or ISDN, not as interworking between PLMN and ISDN since this is the normal case. In this sense, PLMN and ISDN are seen within the same environment, called the PLMN/ISDN environment.

During call establishment, the call may leave a PLMN/ISDN environment; e.g., because of interworking with another network, with a non-PLMN/ISDN user, or with non-PLMN/ISDN equipment within the called user's premises. When such situations occur, a progress indicator information element shall be returned to the calling Mobile Station either:

a) in an appropriate call control message when a state change is required (e.g. ALERTING or CONNECT); or,

b) in the PROGRESS message when no state change is appropriate.

The progress indicator information element sent to the Mobile Station may contain one of the following progress description values:

a) #1 "call is not end-to-end PLMN/ISDN; further call progress information may be available in-band".

b) #2 "destination address is non-PLMN/ISDN".

c) #4 "call has returned to PLMN/ISDN.

If the progress indicator information element is included in a call control message other than PROGRESS, the procedures as described in the remainder of sect. 5.2.1 apply. If the progress indicator information element is included in the PROGRESS message, no state change will occur but all call control timers shall be stopped in the Mobile Station. In both cases, if indicated by the progress indicator information element , the Mobile Station attach the user connection for speech and then monitor it for further in-band information.

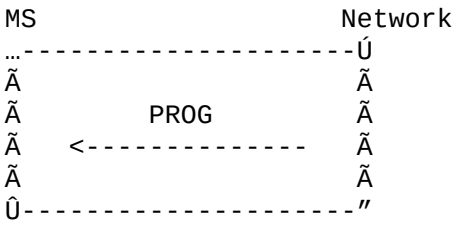


Fig. 5.4/GSM 04.08
Notification sequence
at mobile originating call establishment

5.2.1.1.5 Call confirmation indication

Upon receiving an indication that user alerting has been initi-ated at the called address, the network shall: send an ALERTING message across the radio interface of the calling mobile station and enter the "call delivered" state.

When the Mobile Station receives the ALERTING message, the Mobile Station: may begin an internally-generated alerting indication; shall stop timer T303 or 310 and shall enter the "call delivered" state.

Abnormal cases:

On the Mobile Station side, if timer T310 expires, the Mobile Station shall initiate call clearing as described in section 5.4.

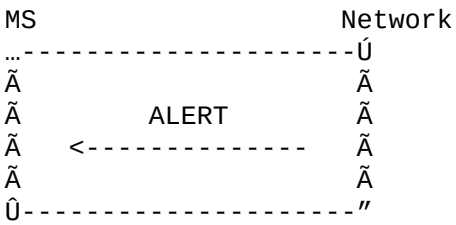


Fig. 5.5/GSM 04.08
Call confirmation
at mobile originating call establishment

5.2.1.1.6 Call connected

Upon receiving an indication that the call has been accepted, the network shall: send a CONNECT message across the radio interface to the calling Mobile Station; start timer T313 and enter the "connect indication" state.

This message indicates to the calling Mobile Station that a connection has been established through the network.
On receipt of the CONNECT message, the calling Mobile Station shall:
- attach the user connection to the radio path;
- return a CONNECT ACKNOWLEDGE message;
- stop any locally generated alerting indication (if applied);
- stop timer T303 or T310 (if any of them is running);
- enter the "active" state.

Abnormal cases:
On the Mobile Station side, if timer T303 or T310 expires, the Mobile Station shall initiate call clearing as described in section 5.4.

Note: The Mobile Station may have applied an internal alerting supervision timing function, e.g. an incorporated Unit Call Control, and when it expires initiates a call clearing.

On receipt of the CONNECT ACKNOWLEDGE message the network shall: stop timer T313 and enter the "active" state.

Abnormal cases:
On the network side, if timer T313 elapses before a CONNECT ACKNOWLEDGE message has been received, the network shall perform the clearing procedure as described in section 5.4.

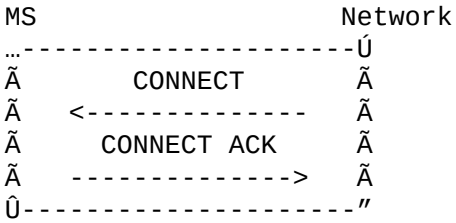


Fig. 5.6/GSM 04.08
Call acceptance sequence
at mobile originating call establishment

5.2.1.1.7 Call rejection

Upon receiving an indication that the network or the called user is unable to accept the call, the network shall initiate call clearing at the radio interface to the mobile which originated the call, as described in sect. 5.4 using the cause provided by the terminating network or the called user.

5.2.1.1.8 Transit network selection

Note: For further study.

5.2.1.1.9 Traffic channel assignment at mobile originating call establishment

It is a network dependent decision when to initiate the assignment of a traffic channel during the mobile originating call establishment phase. After initiation of the assignment phase, the CC-entity of the network shall: enter the "assignment pending" state and suspend any message to be sent. Upon completion of the assignment phase, the network shall re-enter its previous state and resume any stored message for transmission.

The assignment procedure does not affect any call control timer.

5.2.1.1.10 Call queuing at mobile originating call establishment

The conditions to apply queuing are described in Rec. GSM 03.01.

If an idle traffic channel is not available at the assignment instant, the network may place the traffic channel request in a queue. Calls arriving when all positions in the queue are occupied shall be cleared by the network using the cause #34 "no circuit/channel available".

An explicit queuing indicator is not provided to the mobile station. However, the mobile station can implicitly derive the queuing status from the combination of states of the call control and radio resource management entities.

While the mobile station is queuing for a traffic channel, further mobile originating and mobile terminating call requests, if supported by the mobile station, are released by the network using cause #34 "no circuit/channel available".

The maximum queuing interval is supervised by the network. The limit is a network dependent choice. In case the network is not able to allocate a traffic channel within the queuing limit, the network will release the call using cause #34 "no circuit/channel available".

Specific indications provided in the network to the remote user are a network dependent choice.

5.2.1.2 Emergency call establishment

The call control entity of the mobile station requests the establishment of a MM-connection indicating that the call shall be an emergency call. This may lead to the provision of a MM-connection with specific characteristics.

In case the network has accepted the emergency call request, it may initiate the Authentication procedure and ciphering. The mobile Station initiates the call establishment by transfering an EMERGENCY SETUP message across the radio interface. All further actions at the radio interface are the same as for a normal outgoing call according to section 5.2.1.1.

5.2.2 Mobile terminating call establishment

Before call establishment can be initiated in the Mobile station, the MM-connection must be established by the network.

5.2.2.1 Call indication

After the arrival of a call from a remote user, the network shall : initiate the MM-connection establishment according to section 4 and enter the "MM-connection pending" state. The request to establish the MM-connection is passed from the CM-sublayer to the MM-sublayer. It contains the necessary routing information derived from the SETUP message.
Upon completion of the MM-connection, the network shall : send the SETUP message to the mobile station, start timer T303 and enter the "call present" state.

Upon receipt of a SETUP message, the Mobile Station shall perform compatibility checking as described in 5.2.2.2. If the result of the compatibility checking was compatibility, the Mobile Station shall enter the "call present" state otherwise the Mobile Station shall proceed as described in 5.2.2.2.

If no response to the SETUP message is received by the network before the expiry of timer T303, the procedures described in section 5.2.2.3.3 shall apply.

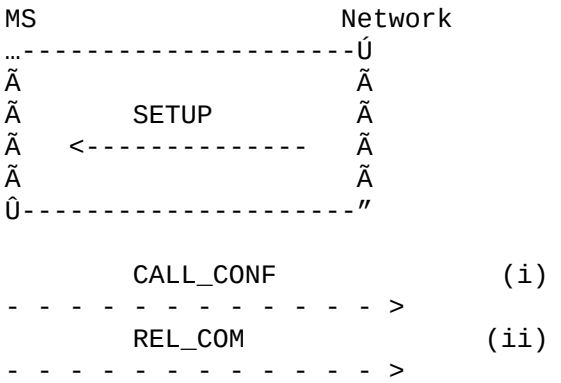


Fig. 5.7/GSM 04.08
Mobile terminating call initiation
and possible subsequent responses.

5.2.2.2 Compatibility checking

The Mobile Station receiving a SETUP message shall perform compatibility checking before responding to that SETUP message. Any reference to the Mobile Station in sections 5.2.2.3 through 5.2.2.8 implicitly refers to compatible user equipment included in the Mobile Station. Annex B defines compatibility checking to be performed by user equipment upon receiving a SETUP message.

An incompatible Mobile Station shall respond with a RELEASE COMPLETE message with cause #88 "incompatible destination", and enter the "null" state. The network shall process this RELEASE COMPLETE message in accordance with sect. 5.2.2.3.4.

5.2.2.3 Call confirmation

5.2.2.3.1 Response to SETUP

Following the compatibility checking the Mobile Station shall - with the exception of the cases described below - acknowledge the SETUP message by a CALL CONFIRMED message, and enter the "mobile terminating call confirmed" state.

The mobile station may include in the CALL CONFIRMED message to the network one or several bearer capability information elements to the network, either preselected in the Mobile Station or corresponding to a service dependent directory number (see Rec. GSM 09.07).

Note: The possibility of alternative responses (e.g., in connection with supplementary services) is for further study.

A busy Mobile Station which satisfies the compatibility requirements indicated in the SETUP message shall respond either with a CALL CONFIRMED message or a RELEASE COMPLETE message, both with cause #17 "user busy".

If the mobile user wishes to refuse the call, a RELEASE COMPLETE message shall be sent with the cause #21 "call rejected" .

In the two cases mentioned above, the Mobile Station shall release the MM-connection and enter the "null" state after sending the RELEASE COMPLETE message.
The network shall process the RELEASE COMPLETE message in accordance with section 5.4.

5.2.2.3.2 Receipt of CALL CONFIRMED and ALERTING by the network

Upon receipt of the CALL CONFIRMED message, the network shall : stop timer T303, start timer T310 and enter the "mobile terminating call confirmed" state.

The MS having entered the "mobile terminating call confirmed" state, if the call is accepted at the called user side, the Mobile Station proceeds as described in 5.2.2.5. Otherwise, if the signal information element was present in the SETUP message user alerting is initiated at the Mobile Station side; if the signal information element was not present in the SETUP message, user alerting is initiated when an appropriate channel is available.
Here, initiation of user alerting means:
- the generation of an appropriate tone or indication at the Mobile Station, and
- sending of an ALERTING message by the MS to the network.

Upon receipt of an ALERTING message subsequent to receipt of a CALL CONFIRMED message, the network shall: send a corresponding ALERTING indication to the calling user; stop timer T310; start timer T301, and enter the "call received" state.

5.2.2.3.3 Call failure procedures

In case of abnormal behavior the following call failure procedures apply:

i. If the network does not receive any response to the SETUP message prior to the expiration of timer T303, then the network shall: initiate clearing procedures towards the calling user with cause #18 "no user responding"; and initiate clearing procedures towards the called Mobile Station in accordance with 5.4.4 using cause #102 "recovery on timer expiry".

ii. If the network has received a CALL CONFIRMED message, but does not receive an ALERTING, CONNECT or DISCONNECT message prior to the expiration of timer T310, then the network shall:
initiate clearing procedures towards the calling user with cause #18 "no user responding"; and initiate clearing procedures towards the called Mobile Station in accordance with sect. 5.4.4 using cause #102 "recovery on timer expiry".

iii. If the network has received an ALERTING message, but does not receive a CONNECT or DISCONNECT message prior to the expiry of timer T301 (or a corresponding internal alerting supervision timing function), then the network shall: initiate clearing procedures towards the calling user with cause #19 "user alerting, no answer"; and initiate clearing procedures towards the called Mobile Station in accordance with sect. 5.4.4, using cause #102 "recovery on timer expiry".

5.2.2.3.4 Called Mobile Station clearing during mobile terminating call establishment

If a RELEASE COMPLETE or DISCONNECT message is received before a CONNECT message has been received from the Mobile Station, the network shall stop timer T303, T310 or T301 (if running); continue to clear the Mobile Station as described in sect. 5.4.3; and clear the call to the calling user with the cause received in the RELEASE COMPLETE or DISCONNECT message.

5.2.2.4 Notification of interworking in connection with mobile terminating call establishment

Note: In this section, the term "interworking" is used only in the meaning of interworking with a network other than PLMN or ISDN, not as interworking between PLMN and ISDN since this is the normal case. In this sense, PLMN and ISDN are seen within the same environment, called the PLMN/ISDN environment.

During call establishment the call may enter an PLMN/ISDN environment, e.g., because of interworking with another network, with a non-PLMN/ISDN user, or with non-PLMN/ISDN equipment within the calling or called user's premises. When this occurs, the point at which the call enters an PLMN/ISDN environment shall cause a progress indicator information element to be included in the SETUP message to be sent to the called Mobile Station:

a) #1 "call is not end-to-end PLMN/ISDN; further call progress information may be available in-band".

b) #3 "origination address is non-PLMN/ISDN".

5.2.2.5 Call accept

A Mobile Station indicates acceptance of a mobile terminating call by sending a CONNECT message to the network. Upon sending the CONNECT message the Mobile Station shall start Timer T313 and enter the "connect request" state.

5.2.2.6 Active indication

On receipt of the CONNECT message, the network shall: stop timers T310, T303 or T301 (if running); send a CONNECT ACKNOWLEDGE message to the called user; initiate procedures to send a CONNECT message towards the calling user and enter the "active" state.

There is no guarantee of an end-to-end connection until a CONNECT message is received at the calling user's side. Upon receipt of the CONNECT ACKNOWLEDGE message the Mobile Station shall: stop timer T313, attach the user connection and enter the "active" state.

When timer T313 expires prior to the receipt of a CONNECT ACKNOWLEDGE message, the mobile station shall initiate clearing in accordance with section 5.4.3.

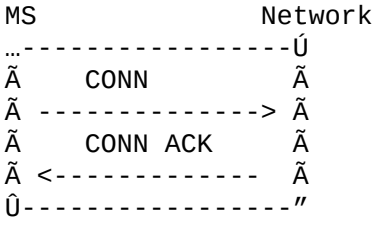


Fig. 5.8/GSM 04.08
Call acceptance and active indication
at mobile terminating call establishment

5.2.2.7 Traffic channel assignment at mobile terminating call establishment

It is a network dependent decision when to initiate the assignment of a traffic channel during the mobile terminating call establishment phase.

After initiation of the assignment phase, the CC-entity of the network shall : enter the "assignment pending" state and suspend any message to be sent. Upon completion of the assignment phase, the network shall re-enter its previous state and resume any stored message for transmission.

The assignment procedure does not affect any call control timer.

5.2.2.8 Call queuing at mobile terminating call establishment

The principles described in section 5.2.1.1.10 apply accordingly.

Note: the interworking to the fixed network has to fulfill the network specific requirements.

5.3 Signalling procedures during the "active" state

5.3.1 User notification procedure

This procedure allows the network to notify a Mobile Station of any appropriate call-related event during the "active" state of a call. It also may allow a Mobile Station to notify the remote user of any appropriate call-related event during the "active" state of a call by sending a NOTIFY message containing a notification indicator to the network; upon receipt of this message, the network sends a NOTIFY message containing the same notify indicator to the other user involved in the call. No state change occurs at any of the interface sides following the sending or the receipt of this message.

5.3.2 Call rearrangements

Call rearrangements on the air interface are not supported by SUSPEND and RESUME messages. However if a remote non-PLMN user initiates call rearrangements, the network shall inform the Mobile Station by means of a NOTIFY message. In a similar way the Mobile Station can inform the network about rearrangements by sending a NOTIFY message (e.g. change of user equipment connected to the Mobile Station).

5.3.3 DTMF protocol control procedure

Dual Tone Multi Frequency (DTMF) is an inband one out of four plus one out of four signalling system primarily used from terminal instruments in telecommumication networks. The support of DTMF in the network is described in Rec. GSM 03.14.
The use of DTMF is only permitted when the speech teleservice is being used or during the speech phase of alternate speech/data and alternate speech/facsimile teleservices and shall be disabled in all other phases.

Note 1: Since the DTMF protocol messages are sent in a store and forward mode on the signalling channels the control of the device at the far end may be delayed dependent on the load of quality of the channels.

Note 2: The procedures described in this paragraph supports DTMF only in the direction Mobile Station to network. The need for DTMF support in the opposite direction is for further study.

5.3.3.1 Start DTMF request by the Mobile Station

A user may cause a DTMF tone to be generated e.g. by depression of a key in the MS. The relevant action is interpreted by the Mobile Station as a requirement for a DTMF digit to be sent in a START DTMF message on an established FACCH. This message contains the value of the digit to be transmitted (0, 1, ..., O, A, B, C, D, *, #).

Only a single digit will be transferred in each START DTMF message.

5.3.3.2 Start DTMF response by the network

Upon receiving the START DTMF message the network will reconvert the received digit back into a DTMF tone which is applied toward the remote user and returns a START DTMF ACKNOWLEDGE message to the Mobile Station. This acknowledgement may be used in the Mobile Station to generate an indication as a feedback for a successful transmission. If the network cannot accept the START DTMF message a START DTMF REJECT message will be sent ot the Mobile Station.

5.3.3.3 Stop DTMF request by the Mobile Station

When the user indicates that the DTMF sending should cease e.g. by releasing the key the Mobile Station will send a STOP DTMF message to the network.

5.3.3.4 Stop DTMF response by the network

Upon receiving the STOP DTMF message the network will stop sending the DTMF tone and return a STOP DTMF ACKNOWLEDGE message to the Mobile Station.

5.3.3.5 Sequencing of subsequent start DTMF requests by the Mobile Station

The minimum length of tone generated by the switch should be according to CEPT recommendation T/CS 46-02.

The minimum gap between two subsequent tones should be according to CEPT recommendation T/CS 46-02.

There is no defined maximum length to the tone, which will normaly cease when a STOP DTMF message is received from the MS. However, the operator may choose to put a pre-defined time limit on the duration of tones sent.

Therefore the Mobile Station shall ensure that messages are not sent towards the network faster than the minimum times mentioned above will allow.

The appropriate sequencing of DTMF control messages is achieved by using the timers Ts and To shown in Fig. 5.9a and 5.9b which cannot expire before the minimum intervals. Ts and To are specified in CEPT Rec. T/CS 34-08.

Note: The network may implement the time limit option where the DTMF tone duration is controlled by the network irrespective of the receipt of a STOP DTMF message from the Mobile Station.

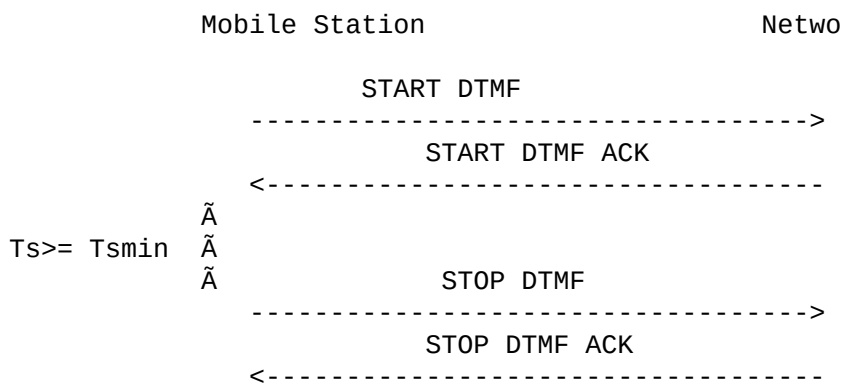


Fig. 5.9a/GSM 04.08
Single DTMF transmission

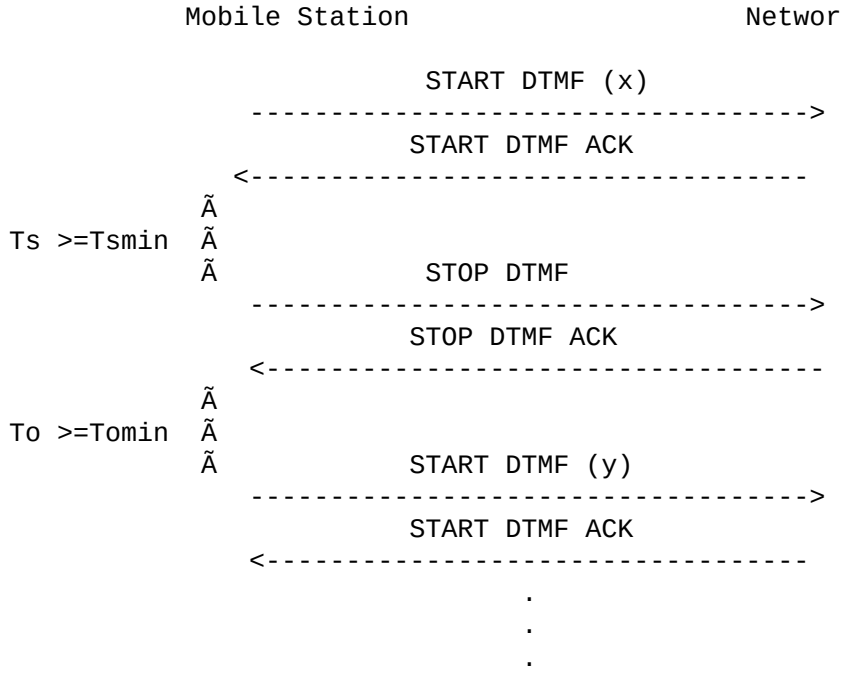


Fig. 5.9b/GSM 04.08
Multiple DTMF transmission

5.3.4 In-call modification

Note: Considering a possible future evolution, in-call modification is specified as a symmetrical procedure.

The in-call modification procedure is used to realize the following required services:

a) Alternate Speech/Unrestricted digital - transparent (GSM 02.02 26)

b) Alternate Speech/Unrestricted digital - non transparent (GSM 02.02 27)

c) Speech then unrestricted digital information - transparent (GSM 02.02 31)

d) Speech then unrestricted digital information - non transparent (GSM 02.02 32)

e) Alternate Speech/Group 3 fax (Teleservice Group 3 fax GSM 02.03).

5.3.4.1 Service Description

This circuit switched service allows the two users on a point-to-point connection to use the connection between them for different information transfer during the same call, but not at the same time.

The procedure provided for the support of multiple capability mobile stations only.

In some cases the in-call modification procedure makes it necessary to change the channel configuration by allocating a new channel and in other cases to change channel configuration parameters while keeping the previously allocated channel. This change is determined by the network, which initiates either the assignment procedure or channel mode modify procedure (see section 3).

The capability and the initial mode desired must be identified by the mobile station by identifying each mode of operation with a separate information element during call establishment. Further the type of change between the modes must be identified by means of the repeat indicator:

mode 1 "alternate" mode 2, or
mode 1 "and then" mode 2.

5.3.4.2 Call establishment

At both originating and destination interfaces, the normal call establishment procedures apply.

5.3.4.2.1 Establishment at the originating interface

The service is requested by the originating Mobile Station by transferring a SETUP message to the network containing two bearer capabilities information elements preceded by a repeat indicator information element. The first mode of operation shall be indicated by the first bearer capability information element and the second mode by the second bearer capability information element.

A low layer compatibility information element may optionally be specified for each call mode.

If a call mode includes a low layer compatibility specification, then the number of low layer compatibility information elements shall equal the number of bearer capability information elements. A given low layer compatibility information element shall be empty if no low layer compatibility specification applies for the corresponding call mode.

Similarly, a high layer compatibility information element may optionally be specified for each call mode.

The specific part of the network which is sensitive to the call mode shall examine each mode described in the bearer capabilities included in the SETUP message. If one of the described modes can not be supported on that call then the network shall initiate call clearing as specified in section 5.4 with the following causes:

a) #57 "bearer capability not authorized"
b) #58 "bearer capability not presently available"
c) #65 "bearer capability not implemented"
d) #70 "only restricted digital information bearer capability is available"

5.3.4.2.2 Establishment at the destination interface

The service is indicated to the destination mobile station by a SETUP message coded in the same manner as the originating call establishment. In line with normal call establishment at the destination interface, the service may be indicated by the called mobile station in the CALL CONFIRMED message as for any other bearer capability.

The destination mobile station shall perform the compatibility checking for both required modes if indicated in the SETUP message.
If compatibility checking fails, the call shall be cleared according to the procedures of section 5.4 with one of the following causes:

a) #57 "bearer capability not authorized"
b) #58 "bearer capability not presently available"
c) #65 "bearer service not implemented"
d) #88 "incompatible destination"

The mobile station may accept the call if the first mode indicated is free irrespective of whether the other mode is free or busy.

5.3.4.3 Changing the Call Mode

In order to change the call mode, the following in-call modification procedures shall be used.

Either side of the radio interface may act as the requesting user to invoke the in-call modification.

Upon each successful completion of the in-call modification procedure, the call changes to the next mode negotiated and agreed during the establishment phase of the call.

The in-call modification procedures are completely symmetrical at the radio interface.

5.3.4.3.1 Initiation of in-call modification

The procedure is initiated by the requesting originating side in the "active" state of the call. It shall send a MODIFY message including the new mode to be changed to; start timer T323; and enter the "mobile originating modify" state. Any internal resources necessary to support the next call mode shall be reserved. The new mode given in the MODIFY message shall be one of those already negotiated and agreed during the establishment phase of the call. The MODIFY originating side shall stop sending Bm-channel information ; and stop interpreting received Bm-channel information according to the old call mode.

Upon receipt of the MODIFY message, the destination side shall check to ensure that the requested call mode can still be supported and if so, it shall initiate the reservation of any resources necessary to support the next call mode and remain in the "active" state.

5.3.4.3.2 Successful completion of in-call modification

If the destination network/Mobile Station receives a MODIFY message with a new mode which is already the actual one of the call the network/Mobile Station shall remain in the "active" state; send a MODIFY COMPLETE message with the actual mode; and shall not initiate anything else.

If the requested mode is not the actual one and can be supported by the destination interface it shall step on to any internal resources necessary to support the next call mode; start sending Bm-channel information according to the next call mode (i.e. assignment procedure or channel mode modify procedure, see section 3), start interpreting received Bm-channel information according to the next call mode; send a MODIFY COMPLETE message including the next call mode and remain in the "active" state.

Upon receipt of the MODIFY COMPLETE message at the originating side the network shall: initiate the alternation to those resources necessary to support the next call mode; stop timer T323; and enter the "active" state.

5.3.4.3.3 Change of the channel configuration

In case the requested bearer capability cannot be supported by the current channel configuration the network shall initiate the assignment procedure and change the channel configuration accordingly.

5.3.4.3.4 Failure of in-call modification

5.3.4.3.4.1 Network rejection of in-call modification

If the network cannot support the change to the requested call mode the network shall: release the resources which had been reserved for the alternation: send a MODIFY REJECT message with the old bearer capability and with cause # 58 "bearer capability not presently available" to the initiating mobile station; and enter the "active" state.

Upon receipt of the MODIFY REJECT message with the old bearer capability the initiating mobile station shall: stop timer T323; release any resources which had been reserved for the alternation; resume sending Bm-channel information according to the present call mode; resume interpreting received Bm-channel information according to the present call mode; and enter the "active" state.

5.3.4.3.4.2 Mobile Station rejection of in-call modification

If the mobile station cannot support the change to the requested call mode, the mobile station shall: release any resources which had been reserved for the alternation; send a MODIFY REJECT message with the old bearer capability and cause # 58 "bearer capability not presently available", and remain in the "active" state.

Upon receipt of the MODIFY REJECT message the network shall: stop timer T323, release any resources which had been reserved for the alternation.

5.3.4.3.4.3 Time-out recovery

Upon expiration of T323 in either the Mobile Station or the network the procedures for call clearing shall be initiated with cause # 102 "recovery on timer expiry".

5.3.4.4 Abnormal procedures

If a MODIFY, MODIFY COMPLETE or MODIFY REJECT message is received in the "disconnect indication", "disconnect request" or "release request" state then the received message shall be discarded and no action shall be taken.
If a MODIFY COMPLETE message indicating a call mode which does not correspond to the requested one is received or if a MODIFY REJECT message indicating a call mode which does not correspond to the actual one is received then the received message shall be discarded and no action shall be taken.
If a MODIFY message indicating a call mode which does not belong to those negotiated and agreed during the establishment phase of the call, is received, then a MODIFY REJECT message with the actual call mode and with cause # 57 "bearer capability not authorized" shall be sent back.

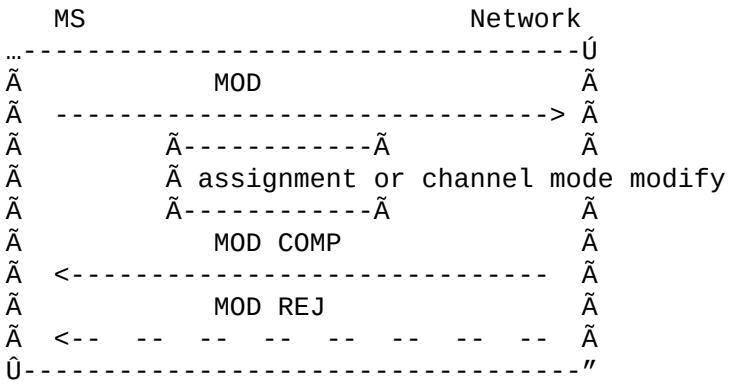


Fig. 5.10a/GSM 04.08
In-call modification sequence initiated by MS

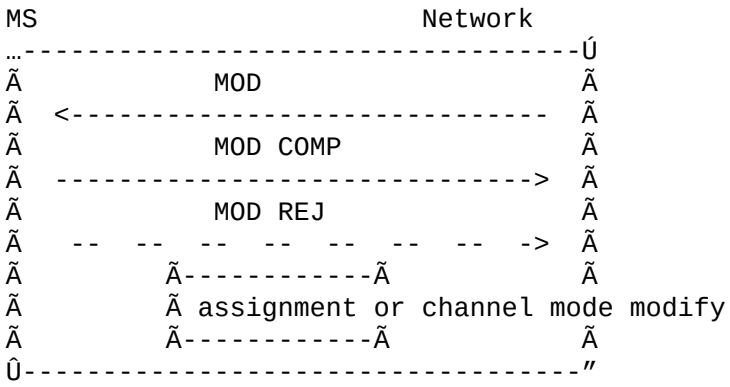


Fig. 5.10b/GSM 04.08
In-call modification sequence initiated by network

5.4 Call clearing

5.4.1 Terminology

The following terms are used in this Recommendation in the description of clearing procedures:

- A traffic channel (see Rec. GSM 04.03) is "connected" when the channel is part of a circuit-switched connection established according to this Recommendation.

- A traffic channel is "disconnected" when the channel is no longer part of a circuit-switched connection, but is not yet available for use in a new connection.

5.4.2 Exception conditions

Under normal conditions, call clearing is initiated when the Mobile Station or the network sends a DISCONNECT message and follows the procedures defined in sect. 5.4.3 and 5.4.4 respectively.

As an exception to the above rule, the Mobile Station or the network, in response to a SETUP message, can reject a call by responding with a RELEASE COMPLETE message provided no other response has previously been sent.

As a further exception, the network may initiate call clearing by sending a RELEASE message in the following cases :

a) forced release (e.g. recovery)

b) tones/announcements are not provided and the mobile subscriber has no subscription for at least one of the following supplementary services :

- malicious call identification (only valid for the called subscriber)
- user-to-user signalling
- call dependent supplementary services :

  * advice of charge
  * call waiting
  * conference call
  * call hold
  * three-party service

5.4.3 Clearing initiated by the Mobile Station

Apart from the exceptions identified in sect. 5.4.2, the Mobile Station shall initiate clearing by: sending a DISCONNECT message; starting timer T305; and entering the "disconnect request" state.
Following the receipt of the DISCONNECT message the network shall consider the call to be in the "disconnect request" state.

Note: When a Mobile Station initiates call clearing by sending a RELEASE message, the procedures described in sect. 5.4.4 are then followed.

The network will also initiate procedures to clear the network connection and the call to the remote user.

On receipt of the DISCONNECT message by the network, a RELEASE message is sent to the Mobile Station, timer T308 is started, and the network shall consider the call to be in the "release request" state.

Note: The RELEASE message has only local significance and does not imply an acknowledgement of clearing from the remote user.

On receipt of the RELEASE message the Mobile Station shall: stop timer T305; send a RELEASE COMPLETE message; release the MM-connection; and return to the "null" state. Following the receipt of a RELEASE COMPLETE message from the Mobile Station, the network shall: stop timer T308; release the MM- connection; and return to the "null" state.

Abnormal cases

If the Mobile Station does not receive a RELEASE message in response to the DISCONNECT message before timer T305 expires, it shall send a RELEASE message to the network with the cause number originally contained in the DISCONNECT message, and start timer T308. In addition, the Mobile Station may indicate a second cause information element with cause #102 "recovery on timer expiry".

If a RELEASE COMPLETE message is not received by the network before the first expiry of timer T308, the RELEASE message shall be retransmitted and timer T308 shall be restarted. If no RELEASE COMPLETE message is received from the Mobile Station before timer T308 expires a second time, the network shall: release the MM-connection; and return to the "null" state.

5.4.4 Clearing initiated by the network

Apart from the exception conditions identified in sect. 5.4.2, the network shall initiate clearing by: sending a DISCONNECT message; and entering the "disconnect indication" state. The DISCONNECT message is a local invitation to clear the call.

Note: When the network initiates clearing by sending a RELEASE message, procedures described in sect. 5.4.3 are followed.

5.4.4.1 Clearing when tones/announcements provided

When in-band tones/announcements are provided (see section 5.5.1), the network shall initiate clearing by sending a DISCONNECT message containing progress indicator #8 "in-band information or appropriate pattern now available", start timer T306, and enter the "disconnect indication" state.

On receipt of the DISCONNECT message with progress indicator #8, the mobile station shall :

i) if a traffic channel is not connected, continue clearing without connecting to the in-band tone/announcement;

ii) if a traffic channel is connected, proceed in either of the following ways:
- connect to the in-band tone/announcement and enter the "disconnect indication" state; or
- continue clearing without connecting to the in-band tone/announcement by sending a RELEASE message; starting timer T308, and entering the "release request" state. The network shall, when receiving the RELEASE message, send a RELEASE COMPLETE message, release the transaction identifier, stop timer T306 and enter the "null" state.

If timer T306 expires, the network shall continue clearing by sending the RELEASE message with the cause number originally contained in the DISCONNECT message; starting timer T308, and entering the "release request" state.
Upon receipt of the RELEASE message, the mobile station shall send a RELEASE COMPLETE message, release the MM- connection, and return to the "null" state. Following the receipt of a RELEASE COMPLETE message from the mobile station, the network shall stop timer T308, release the MM-connection and return to the "null" state.

Abnormal cases :
See the abnormal procedures in section 5.4.3.

5.4.4.2 Clearing when tones/announcements not provided

When in-band tones and announcements are not provided, the DISCONNECT message does not contain progress indicator #8 "in-band information or appropriate pattern now available". The network shall initiate clearing by sending a DISCONNECT message, start timer T305 and enter the "disconnect indication" state.

On the receipt of the DISCONNECT message the Mobile Station shall:
send a RELEASE message;
start timer T308;
and enter the "release request" state.

On receipt of the RELEASE message, the network shall: stop timer T305; send a RELEASE COMPLETE message; release the MM-connection; and return to the "null" state.

If the network does not receive a RELEASE message in response to the DISCONNECT before timer T305 expires, it shall: send a RELEASE message to the Mobile Station with the cause number originally contained in the DISCONNECT message; start timer T308; and enter the "release request" state. In addition to the original clearing cause, the RELEASE message may contain a second cause information element with cause #102 "recovery on timer expiry".

5.4.4.3 Completion of clearing

Following the receipt of a RELEASE COMPLETE message from the network, the Mobile Station shall: stop timer T308; release the MM-connection, and return to the "null" state.

If a RELEASE COMPLETE is not received by the Mobile Station before the first expiry of timer T308, the RELEASE message shall be retransmitted and timer T308 shall be restarted. If no RELEASE COMPLETE message is received from the network before timer T308 expires a second time, the Mobile Station shall: release the MM-connection; and return to the "null" state.

5.4.5 Clear collision

Clear collision occurs when both the Mobile Station and the network simultaneously transfer DISCONNECT messages specifying the same call.

When the network receives a DISCONNECT message whilst in the "disconnect indication" state, the network shall: stop timer T305; send a RELEASE message; start timer T308; and enter the "release request" state. Similarly, when the Mobile Station receives a DISCONNECT message whilst in the "disconnect request" state, the Mobile Station shall: stop timer T305; send a RELEASE message; start timer T308; and enter the "release request" state.

Clear collision can also occur when both sides simultaneously transfer RELEASE messages related to the same call. The entity receiving such a RELEASE message whilst within the "release request" state shall: stop timer T308; release the MM-connection; and enter the "null" state (without sending a RELEASE COMPLETE message).

5.5 Miscellaneous procedures

5.5.1 In-band tones and announcements

When in-band tones/annoucement, not associated with a call state change, are to be provided by the network before reaching the "active" state, a PROGRESS message is returned simultaneously with the application of the in-band tone/announcement. The PROGRESS message contains the progress indicator #8 "in-band information or appropriate pattern is now available".

When tones/annoucements have to be provided together with a call state change, then the appropriate message (e.g. ALERTING, DISCONNECT etc...) with progress indicator #8 "in- band information or appropriate pattern is now available" is sent simultaneously with the application of the in-band tone/annoucement.

Note: When the PROGRESS message is used, the Mobile Station may initiate clearing as a result of the applied in- band tone/announcement according to the procedure specified in sect. 5.4.4.1.

5.5.2 Call collisions

Call collisions as such cannot occur at the network. Any simultaneous mobile originating or mobile terminating calls are dealt with separately assigned and different transaction identifiers.

Channel selection conflicts cannot occur because channel selection is exclusively performed by the network. In case the Mobile Station has not the capability to handle more than one call in parallel a collision between mobile originating and mobile terminating call cannot appear at the Mobile Station.

5.5.3 Status procedures

5.5.3.1 Status enquiry procedure

Whenever a call control entity wishes to check the correctness of a call state at a peer entity, a STATUS ENQUIRY message may be sent requesting the call state. This may, in particular, apply to procedural error conditions described in sect. 8.

Upon sending the STATUS ENQUIRY message, timer T322 shall be started in anticipation of receiving a STATUS message. While timer T322 is running, only one outstanding request for call state information shall exist. Therefore, if timer T322 is already running, it shall not be restarted. If a clearing message is received before timer T322 expires, timer T322 shall be stopped,and call clearing shall continue.

Upon receipt of a STATUS ENQUIRY message, the receiver shall respond with a STATUS message, reporting the current call state and cause #30 "response to STATUS ENQUIRY" or #97 "message type non-existent or not implemented". Receipt of the STATUS ENQUIRY does not result in a state change.

The sending or receipt of the STATUS message in such a situation will not directly affect the call state of either the sender or receiver. The side having received the STATUS message shall inspect the cause information element. If the STATUS message contains cause # 97 "message type non existent or not implemented" timer T322 shall continue to time for an explicit response to the STATUS ENQUIRY message. If a STATUS message is received that contains cause # 30 "response to status enquiry", timer T322 shall be stopped and the appropriate action taken, based on the information in that STATUS message, relative to the current state of the receiver. If timer T322 expires and a STATUS message with cause # 97 was received, the appropriate action shall be taken, based on the information in the STATUS message, relative to the current call state of the receiver.

These further "appropriate actions" are implementation dependent. However, the actions prescribed in the following section shall apply.

If timer T322 expires, and no STATUS message was received, the STATUS ENQUIRY message may be retransmitted once. The call shall be cleared with cause # 41, "temporary failure", if the STATUS ENQUIRY is retransmitted the maximum number of times. The network shall initiate the call clearing procedure according to section 5.4.4.

5.5.3.2 Receiving a STATUS message by a CC-entity.

On receipt of a STATUS message reporting an incompatible state, the receiving entity shall clear the call by sending the appropriate clearing message with cause # 101 "message not compatible with call state".

Except for the following rules, the determination of which states are incompatible is left as an implementation decision:

a) If a STATUS message indicating any call state except the "null" state is received in the "null" state, then the receiving entity shall send a RELEASE COMPLETE message with cause # 101 "message not compatible with call state" and remain in the "null" state.

b) If a STATUS message indicating any call state except the "null" state is received in the "release request" state, no action shall be taken.

c) If a STATUS message, indicating the "null" state, is received in any state except the "null" state, the receiver shall release all resources and move into the "null" state.

When in the "null" state, the receiver of a STATUS message indicates the "null" state shall take no action other then to discard the message and shall remain in the "null" state.

A STATUS message may be received indicating a compatible call state but containing one of the following causes:

a) # 96 "mandatory information element error";
b) # 97 "message type non-existing or not implemented";
c) # 99 "information element non-existent or not implemented"; or
d) # 100 "invalid information element contents".

In this case, the call shall be cleared according to section 5.4.

5.5.4 Call re-establishment

This section describes the internal handling in the mobile station as far as call control is concerned.

5.5.4.1 Indication from the mobility management sublayer

When a MM-connection has been established, an indication may be given by the MM-sublayer to the call control entity to announce that the current MM-connection has been interrupted but might be re-established on request of call control.

5.5.4.2 Reaction of call control

Depending whether call re-establishment is allowed or not and on its actual state, call control shall decide to either request re-establishment or to release the MM- connection.

a) Re-establishment not required

If the call is in the call establishment or call clearing phase, i.e. any state other than the "active" state or the "mobile originating modify" state, call control shall release the MM-connection

b) Re-establishment required

If the call is in the "active" state or "mobile originating modify" state, the indication from MM that re-establishment is possible shall cause call control to request re-establishment from the MM-connection, suspend any further message to be sent and await the completion of the re-establishment procedure.

5.5.4.3 Completion of re-establishment

Upon successful re-establishment, a confirmation shall be given to call control to resume the transmission of possibly suspended messages.

5.5.4.4 Unsuccessful outcome

If the attempt to re-establish the connection was unsuccessful, the MM-connection shall be released and a release indication shall be given to call control.

6 PACKET COMMUNICATION ACROSS THE RADIO INTERFACE

6.1 General

The user at Mobile Station may access or be accessed by packet facilitities by means of the following alternatives:

a) circuit-switched access to PSPDN services (case A) by establishing a circuit-switched access connection through the MSC to the access port of a public network (e.g. PSPDN) referred to as "access unit (AU)". This connection may be initiated by the Mobile Station or the AU.

b) Packet-switched access to an ISDN virtual circuit service (case B) by establishing a packet-mode access connection to the packet handler (PH) of the MSC. This connection may be initiated by the Mobile Station or the PH.

6.2 Packet-mode access connection control states

This section defines the basic packet-mode access connection control states for access to the GSM PLMN virtual circuit bearer service (case B). The procedures for access connection control are given in section 6.4.

6.2.1 Access connection states at the mobile station side of the interface

The states which may exist on the mobile station side of the radio interface are defined in this paragraph.

6.2.1.1 Null state (U0)

No access connection exists

6.2.1.2 Call initiated (U1)

This state exists for a mobile originating access connection, when the mobile station requests access connection establishment from the network.

6.2.1.3 Mobile originating call proceeding (U3)

This state exists for a mobile originating access connection when the mobile station has received acknowledgement that the network has received all access connection information necessary to effect access connection establishment.

6.2.1.4 Call present (U6)

This state exists for a mobile terminating access connection when the mobile station has received an access conneciton establishment request but has not yet responded.

6.2.1.5 Call received (U7)

This state exists for a mobile terminating access connection when the mobile station has indicated alerting but has not yet answered.

6.2.1.6 Connect request (U8)

This state exists for a mobile terminating access connection when the mobile station has accepted the access connection and is waiting to be awarded the access connection.

6.2.1.7 Mobile terminating call proceeding (U9)

This state exists for a mobile terminating access connection when the mobile station has sent acknowledgement that the mobile station has received all access connection information necessary to effect access connection establishment.

6.2.1.8 Active (U10)

This state exists for a mobile terminating access connection when the mobile station has received an acknowledgement from the network that the mobile station has been awarded the access connection. This state exists for a mobile originating access connection when the mobile station has received an indication that the local network has completed the access connection.

6.2.1.9 Disconnect request (U11)

This state exists when the mobile station has requested the local network to clear the access connection and is waiting for a response.

6.2.1.10 Disconnect indication (U12)

This state exists when the Mobile Station has received an invitation to disconnect the access connection.

6.2.1.11 Release request (U19)

This state exists when the Mobile Station has requested the network to release the access connection and is waiting for a response.

6.2.2 Access connection states at the network side of the interface

The states which may exist on the network side of the radio interface are defined in this section.

6.2.2.1 Null (N0)

No access connection exists.

6.2.2.2 Call initiated (N1)

This state exists for a mobile originating access connection when the network has received an access connection establishment request but has not yet responded.

6.2.2.3 Mobile originating call proceeding (N3)

This state exists for a mobile originating access connection when the network has sent acknowledgement that the network has received all access connection information necessary to effect access connection establishment.

6.2.2.4 Call present (N6)

This state exists for an incoming access connection when the network has sent an access connection establishment request but has not yet received a satisfactory response.

6.2.2.5 Call received (N7)

This state exists for a mobile terminating access connection when the network has received an indication that the Mobile Station is alerting but has not yet received an answer.

6.2.2.6 Connect request (N8)

This state exists for a mobile terminating access connection when the network has received an answer but the network has not yet awarded the access connection.

6.2.2.7 Mobile terminating call proceeding (N9)

This state exists for a mobile terminating access connection when the network has received acknowledgement that the Mobile Station has received all access connection information necessary to effect access connection establishment.

6.2.2.8 Active (N10)

This state exists for a mobile terminating access connection when the network has awarded the access connection to the called Mobile Station. This state exists for a mobile originating access connection when the network has indicated that the access connection has been completed.

6.2.2.9 Disconnect request (N11)

This state exists when the network has received a request from the Mobile Station to clear the access connection.

6.2.2.10 Disconnect indication (N12)

This state exists when the network has sent an invitation to disconnect the Mobile Station - network access connection.

6.3 Conditions relating to circuit-switched access to/from PSPDN services (case A)

The circuit-switched call control procedures of sect. 5 apply to this case.

For Mobile Station originating calls the appropriate AU is selected on the basis of information contained in the SETUP message (e.g. called party number identifying the AU, bearer capability information or low layer compatibility information, etc).

6.4 Conditions relating to access to/from ISDN virtual circuit service (case B)

6.4.1 Type of channel

The procedures described below apply only to traffic channels. The possible use of signalling (Dm) channels for supprot of virtual circuit services is not considered in this Recommendation.

6.4.2 Mobile originating calls

The connection is controlled using the signalling procedures of sect. 5.2.1 with the following exceptions:

i) The procedures for notification of interworking at the originating interface, section 5.2.1.1.4, do not apply;

ii) The procedures for call confirmation indication, section 5.2.1.1.5, do not apply;

iii) The procedures for call connected, section 5.2.1.1.6, apply as follows:

- upon accepting the access connection, the network shall: complete the assignment of a suitable traffic channel if that has not been done at earlier stage; send a CONNECT message across the radio interface; and enter the Active state.

- this message indicates to the calling Mobile Station that an access connection to the packet handler has been established;

- on receipt of the CONNECT message, the calling Mobile Station shall enter the Active state;

iv) the procedures for transit network selection, section 5.2.1.1.8, do apply.

6.4.3 Mobile terminating calls

The connection is controlled using the procedures of section 5.2.2 with the following exceptions:

i) The receipt of an ALERTING (sect. 5.2.2.3.2) message shall not cause the network to send corresponding ALERTING message to the calling user;

ii) The procedures for call failure (sect. 5.2.2.3.3) apply with the following note:

NOTE: The network clears the incoming X.25 virtual call towards the calling X.25 DTE using the appropriate cause defined for PSPDNs;

iii) The procedures for notification of interworking at the teminating interface, section 5.2.2.4, do not apply;

iv) The procedures for active indication, section 5.2.2.6, apply with the exception that the entwork shall not initiate procedures to send CONNECT message towards the calling user;

v) The procedures for user notification, sect. 5.2.3.1, do not apply.

6.4.4 Call clearing

The access connection is cleared using the procedure of sect. 5.4 with the following exception:

- the procedures for clearing with tones and announcement provided in section 5.4.4.1, do not apply.

6.5 Virtual call establishment and release

These procedures are not part of this Recommendation. See Recommendation GSM 09.06.

7 STRUCTURED PROCEDURES

7.1 General

Note: This section does not include mandatory implementation requirements. The purpose of the section is to provide guidance in terms of examples in order to facilitate implementation.

Structured procedures describe the possible transactions at the radio interface. Structured procedures consist of specific combinations of elementary procedures described in sect. 3 to 6 of this Recommendation.

In this chapter selected examples of structured procedures are described. The primitives used between the sublayers and the peer-to-peer communication across the radio interface are described in general terms in Rec. GSM 04.07.

In the structured procedures the elements shown in Fig. 7.1 can be identified. Depending on the transaction, some elements may not be used.

These elements are described in more detail in the following.

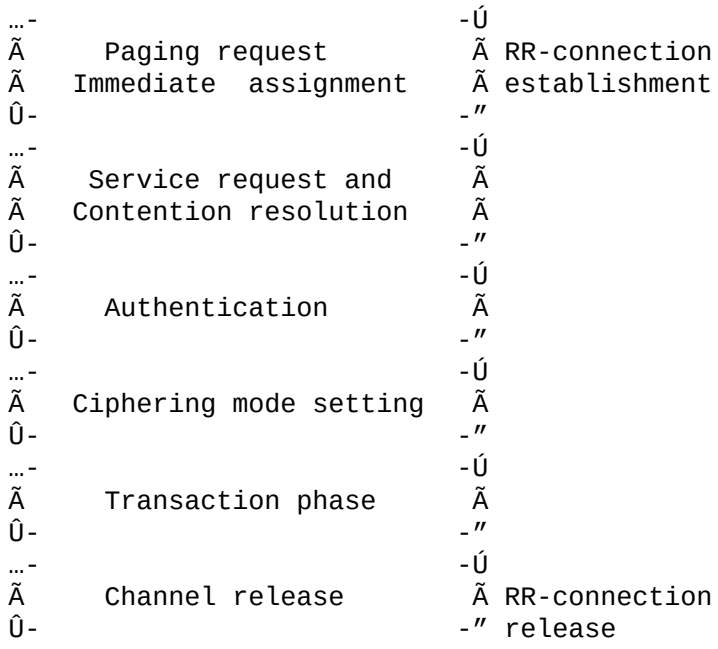


Fig. 7.1/GSM 04.08
Elements of structured procedures

7.1.1 Paging request

The paging procedure is used to locate a Mobile Station.

Upon receipt of a PAGING REQUEST message the addressed Mobile Station initiates the immedate assignment procedure.

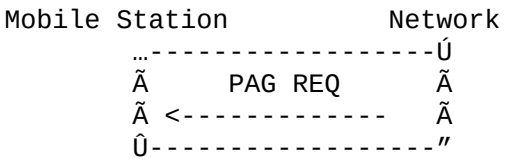


Fig. 7.2/GSM 04.08 Paging request

7.1.2 Immediate assignment procedure

The immediate assignment procedure is always initiated by the Mobile Station. It may be triggered by a paging request or by a mobile originated transaction.

The Mobile Station sends a CHANNEL REQUEST message on the Random Access Channel. The network responds with an IMMEDIATE ASSIGNMENT message which causes the Mobile Station to seize the indicated dedicated channel.

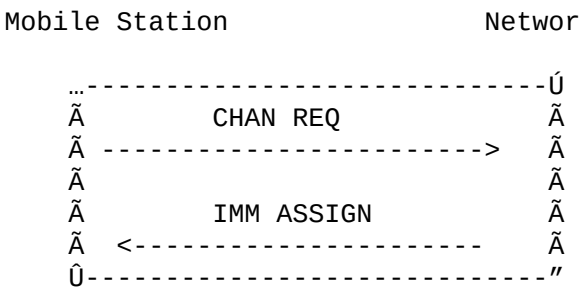


Fig. 7.3/GSM 04.08 Immediate assignment

7.1.3 Authentication

The purpose of authentication is to check whether or not the identity provided by the Mobile Station is authorized. It is initiated by the network. The authentication procedure also provides the Mobile Station with information from which a new ciphering key can derived. The network decides whether or not to use authentication. This may depend on the context.

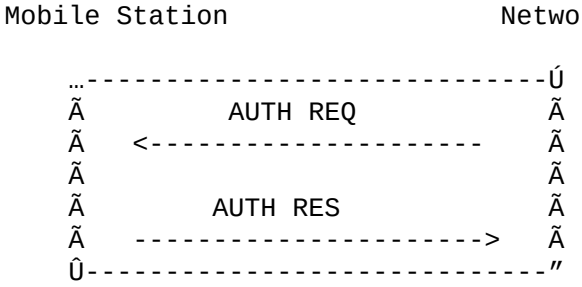


Fig. 7.4/GSM 04.08 Authentication

7.1.4 Ciphering mode setting

Ciphering mode setting is initiated by the network. Its purpose is to instruct the Mobile Station whether or not to use ciphering.

Where ciphering is used, this procedure synchronizes the start of ciphering at the Mobile Station and in the network.

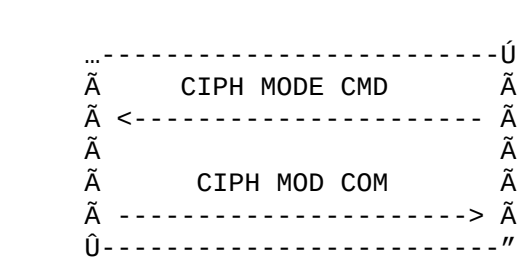


Fig. 7.5/GSM 04.08 Ciphering mode setting

7.1.5 Transaction phase

A variety of procedures may occur during the transaction phase as described in sections 3 to 6.

7.1.6 Channel release

Once the transaction phase has been completed the channel is released by the channel release procedure. The data link layer is released explicitely as described in Rec. GSM 04.06. Upon channel release, the radio resources which were in use may be reallocated by the network.

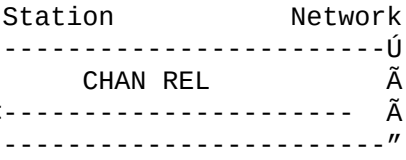


Fig. 7.6/GSM 04.08 Channel release

7.2 Abnormal cases

Abnormal cases may arise from:

a) failure at a lower layer (e.g. loss of radio connection);
b) failure of an elementary procedure;
c) syntax errors in a structured procedure.

Cases (a) and (b) are treated in the description of radio resource management (section 3), mobility management (section 4) and call control (section 5). Case (c) is treated in section 7.3.

7.3 Selected examples

The following examples are considered:

- location updating

- mobile originating call establishment
  a) without OACSU (early assignment)
  b) with OACSU

- mobile terminating call establishment
  a) without OACSU (early assignment)
  b) with OACSU

- call clearing:
  a) network initiated
  b) mobile initiated

- DTMF protocol control.

- handover:
  a) between finely synchronized cells
  b) between non-synchronized cells
  c) handover failure, where reconnection of the old channel is possible

- in-call modification

- call re-establishment

7.3.1 Location updating

Location updating is always initiated by the Mobile Station when it finds itself in a different location area from the one in which it was registered before.

The procedure is shown in Fig. 7.7/GSM 04.08.

The Mobile Station initiates immediate assignment and sends a layer 2 SABM-frame containing a LOCACTION UPDATING REQUSET message to the network. The network returns a layer 2 UA- frame containing the same layer 3 message sent in the SABM- frame.

The network may perform authentication.

Ciphering has to be activated by the CIPHERING MODE COMMAND message if the LOCATION UPDATING ACCEPTED message includes a new TMSI. Where the location updating is used for periodic registration or the network does not allocate a new TMSI, ciphering need not to be activated depending on the network option.

After having sent the LOCATION UPDATING ACCEPTED message, the network will initiate the channel release if no further transactions are scheduled.

In case the identity confidentiality service is active, a new TMSI will be allocated using the LOCATION UPDATING ACCEPTED message. A TMSI REALLOCATION COMPLETE message is sent to the network to acknowledge the receipt of the new TMSI. Upon receipt of the TMSI REALLOCATION COMPLETE message the network will initiate the channel release.

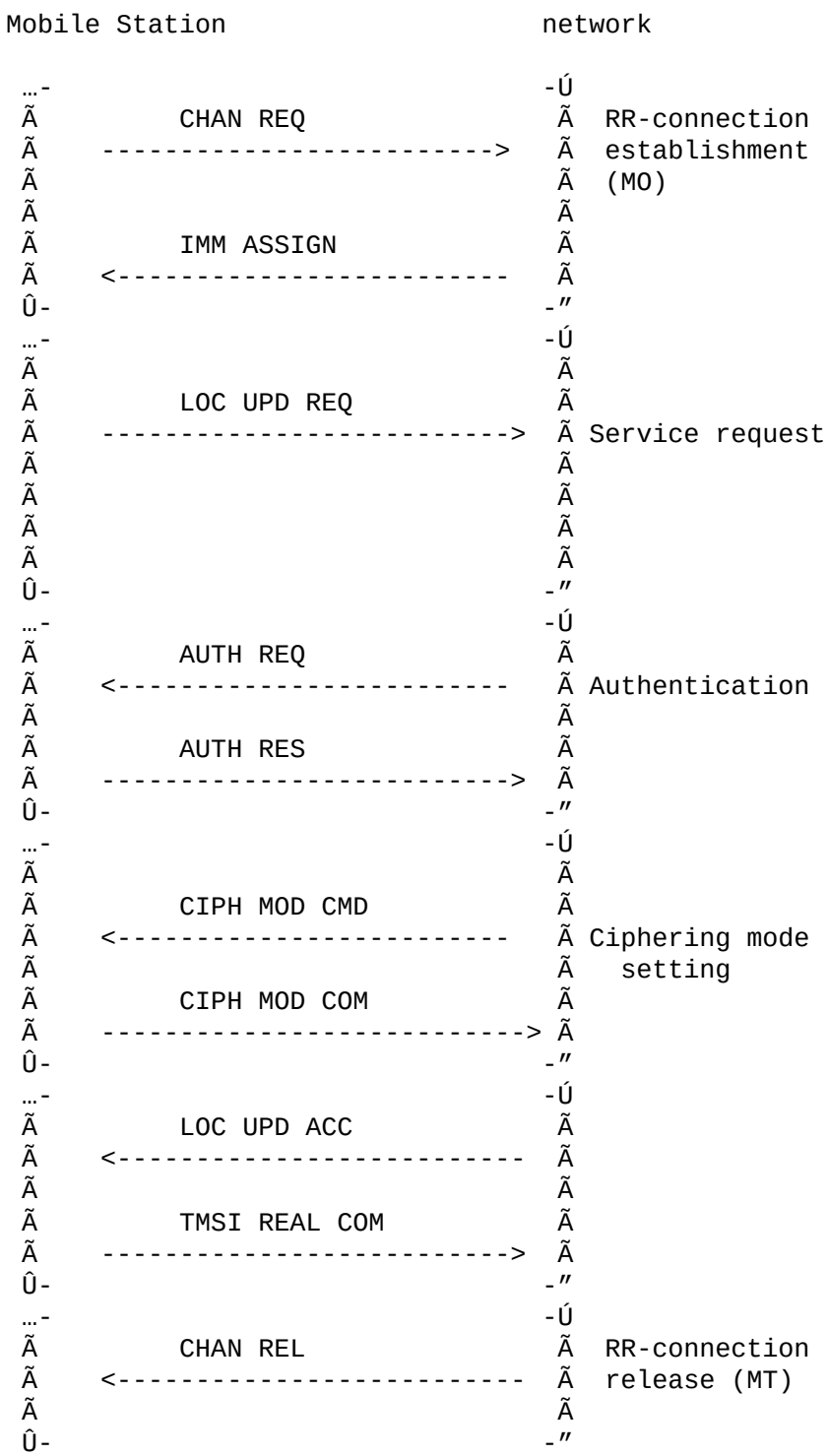


Fig. 7.7/GSM 04.08 Location updating: successful case

7.3.2 Mobile originating call establishment

7.3.2.1 Successful case

The Mobile Station initiates immediate assignment and sends a layer 2 SABM-frame containing the setup request (CM SERVICE REQUEST) to the network. The same message is returned in a layer 2 UA-frame.

The network may initiate authentication and always starts the ciphering mode setting.

Upon sending the CIPHERING MODE COMMAND the Mobile Station will initiate call establishment by sending the SETUP message to the network. This message will be answered by the network in the successful case with a CALL PROCEEDING message.

a) Non OACSU option (early assignment)

With this option the network will allocate a traffic channel to the Mobile Station before it initiates call establishment in the fixed network.

If call queuing is applied, it may cause variable delay in the traffic channel assignment.

When user alterting has been initiated at the called side, an ALERTING message is sent to the Mobile Station. The network may optionally instruct the MS to attach the user connection at this stage of the call, by means of the progress indicator information element set to the value #1 (if the ringing tone will be sent by the remote end) in the ALERTING message. In that case, an alerting ringing tone has to be generated by the network.

Note: The speech codec is transparent for supervisory tones.

A CONNECT message and its acknowledgement CONNECT ACKNOWLEDGE complete the call establishment when the called party has answered.

The mobile originated call setup with early assignment is shown in Fig. 7.8a/GSM 04.08.

b) OACSU option [F.S.]

The network determines when the traffic channel is to be assigned. The assigment may be performed at any time after call establishment has been initiated in the fixed network. In the following the most extreme case is considered where the network will only allocate a traffic channel after the called party has answered the call (late assignment).

As in a) an ALERTING message is sent to the Mobile Station when user alerting has been initiated at the called side. However, the ringing tone has to be generated locally at the Mobile Station (if needed) as no traffic channel is allocated. When the called party has answered, the network will initiate the channel assignment procedure in order to allocate a traffic channel to the Mobile Station. If call queuing is applied, it may cause variable delay in the traffic channel assignment. Once the channel assignment has been completed the network will send a CONNECT message to the Mobile Station. The MS attaches then the user connection, except if a previous instruction of early attachment was previously delivered by means of a progress indicator information element. The CONNECT ACKNOWLEDGE message will complete the call setup.

The mobile originated call setup with late assignment is shown in Fig. 7.8b/GSM 04.08.

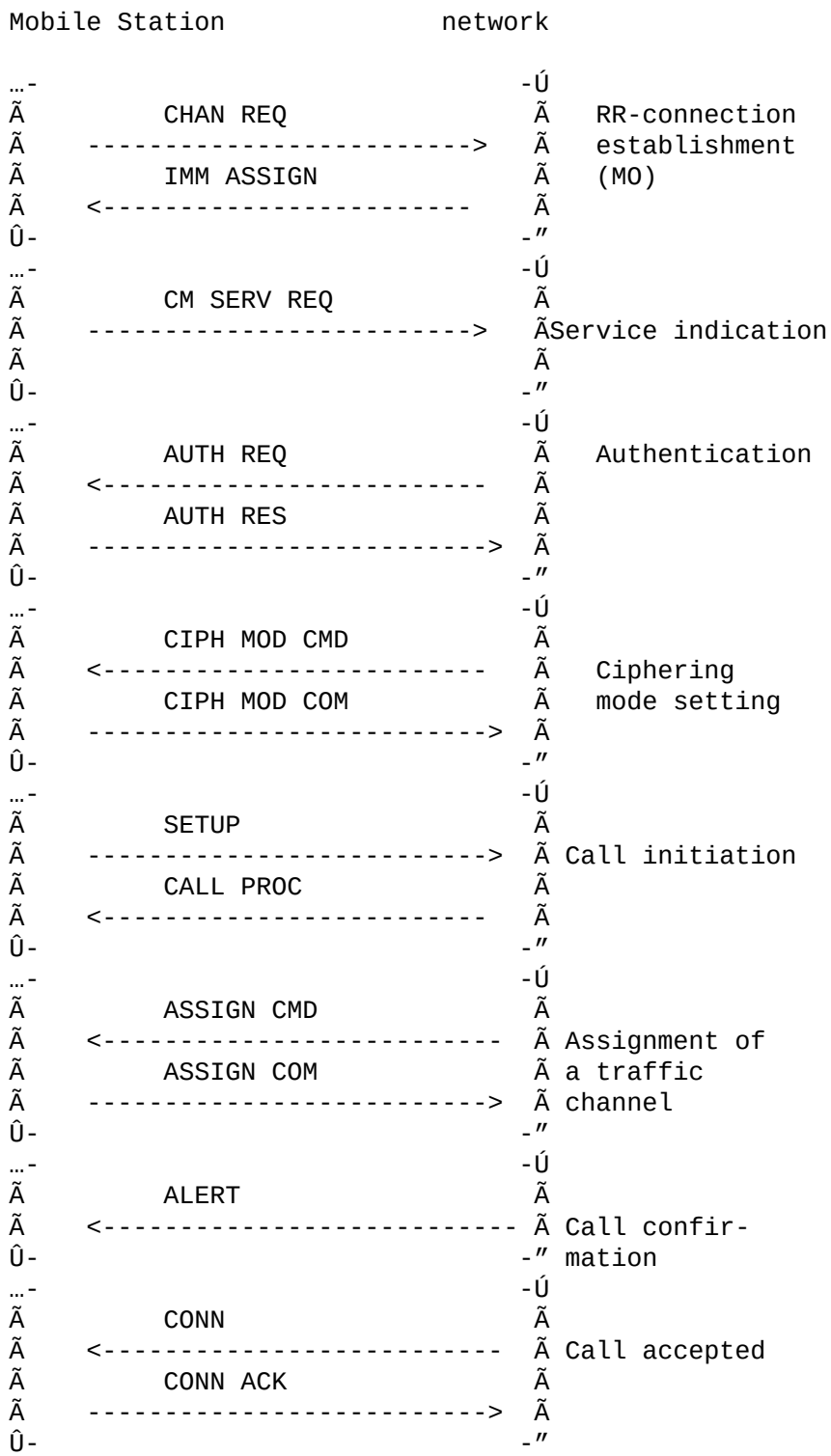


Fig. 7.8a/GSM 04.08
Mobile originating call establishment without OACSU

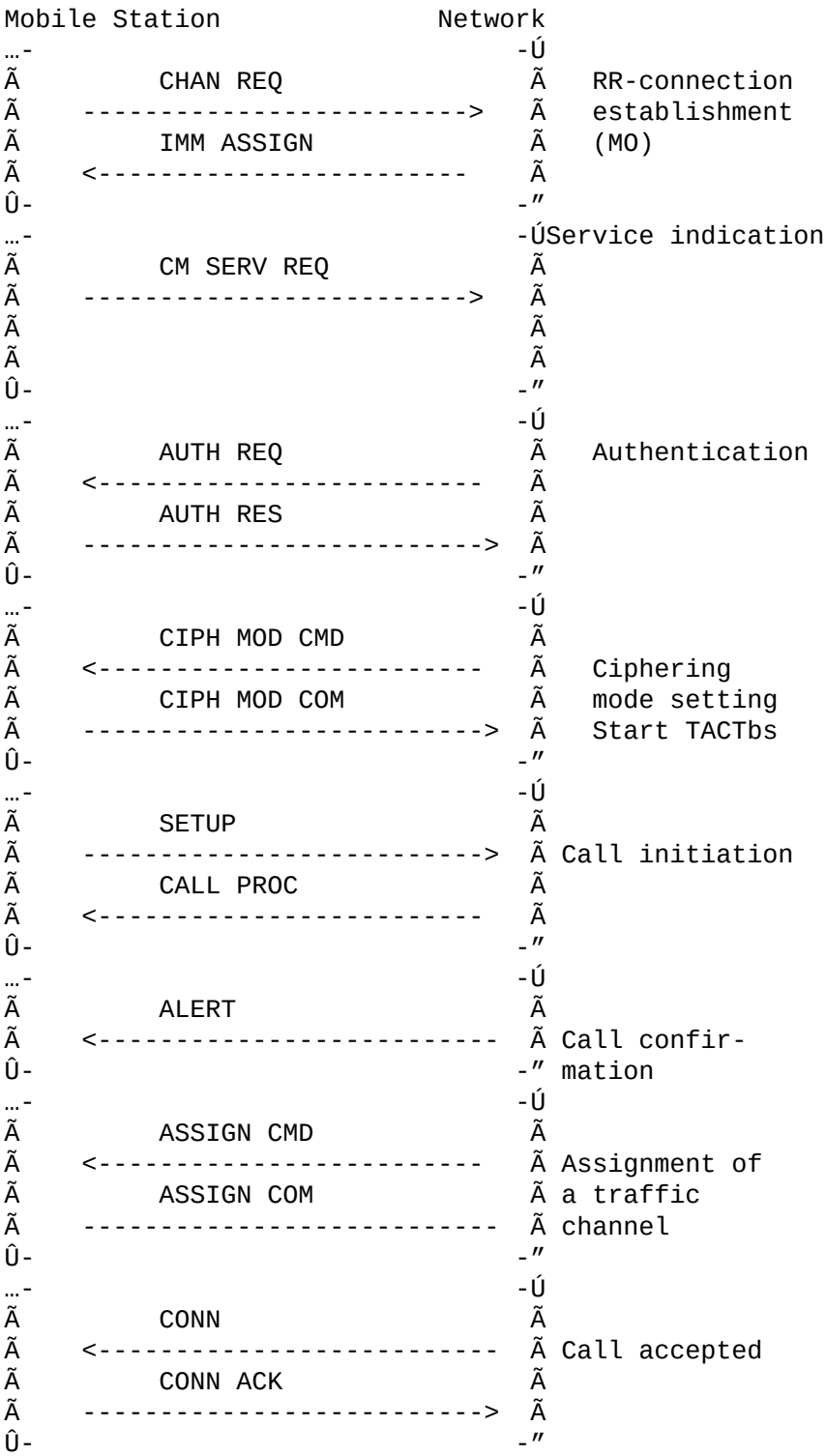


Fig. 7.8b/GSM 04.08
Mobile originated call with OACSU (late assignment)

7.3.3 Mobile terminated call establishment

7.3.3.1 Successful case

Mobile terminating call establishmend is initiated by the network with sending the PAGING REQUEST message (see Fig. 7.9a/GSM 04.08). Upon receiving this message the Mobile Station initiates the immediate assignment procedure and responds to the network by sending the PAGING RESPONSE message within a layer 2 SABM-frame. The same message is returned in a layer 2 UA-frame.

Authentication and ciphering are treated by the network in the same way as defined for the mobile originating call establishment (sect. 7.3.2). After the ciphering has been initiated, the network sends a SETUP message to the Mobile Station. The capability of the Mobile Station (at that time) to accept the call is confirmed when the Mobile Station returns a CALL CONFIRMED message to the network.

a) Non OACSU option (early assignment)

With this option the network initiates the assignment of a traffic channel upon receiving the CALL CONFIRMED message.

User alerting is initiated, after a traffic channel has been allocated. An ALERTING message will be sent to the network.

When the called user answers, the Mobile Station sends a CONNECT message to the network. Upon receiving the CONNECT message the network completes the through- connection of the communication path and sends a CONNECT ACK message to the Mobile Station.

b) OACSU option

In that case, user alerting is initiated as soon as the MS has accepted the call. This is notified to the MS by means of the signal information element.

The network determines when the traffic channel is to be assigned. The assignment may be performed at any time after user altering has been initiated. In the following the most extreme case is considered where the network will only allocate a traffic channel to the Mobile Station after having received the CONNECT message sent from the Mobile Station (see Fig. 7.9b).

Upon receiving the ASSIGNMENT COMMAND message from the Mobile Station, the network completes the through- connection of the communication path and sends a CONNECT ACKNOWLEDGE message to the Mobile Station.

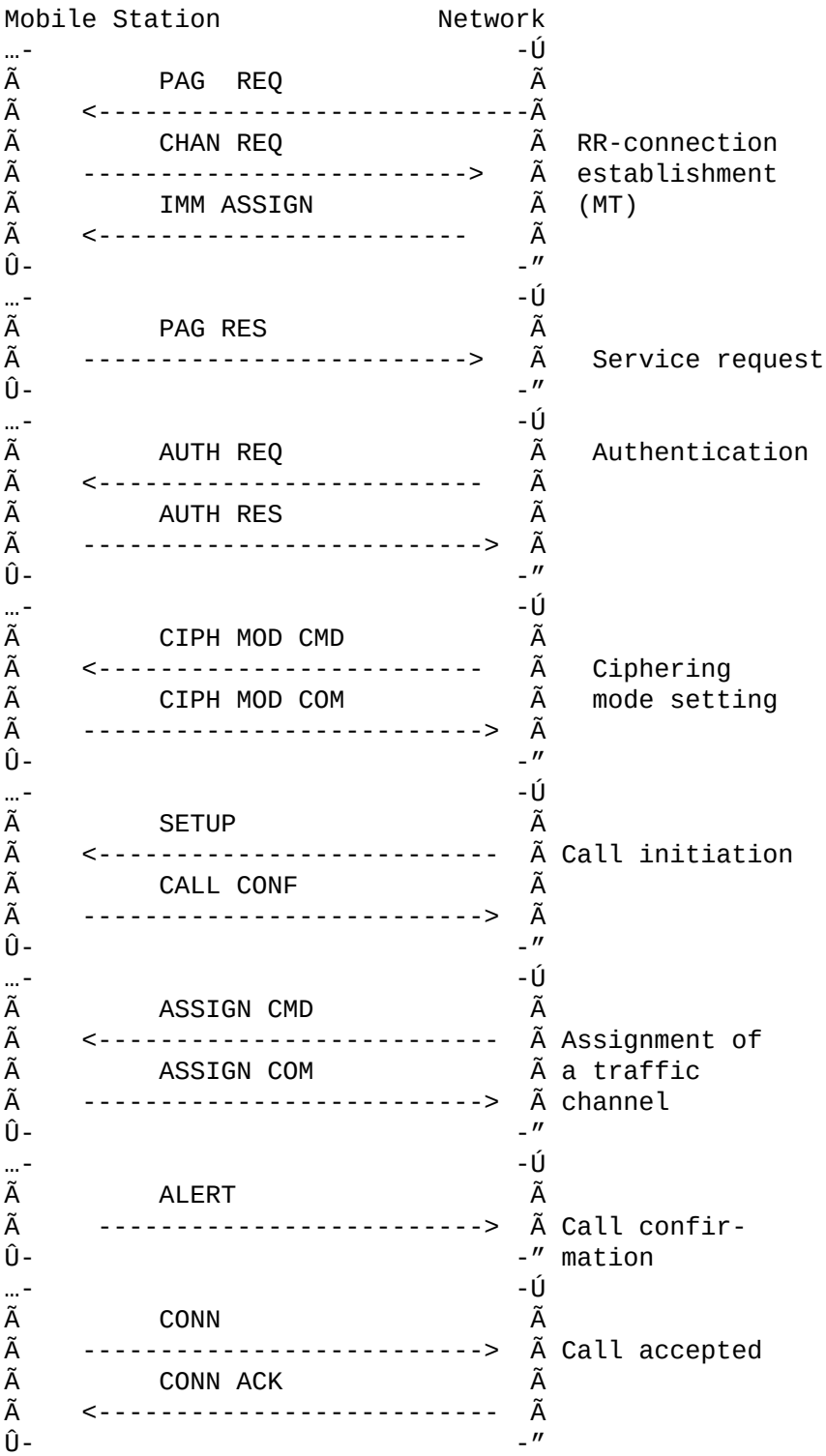


Fig. 7.9a/GSM 04.08 - Mobile terminating call establishment without OACSU (early assignment)

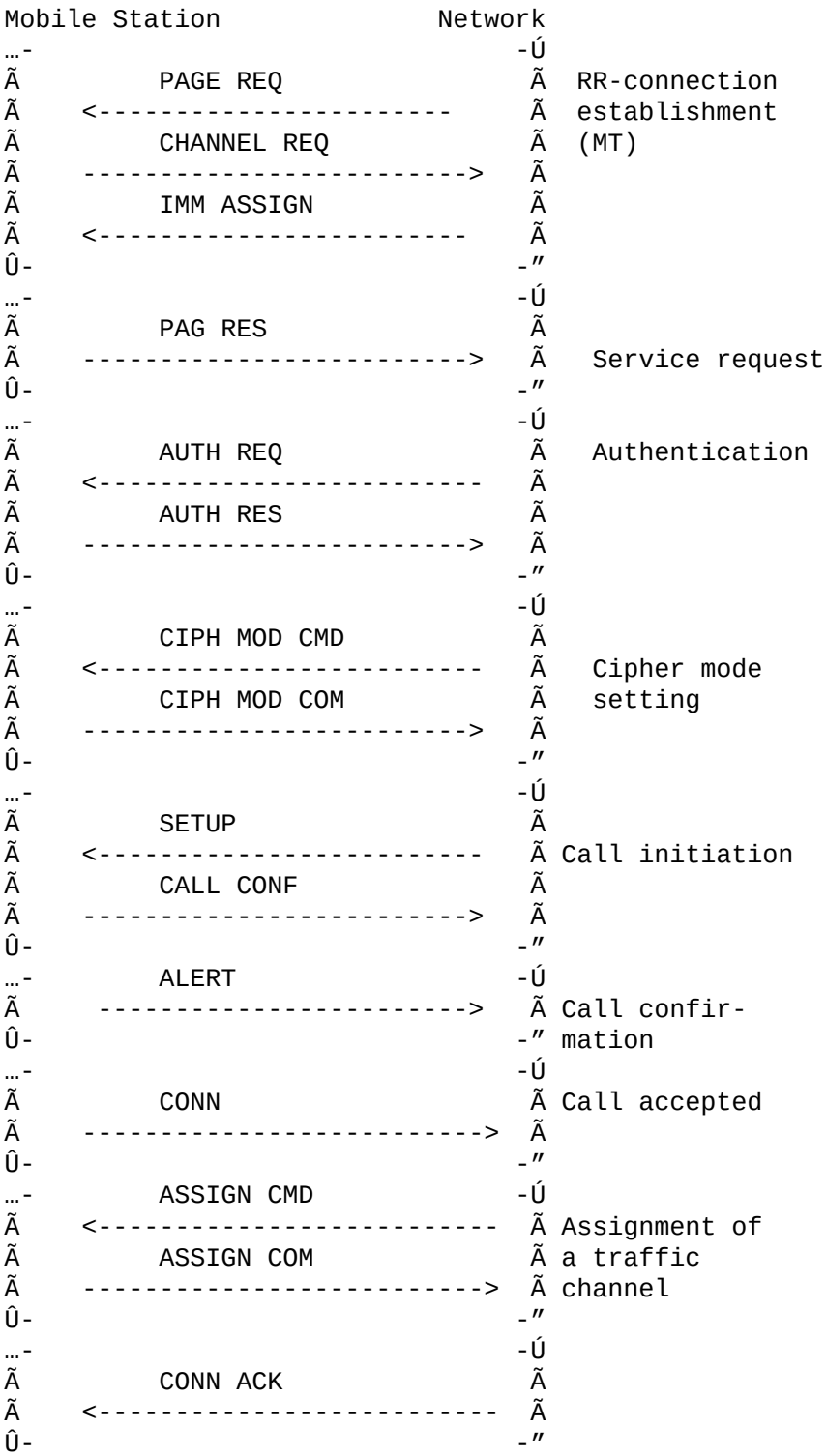


Fig 7.9b/GSM 04.08 Mobile terminating call establishment with OACSU (late assignment)

7.3.4 Call clearing

a) Network initiated

The network initiates the clearing of a call by sending a DISCONNECT message to the Mobile Station (see also sect. 5.4.4). Upon receiving the RELEASE message from the Mobile Station, the network :

- sends a RELEASE COMPLETE to the Mobile Station and
- if the traffic channel is not any longer needed (e.g. last activity on the traffic channel), performs the channel release procedure as described in sect. 7.1.6.

Upon receiving the DISCONNECT message from the network the Mobile Station performs call clearing as described in sections 5.4.4.1 and 5.4.4.2.

Upon receiving the RELEASE COMPLETE message and if the cleared call was the last activity on the traffic channel, the Mobile Station waits for the release of the channel which is always initiated by the network.

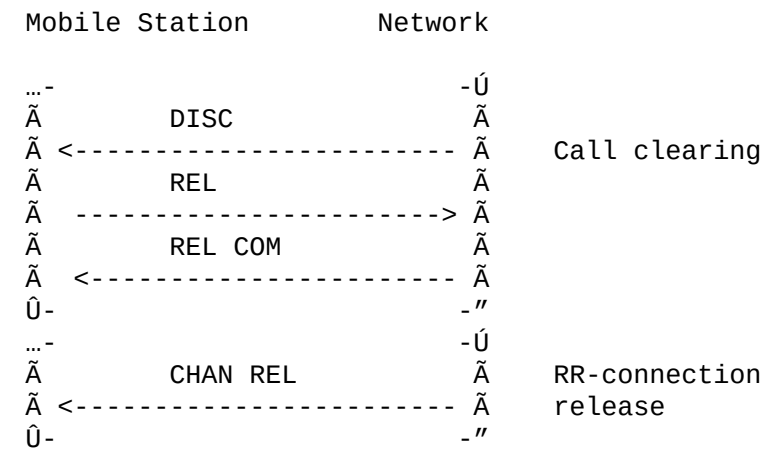
The network initiated call clearing is shown in Fig. 7.10a.

b) Mobile initiated

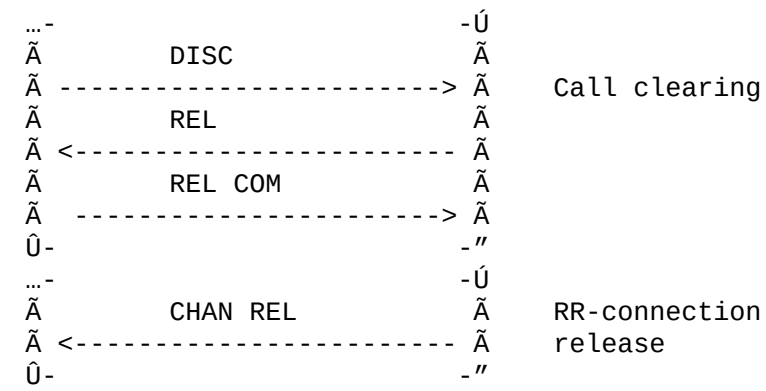
The Mobile Station initiates clearing of a call by sending a DISCONNECT message to the network. The clearing procedure as described in sect. 5.4.3 then applies with the exchange of the RELEASE and RELEASE COMPLETE messages.

Upon receiving the RELEASE COMPLETE message and if the cleared call was the last activity on the traffic channel, the network initiates the channel release procedure according to sect. 7.1.6.

Mobile initiated call clearing is shown in Fig. 7.10b.



a) Network initiated call clearing



b) MS initiated call clearing

Fig. 7.10/GSM 04.08
Call clearing

7.3.5 DTMF protocol control

Fig. 7.11 shows the structured procedure for DTMF protocol control.

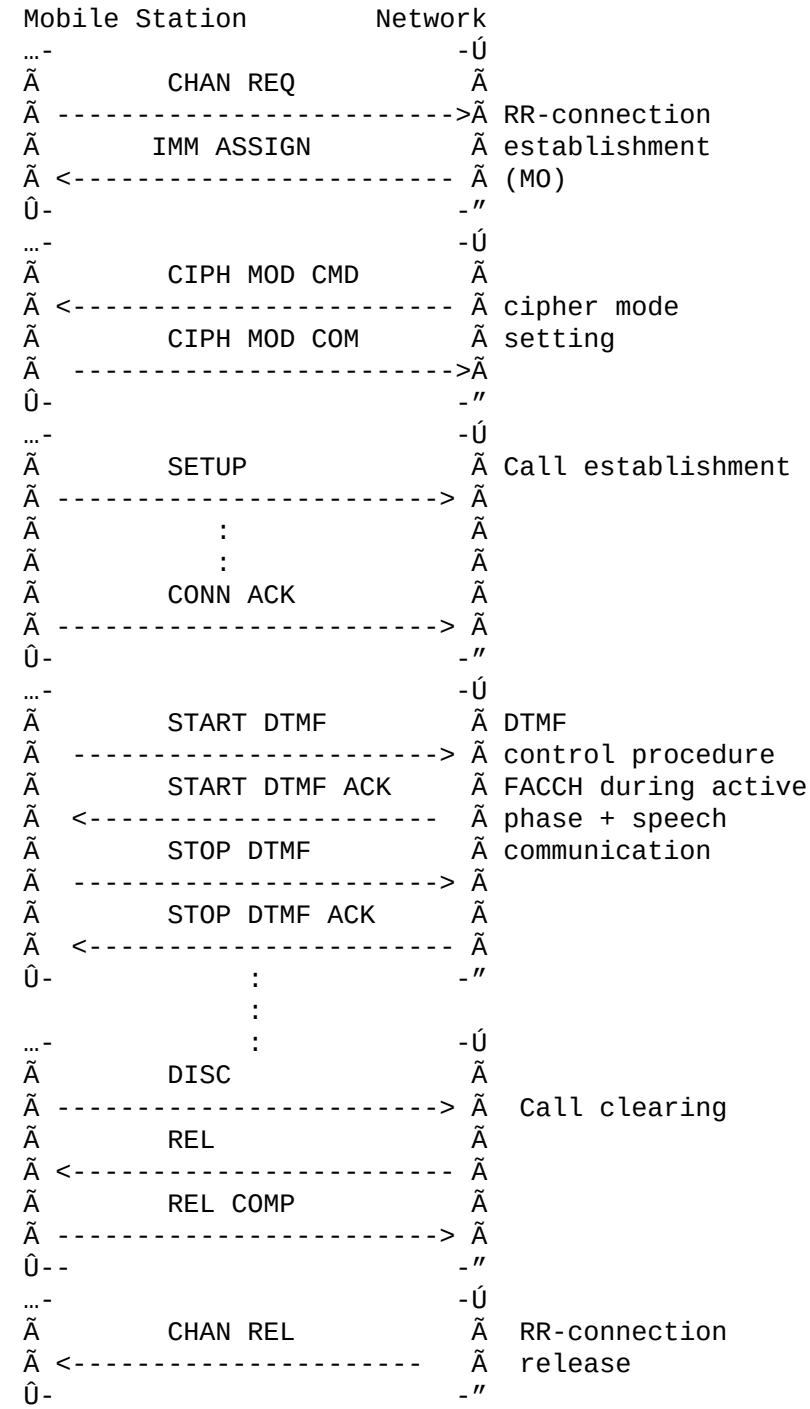


Fig. 7.11/GSM 04.08 DTMF protocol control

7.3.6 Handover

Fig. 7.12 shows the structured procedure for handover to a finely synchronized cell, successful case.
Fig. 7.13 shows the structured procedure for handover to a non-synchronized cell, successful case.
Fig. 7.14 shows the structured procedure for handover failure, and reconnection to the old traffic channel.

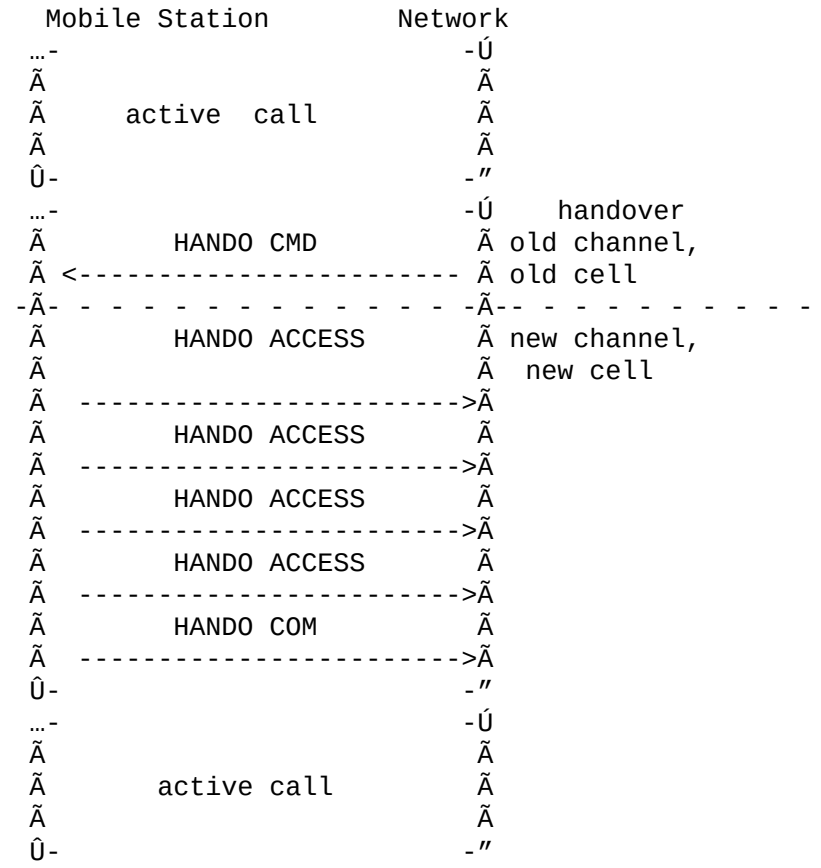


Figure 7.12/GSM 04.08
Handover to a finely synchronized cell, successful case

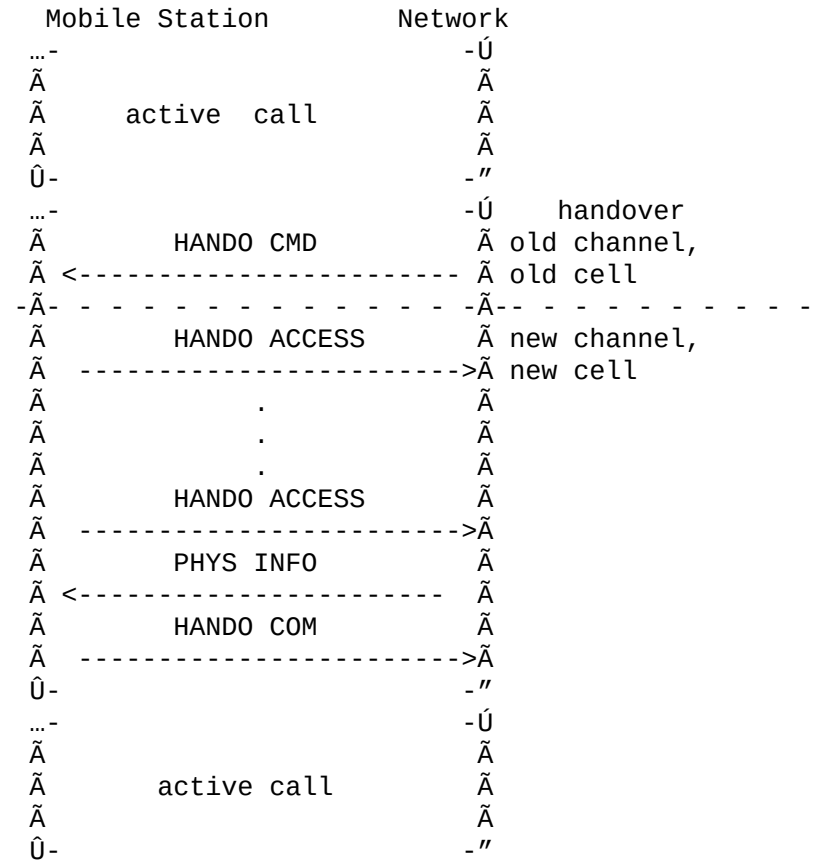


Figure 7.13/GSM 04.08
Handover to a non-synchronized cell, successful case

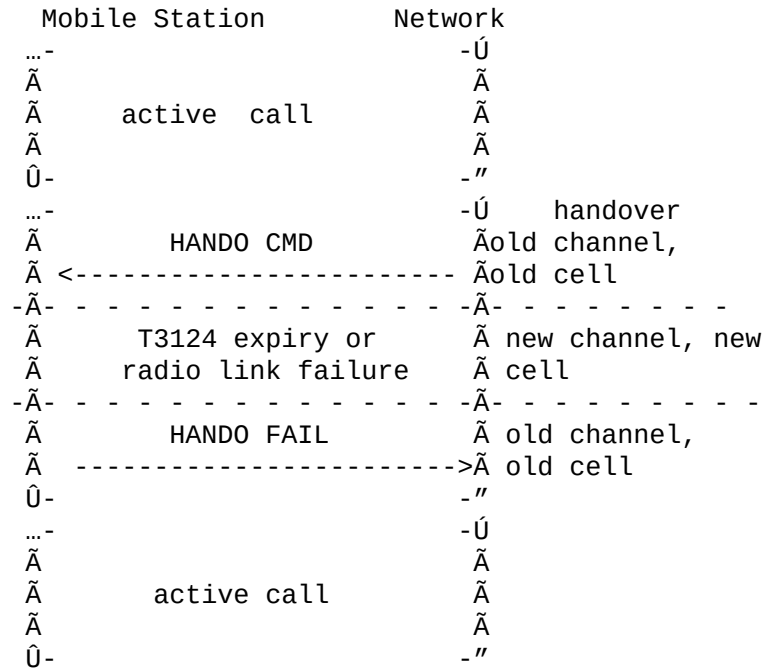


Figure 7.14/GSM 04.08
Handover failure, reconnection to the old traffic channel

7.3.7 In-call modification

Figure 7.15/GSM 04.08 shows the structured procedure for in- call modification.

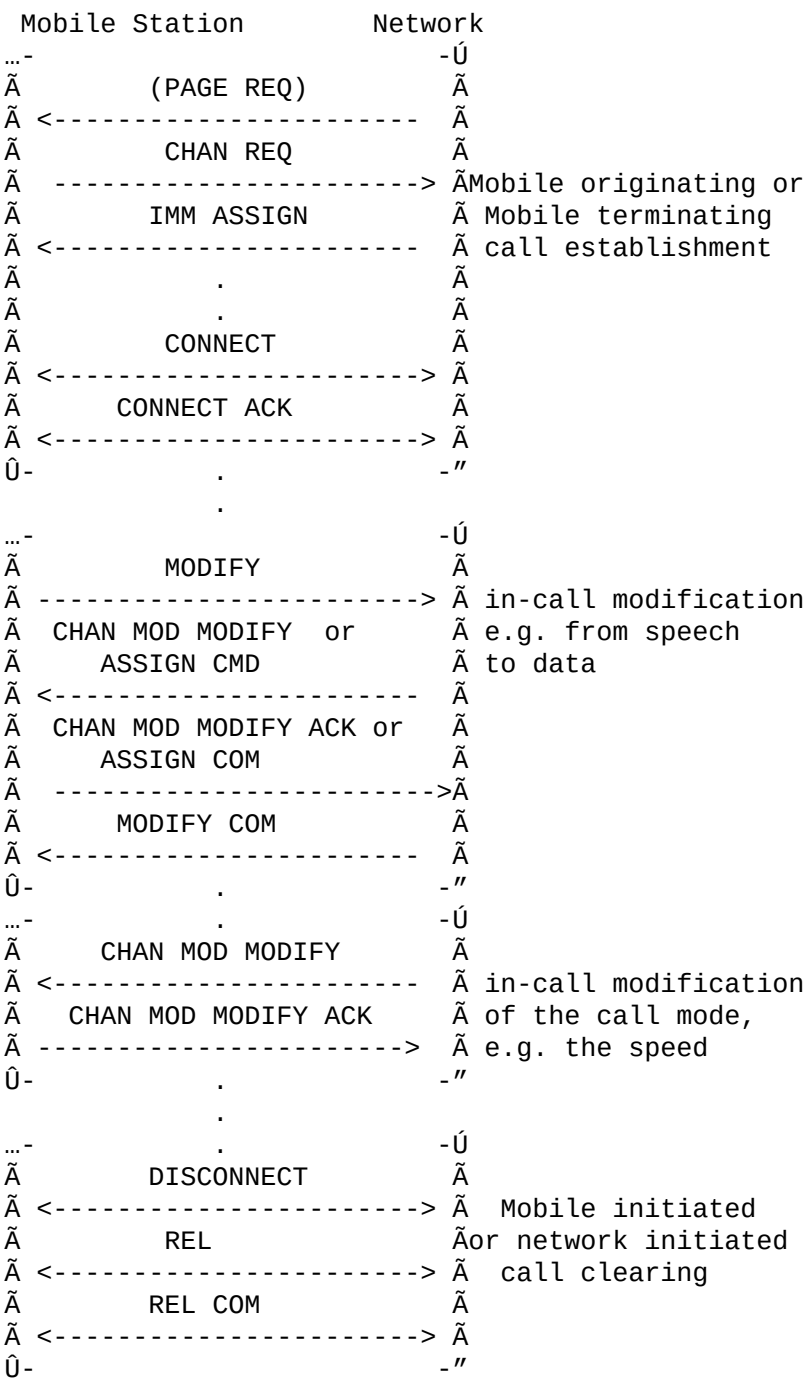


Figure 7.15/GSM 04.08
In-call modification

7.3.8 Mobile originating call re-establishment

Figure 7.16/GSM 04.08 shows the structured procedure for call re-establishment.

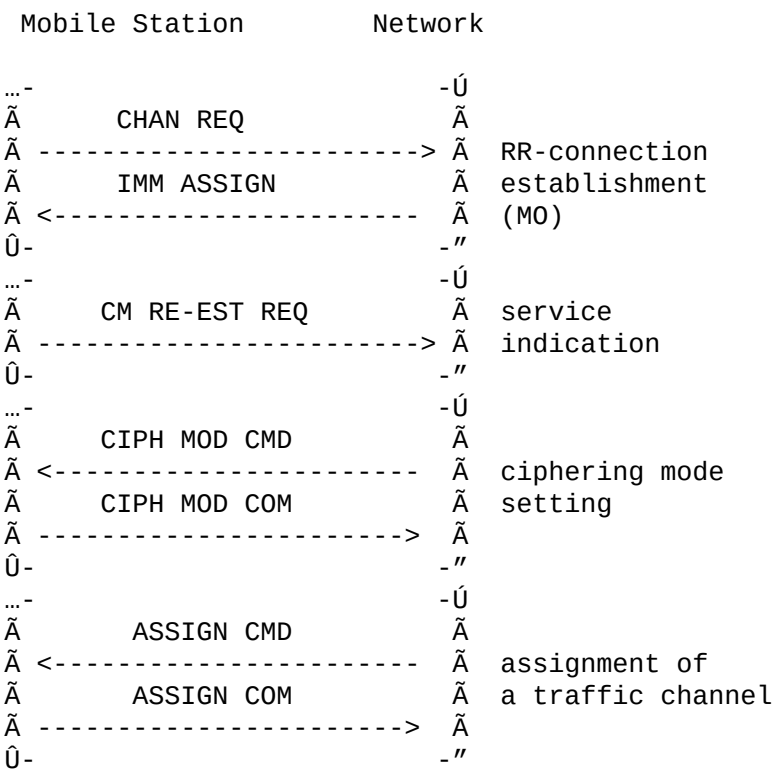


Figure 7.16/GSM 04.08
Call re-establishment

8 HANDLING FOR ERROR CONDITIONS

8.1 General

The procedures specified in this Recommendation apply to those messages which pass the checks described below.

Detailed error handling procedures in the network are implementation dependent and may vary from PLMN to PLMN.

The following sections 8.2 through 8.8 are listed in order of precedence.

8.2 Protocol discrimination error

If the network receives a message with a protocol discriminator different from those specified in this Recommendation, the network may ignore the message or initiate the channel release procedure.

If the mobile station receives a message with a protocol discriminator different from those specified in this Recommendation, the mobile station shall ignore the message.

8.3 Message too short

When a message is received that is too short to contain a complete message type information element, that message shall be ignored.

8.4 Transaction identifier error

8.4.1 Radio ressource management

Whenever an RR message is received specifying a transaction identifier information element different from what is specified in this Recommendation then the RR message shall be ignored.

8.4.2 Mobility managment

Whenever an MM message is received specifying a transaction identifier information element different from what is specified in this Recommendation then the MM message shall be ignored.

8.4.3 Call control

For the Mobile Station, the following procedures shall apply :

a) Whenever any message except SETUP, RELEASE COMPLETE or STATUS is received specifying a transaction identifier which is not recognized as relating to an active call or to a call in progress, the receiving entity shall send a RELEASE COMPLETE message with cause #81 "invalid transaction identifier value" using the received transaction identifier value and remain in the Null state.

b) When a RELEASE COMPLETE message is received specifying a transaction identifier which is not recognized as relating to an active call or to a call in progress, The MM-connection associated with that transaction identifier shall be released.

c) When a SETUP message is received specifying a transaction identifier which is not recognized as relating to an active call or to a call in progress, and with a transaction identifier flag incorrectly set to "1", this message shall be ignored.

d) When a SETUP message is received specifying a transaction identifier which is recognized as relating to an active call or to a call in progress, this SETUP message shall be ignored.

e) When a STATUS message is received specifying a transaction identifier which is not recognized as relating to an active call or to a call in progress, the procedures of section 5.5.3 shall apply.

The same procedures may apply to the network.

8.5 Message type error

If the Mobile Station receives a non-existent message type, a message not consistent with the Protocol Discriminator, not consistant with the direction or not consistent with the state, the Mobile Station shall ignore the message and return a status message (STATUS, RR-STATUS or MM-STATUS depending on the protocol discriminator) with either of the causes :

97 "message type non-existent or not implemented.

98 "message not compatible with control state or non-existent or not implemented.

The network may follow the same procedures.

8.6 General information element errors

This error category includes:

- information element out of sequence
- duplicated information element.

In those cases where the Mobile Station detects an out of sequence information element, the Mobile Station shall:

- if the information element is mandatory, follow the procedure specified in section 8.7 ;

  Note: This case may be undistinguishable from the case described in section 8.7

- if the information element is non-mandatory, follow the procedure specified in section 8.8.

If a non-mandatory information element is repeated in a message in which repetition of the information element is not permitted, only the contents of the information element appearing first shall be handled and all subsequent repetitions of the information element shall be ignored. When repetition of information elements is permitted, only the contents of permitted information elements shall be handled. If the limit on repetition of information elements is exceeded, the contents of information elements appearing first up to the limit of repetitions shall be handled and all subsequent repetitions of the information element shall be ignored.

The general information element error procedures may also apply to information elements in codesets other than 0 for call control.
In that case, the diagnostics in the cause information element may indicate information elements other than those in codeset 0 by applying locking or non locking shift procedures as described in section 10.5.4.

The network may follow the same procedures.

Note 1: The cases where an information element is syntactically correct but semantically incorrect and is detected as such then the message shall be ignored. A status message (STATUS, RR-STATUS or MM-STATUS depending on the protocol discriminator) shall be sent.

Note 2: Bits indicated as spare are not checked.

8.7 Mandatory information element error

This corresponds to either a missing information element or an information element content error. These cases are undistinguishable in this Recommendation.

When a message other than the messages listed in the sections below is received by the Mobile Station with mandatory information element errors, no action shall be taken on the message and no state change shall occur. A status message (STATUS, RR-STATUS or MM-STATUS depending on the protocol discriminator) is returned with cause # 100 "invalid information element contents".

The network may follow the applicable procedures defined in this section.

8.7.1 Radio resource management

For the Mobile Station the following procedures shall apply:

a) When a CHANNEL RELEASE message is received with mandatory information element errors, the actions taken shall be the same as specified in 3.5 "RR-connection release".

b) The actions taken when receiving a PARTIAL RELEASE message with mandatory information element errors are for further study.

8.7.2 Mobility management

No exceptional cases are described for Mobility management messages.

8.7.3 Call control

a) When a SETUP or a RELEASE message is received with mandatoryinformation element errors, a RELEASE COMPLETE message with cause # 100 "invalid information element contents" shall be returned.

b) When a DISCONNECT message is received with mandatory information element errors, a RELEASE message shall be returned with cause, # 100 "invalid information element contents" and section § 5.4. "call clearing" applies as normal.

c) A RELEASE COMPLETE message with mandatory information element errors shall be treated as a normal RELEASE COMPLETE message.

8.8 Non-mandatory information element errors

This category includes:

- unrecognized information element;
- non-mandatory information element contents error.

8.8.1 Unrecognized information element

8.8.1.1 Radio resource management

For the operation on the Paging Channel and on the Broadcast Control Channel the following procedures shall apply : the Mobile Station shall ignore all unrecognized information elements.

For other channels the procedures shall be as follow:
When a message is received which has one or more unrecognized information elements, the Mobile Station shall check whether any are encoded to indicate "comprehension required" (refer to Table 10.13/GSM.O4.08 for information element identifiers reserved with this meaning). If any unrecognized information element is encoded to indicate "comprehension required", then the procedures in section 8.7.1 are followed; i.e., as if a "missing mandatory information element" error condition had occured. If no unrecognized information elements is encoded to indicate "comprehension required", then the Mobile Station shall proceed as follows:

Action shall be taken on the message and those information elements which are recognized and have valid content. When the received message is other than CHANNEL RELEASE a RR-STATUS message shall be returned containing one cause information element.

8.8.1.2 Mobility management

When a message is received which has one or more unrecognized information elements, the Mobile Station shall check whether any are encoded to indicate "comprehension required" (refer to Table 10.38/GSM.O4.08. for information element identifiers reserved with this meaning). If any unrecognized information element is encoded to indicate "comprehension required", then the procedures in section 8.7.2 are followed; i.e., as if a "missing mandatory information element" error condition had occured. If no unrecognized information element is encoded to indicate "comprehension required", then the Mobile Station shall proceed as follows:

Action shall be taken on the message and those information elements which are recognized and have valid content.A MM-STATUS message shall be returned containing one cause information element.

8.8.1.3 Call control

When a message is received which has one or more unrecognized information elements, the Mobile Station shall check whether any are encoded to indicate "comprehension required" (refer to Table 10.45/GSM.O4.05. for information element identifiers reserved with this meaning). If any unrecognized information element is encoded to indicate "comprehension required", then the procedures in section 8.7 are followed; i.e., as if a "missing mandatory information element" error condition had occured. If all unrecognized information elements are not encoded to indicate "comprehension required", then the Mobile Station shall proceed as follows:

Action shall be taken on the message and those information elements which are recognized and have valid content. When the received message is other than DISCONNECT, RELEASE, RELEASE COMPLETE, a STATUS message shall be returned containing one cause information element.

Editorial note : The discrimination for comprehension is to be provided.

The STATUS message indicates the call state in which the receiver detected the error. The cause information element shall contain cause # 99 "information element non-existent or not implemented", and the diagnostic field, if present, shall contain the information element identifier for each information element which was unrecognized.

If a call control clearing message contains one or more unrecognized information elements, the Mobile Station shall act in the following manner:

a) When a DISCONNECT message is received which has one or more unrecognized information elements, a RELEASE message with cause # 99, "information element non-existant or non existent or not implemented," shall be returned. The Cause information element diagnostic field, if present, shall contain the information element identifier for each information element which was unrecognized.

b)When a RELEASE message is received which has one or more recognized information elements, a RELEASE COMPLETE message with cause # 99, "information element non-existent or not implemented", shall be returned. The cause information element diagnostic field, if present, shall contain the information element identifier for each information element which was unrecognized.

c) When a RELEASE COMPLETE message is received which has one or more unrecognized information elements, no action shall be taken on the unrecognized information.

The network may follow the same procedures.

Note: The diagnostic(s) of cause # 99 facilitates the decision in selecting an appropriate recovery procedure at the reception of a STATUS message. Therefore, it is recommended to provide cause # 99 with diagnostic(s) if a layer 3 entity expects the peer to take an appropriate action at the receipt of a STATUS message, although inclusion of diagnostic(s) is optional.

8.8.2 Non-mandatory information element content error

8.8.2.1 Radio resource managment

For the operation on the Paging Channel and on the Broacast Control Channel the following procedures shall apply : The Mobile Station shall ignore all non-mandatory information elements with erroneous content.

For other channels the procedures defined in section 8.7 apply.

8.8.2.2 Mobility management

The procedures defined in section 8.7 apply.

8.8.2.3 Call control

When a message is received by the Mobile Station which has one or more non-mandatory information elements with invalid content, action shall be taken on the message and those information elements which are recognized and have valid contents. A STATUS message shall be returned containig one cause information element. The STATUS message indicates the control state in which the receiver detected the error. The cause information element shall contain cause # 100 "invalid information element contents" and the diagnostic field, if present, shall contain the information element identifier for each information element which has invalid contents.

The network may follow the same procedures.

9 MESSAGE FUNCTIONAL DEFINITIONS AND CONTENTS

This section provides an overview of the Rec. GSM 04.08 message structure, which highlights the functional definition and information content (i.e. semantics) of each message. Each definition includes:

a) A brief description of the message direction and use, including whether the message has:

1. Local significance, i.e. relevant only on the originating or terminating access;

2. Access significance, i.e. relevant in the originating and terminating access, but not in the network;

3. Dual significance, i.e. relevant in either the originating or terminating access and in the network; or

4. Global significance, i.e. relevant in the originating and terminating access and in the network.

b) A table listing the information elements in the order of their appearance in the message (mandatory before optional and for the latter in the same relative order for all message types). For each information element the table indicates:

1. The section of this Recommendation describing the information element.

2. The direction in which it may be sent; i.e., mobile station to network (ms --> n), network to mobile station (n -->ms), or both;

3. The type of the information element i.e. whether it is mandatory with fixed length (MF), mandatory with variable length (MV), optional with fixed length (OF) or optional with variable length (OV). For each optional information element a reference to a note is given. The note explains the circumstances under which the information element shall be included.

4. The length of the information element (or permissible range of lengths), in octets, where "?" denotes an undefined maximum length.

c) Further explanatory notes, as necessary.

9.1 Messages for radio resources management

Table 9.1/GSM 04.08 summarizes the messages for radio resources management.

Channel establishment messages:	Reference
ADDITIONAL ASSIGNMENT	9.1.1
IMMEDIATE ASSIGNMENT	9.1.17
IMMEDIATE ASSIGNMENT EXTENDED	9.1.18
IMMEDIATE ASSIGNMENT REJECT	9.1.19
Ciphering messages:	Reference
CIPHERING MODE COMMAND	9.1.9
CIPHERING MODE COMPLETE	9.1.10
Handover messages:	Reference
ASSIGNMENT COMMAND	9.1.2
ASSIGNMENT COMPLETE	9.1.3
ASSIGNMENT FAILURE	9.1.4
HANDOVER ACCESS	9.1.13
HANDOVER COMMAND	9.1.14
HANDOVER COMPLETE	9.1.15
HANDOVER FAILURE	9.1.16
PHYSICAL INFORMATION	9.1.27
Channel release messages:	Reference
CHANNEL RELEASE	9.1.7
PARTIAL RELEASE	9.1.25
PARTIAL RELEASE COMPLETE	9.1.26
Paging messages:	Reference
PAGING REQUEST TYPE 1	9.1.21
PAGING REQUEST TYPE 2	9.1.22
PAGING REQUEST TYPE 3	9.1.23
PAGING RESPONSE	9.1.24

TABLE 9.1/GSM 04.08
Messages for radio resources management

System information messages:	Reference
SYSTEM INFORMATION TYPE 1	9.1.29
SYSTEM INFORMATION TYPE 2	9.1.30
SYSTEM INFORMATION TYPE 3	9.1.31
SYSTEM INFORMATION TYPE 4	9.1.32
SYSTEM INFORMATION TYPE 5	9.1.33
SYSTEM INFORMATION TYPE 6	9.1.34
Miscellaneous messages:	**Reference**
CHANNEL MODE MODIFY	9.1.5
CHANNEL MODE MODIFY ACKNOWLEDGE	9.1.6
CHANNEL REQUEST	9.1.8
CLASSMARK CHANGE	9.1.11
FREQUENCY REDEFINITION	9.1.12
MEASUREMENT REPORT	9.1.20
SYNCHRONISATION CHANNEL INFORMATION	9.1.28
RR-STATUS	9.1.27a

TABLE 9.1/GSM 04.08
Messages for radio resources management
(continued)

9.1.1 Additional assignment

This message is sent on the main DCCH by the network to the mobile station to allocate an additional dedicated channel while keeping the previously allocated channels. See Table 9.2/GSM 04.08.

Message type: ADDITIONAL ASSIGNMENT
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Channel description	10.5.2.5	n -> ms	MF	3
Mobile allocation 1)	10.5.2.12	n -> ms	OV	2-10
Starting time 2)	10.5.2.20	n -> ms	OF	3

TABLE 9.2/GSM 04.08
ADDITIONAL ASSIGNMENT message content

Note 1: This information element appears in the case of frequency hopping. When it appears, it applies to all assigned channels.

Note 2: This information element appears in particular if a frequency hopping change is in progress.

9.1.2 Assignment command

This message is sent on the main DCCH by the network to the mobile station to change the channel configuration to another independent dedicated channel configuration, no timing adjustment needed. See Table 9.3/GSM 04.08

Message type: ASSIGNMENT COMMAND
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Channel description	10.5.2.5	n -> ms	MF	3
Power command	10.5.2.16	n -> ms	MF	1
6) Cell channel descr.	10.5.2.1	n -> ms	OF	17
1) Channel mode	10.5.2.6	n -> ms	OF	2
2) Channel description	10.5.2.5	n -> ms	OF	4
3) Channel mode 2	10.5.2.6a	n -> ms	OF	2
4) Mobile allocation	10.5.2.12	n -> ms	OV	2-10
5) Starting time	10.5.2.20	n -> ms	OF	3

TABLE 9.3/GSM 04.08
ASSIGNMENT COMMAND message content

Note 1: This information element appears if the channel mode is changed for the channel defined in the mandatory part of the message

Note 2: This information element appears in the case of a so-called intracell handover or an assignment occuring after a call reestablishment if the MS carries two connections (on two dedicated channels, e.g. Lm+Lm).
The connection using the channel previously defined in the mandatory part of an ASSIGNMENT COMMAND or HANDOVER COMMAND message shall use the channel defined in the mandatory part of the ASSIGNMENT COMMAND message defining the new configuration.
The first indicated channel (i.e. in the mandatory part) carries the main DCCH. The SACCH used is the one associated with that channel.

Note 3: this information element apears if te channel mode is changed for the channel defined in the optional channel description information element.

Note 4: This information element appears in the case of frequency hopping. It applies to all assigned channels.

Note 5: This information element appears in particular if a frequency change is in progress.

Note 6: This information element if present must be used to decode the mobile allocation in the same message and in subsequent messages.

9.1.3 Assignment complete

This message is sent on the main DCCH from the mobile station to the network to indicate that the mobile station has established the main signalling link successfully. See Table 9.4/GSM 04.08.

Message type: ASSIGNMENT COMPLETE
Significance: dual
Direction: mobile station to network

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	ms -> n	MF	
Transaction identifier	10.3	ms -> n	MF	2
Message type	10.4	ms -> n	MF	
RR cause	10.5.2.19	ms -> n	MF	1

TABLE 9.4/GSM 04.08
ASSIGNMENT COMPLETE message content

9.1.4 Assignment failure

This message is sent on the main DCCH on the old channel from the mobile station to the network to indicate that the mobile station has failed to seize the new channel. See Table 9.5/GSM 04.08

Message type: ASSIGNMENT FAILURE
Significance: dual
Direction: mobile station to network

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	ms -> n	MF	
Transaction identifier	10.3	ms -> n	MF	2
Message type	10.4	ms -> n	MF	
RR cause	10.5.2.19	ms -> n	MF	1

TABLE 9.5/GSM 04.08
ASSIGNMENT FAILURE message content

9.1.5 Channel mode modify

This message is sent on the main DCCH by the network to the mobile station to request the changing of the mode for the indicated channel. See Table 9.6/GSM 04.08.

Message type: CHANNEL MODE MODIFY
Significance: local
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Channel description 1)	10.5.2.5	n -> ms	MF	3
Channel mode	10.5.2.6	n -> ms	MF	1

Note 1: This is sufficient to identify the channel in the case of a Lm+Lm configuration.

TABLE 9.6/GSM 04.08
CHANNEL MODE MODIFY message content

9.1.6 Channel mode modify acknowledge

This message is sent on the main DCCH by the mobile station to the network to indicate the execution of a channel mode modify request. See Table 9.7/GSM 04.08.

Message type: CHANNEL MODE MODIFY ACKNOWLEDGE
Significance: local
Direction: mobile station to network

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	ms -> n	MF	
Transaction identifier	10.3	ms -> n	MF	2
Message type	10.4	ms -> n	MF	
Channel description	10.5.2.5	ms -> n	MF	3
Channel mode	10.5.2.6	ms -> n	MF	1

TABLE 9.7/GSM 04.08
CHANNEL MODE MODIFY ACKNOWLEDGE message content

9.1.7 Channel release

This message is sent on the main DCCH from the network to the mobile station to initiate deactivation of the dedicated channel used. See Table 9.8/GSM 04.08

Message type: CHANNEL RELEASE
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
RR cause	10.5.2.19	n -> ms	MF	1

TABLE 9.8/GSM 04.08
CHANNEL RELEASE message content

9.1.8 Channel request

This message is sent in random mode on the RACH. It does not follow the basic format. The format is presented direcly below, without reference to information fields.The order of bit transmission is defined in Rec. GSM 04.04.

The message is only one octet long, coded as shown in Figure 9.1/GSM 4.08 and Table 9.9/GSM 04.08.

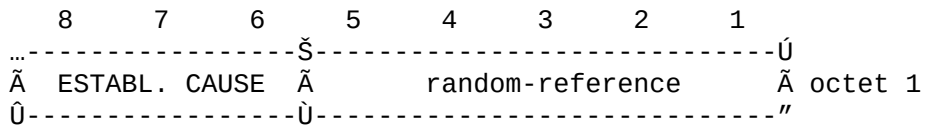


FIGURE 9.1/GSM 04.08
CHANNEL REQUEST message content

ESTABL. CAUSE, Establishment cause (octet 1)

This information field indicates the reason for requesting the establishment of a connection. This field is coded as follows :

Bits	
8 7 6	
1 0 0	Answer to paging
1 0 1	Emergency call
1 1 0	Call re-establishment
1 1 1	Other services requested by the mobile user (originating call, supplementary service short message)
0 0 0	All Other cases

All other values are reserved for future use.

RANDOM-REFERENCE (octet 1)

This is an unformatted 5-bit field.

9.1.9 Ciphering mode command

This message is sent on the main DCCH from the network to the mobile station to indicate that the network has started deciphering and that enciphering and deciphering shall be started in the mobile station, or to indicate that ciphering will not be performed. See Table 9.10/GSM 04.08

Message type: CIPHERING MODE COMMAND
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Cipher mode setting	10.5.2.7	n -> ms	MF	1/2

TABLE 9.10/GSM 04.08
CIPHERING MODE COMMAND message content

9.1.10 Ciphering mode complete

This message is sent on the main DCCH from the mobile station to the network to indicate that enciphering and deciphering has been started in the mobile station. See Table 9.11/GSM 04.08

Message type: CIPHERING MODE COMPLETE
Significance: dual
Direction: mobile station to network

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	ms -> n	MF	
Transaction identifier	10.3	ms -> n	MF	2
Message type	10.4	ms -> n	MF	

TABLE 9.11/GSM 04.08
CIPHERING MODE COMPLETE message content

9.1.11 Classmark change

This message is sent on the main DCCH by the mobile station to the network to indicate a classmark change. See table 9.12/GSM 04.08.

Message type: CLASSMARK CHANGE
Significance: dual
Direction : mobile station to network

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	ms -> n	MF	1/2
Transaction identifier	10.3	ms -> n	MF	2
Message type	10.4	ms -> n	MF	"
Mobile station classmark 2	10.5.1.6	ms -> n	MV	1-3

TABLE 9.12/GSM 04.08
CLASSMARK CHANGE message content

9.1.12 Frequency redefinition

This message is sent on the main DCCH from the network to the mobile station to indicate that the frequencies and the hopping sequence of the allocated channels shall be changed. See Table 9.13/GSM 04.08

Message type: FREQUENCY REDEFINITION
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	1/2
Transaction identifier	10.3	n -> ms	MF	1/2
Message type	10.4	n -> ms	MF	
Channel description	10.5.2.5	n -> ms	MF	3
Mobile allocation	10.5.2.12	n -> ms	MV	1-9
Starting time	10.5.2.20	n -> ms	MF	2
Cell channel description 1)	10.5.2.1	n -> ms	OF	17

TABLE 9.13/GSM 04.08
FREQUENCY REDEFINITION message content

Note 1: If it does not appear, the cell channel description is assumed to be unchanged.

9.1.13 Handover access

This message is sent in random mode on the main DCCH during a handover procedure. It does not follow the basic format. The format is presented directly below without reference to information elements.The order of bit transmission is defined in Rec. GSM 04.04.

This message is only one octet long, coded as shown in Figure 9.2/GSM 04.08 and Table 9.14/GSM 04.08.

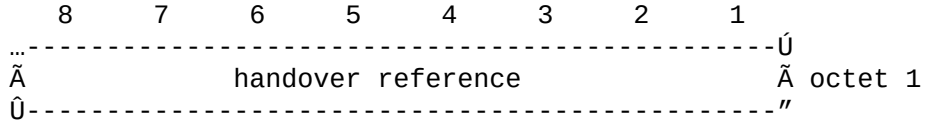


FIGURE 9.2/GSM 04.08
HANDOVER ACCESS message content

HANDOVER REFERENCE This is an unformatted 8 bit field. (also described in section 10.5.2.10)

TABLE 9.14/GSM 04.08
HANDOVER ACCESS message content

9.1.14 Handover command

This message is sent on the main DCCH by the network to the mobile station to change the dedicated channel configuration, timing adjustment needed. See Table 9.15/GSM 04.08.

Message type: HANDOVER COMMAND
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Cell description	10.5.2.2	n -> ms	MF	2
Channel description	10.5.2.5	n -> ms	MF	3
Handover reference	10.5.2.10	n -> ms	MF	1
Power command	10.5.2.16	n -> ms	MF	1
Synchronisation indication	10.5.2.21 1)	n -> ms	OF	1
Cell channel description	10.5.2.1 2)	n -> ms	OF	17
Channel mode	10.5.2.6 3)	n -> ms	OF	2
Channel description	10.5.2.5 4)	n -> ms	OF	4
Channel mode 2	10.5.2.6a 5)	n -> ms	OF	2
Frequency channel sequence	10.5.2.9 6)	n -> ms	OF	10
Mobile allocation	10.5.2.12 7)	n -> ms	OV	2-10
Starting time	10.5.2.20 8)	n -> ms	OF	3

TABLE 9.15/GSM 04.08
HANDOVER COMMAND message content

Note 1: If this information element is omitted, the default value is "non-synchronized".

Note 2: This information element appears if frequency hopping is used on the new cell.

Note 3: this element appears if the channel mode is changed for the channel defined in the mandatory part of the message.

Note 4: This information element appears if the MS carries two connections (on two dedicated channels, e.g. Lm+Lm).
The connection using the channel previously defined in the mandatory part of an ASSIGNMENT COMMAND or HANDOVER COMMAND message shall use the channel defined in the mandatory part of the HANDOVER COMMAND message defining the new configuration.
The first indicated channel (i.e. in the mandatory part) carries the main DCCH. The SACCH used is the one associated with that channel.

Note 5: This element appears if the channel mode is changed for the channel defined in the optional channel description information element.

Note 6: This element is a combination of mobile allocation element and cell channel description element. It is designed to allow the sending of the HANDOVER COMMAND in one signalling block for systems using frequency hopping. If this element is present, then the cell channel description and mobile allocation information elements are not required.

Note 7: This information element appears if frequency hopping is used on the new cell. If it appears, it applies to all assigned channels. This information element cannot appear if the cell channel description information element is not present.

Note 8: This information element appears if a frequency change is in progress. It refers to the new cell time.

9.1.15 Handover complete

This message is sent on the main DCCH from the mobile station to the network to indicate that the mobile station has established the main signalling link successfully. See Table 9.16/GSM 04.08.

Message type: HANDOVER COMPLETE
Significance: dual
Direction: mobile station to network

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	ms -> n	MF	
Transaction identifier	10.3	ms -> n	MF	2
Message type	10.4	ms -> n	MF	
RR cause	10.5.2.19	ms -> n	MF	1

TABLE 9.16/GSM 04.08
HANDOVER COMPLETE message content

9.1.16 Handover failure

This message is sent on the main DCCH on the old channel from the mobile station to the network to indicate that the mobile station has failed to seize the new channel. See Table 9.17/GSM 04.08.

Message type: HANDOVER FAILURE
Significance: dual
Direction: mobile station to network

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	ms -> n	MF	
Transaction identifier	10.3	ms -> n	MF	2
Message type	10.4	ms -> n	MF	
RR cause	10.5.2.19	ms -> n	MF	1

TABLE 9.17/GSM 04.08
HANDOVER FAILURE message content

9.1.17 Immediate assignment

This message is sent on the CCCH by the network to the mobile station in idle mode to change the channel configuration to a dedicated configuration while staying in the same cell. See Table 9.18/GSM 04.08.

Message type: IMMEDIATE ASSIGNMENT
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	1/2
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	"
Page mode	10.5.2.14	n -> ms	MF	1/2
Channel description	10.5.2.5	n -> ms	MF	3
Request reference	10.5.2.18	n -> ms	MF	3
Timing advance	10.5.2.22	n -> ms	MF	1
Mobile allocation 1)	10.5.2.12	n -> ms	MV	1-9
Starting time 2)	10.5.2.20	n -> ms	OF	3

TABLE 9.18/GSM 04.08
IMMEDIATE ASSIGNMENT message content

Note 1: In the case of fixed frequency this element is empty (i.e. LI is 0).

Note 2: This information element appears if a frequency change is in progress.

9.1.18 Immediate assignment extended

This message is sent on the CCCH by the network to two mobile stations in idle mode to change the channel configuration to a dedicated configuration for each while staying in the same cell. See Table 9.19/GSM 04.08

Message type: IMMEDIATE ASSIGNMENT EXTENDED
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	1/2
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Page mode	10.5.2.14	n -> ms	MF	1/2
Channel description 1	1) 10.5.2.5	n -> ms	MF	3
Request reference 1	10.5.2.18	n -> ms	MF	3
Timing advance 1	10.5.2.22	n -> ms	MF	1
Channel description 2	1) 10.5.2.5	n -> ms	MF	3
Request reference 2	10.5.2.18	n -> ms	MF	3
Timing advance 2	10.5.2.22	n -> ms	MF	1
Mobile allocation	2)4) 10.5.2.12	n -> ms	MV	1-5
Starting time	3)4) 10.5.2.20	n -> ms	OF	3

TABLE 9.19/GSM 04.08
IMMEDIATE ASSIGNMENT EXTENDED message content

Note 1: Index 1 refers to the first MS, index 2 refers to the second MS.

Note 2: In the case of fixed frequency this element is empty (i.e. LI is 0).

Note 3: This information element appears if a frequency change is in progress. If included the starting time is common to the two MSs.

Note 4: As the maximum length of the resulting layer 3 data cannot exceed 22 octets, it is not possible to use this message type if the total length of mandatory variable and optional field exceeds 6 octets. In this case it is necessary to use the IMMEDIATE ASSIGNMENT message.

9.1.19 Immediate assignment reject

This message is sent on the CCCH by the network to up to five mobile stations to indicate that no channel is available for assignment. See Table 9.20/GSM 04.08.

Message type: IMMEDIATE ASSIGNMENT REJECT
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	1/2
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Page mode	10.5.2.14	n -> ms	MF	1/2
Request reference	10.5.2.18	n -> ms	MF	3
Wait indication	10.5.2.24	n -> ms	MF	1
Request reference	10.5.2.18	n -> ms	MF	3
Wait indication	10.5.2.24	n -> ms	MF	1
Request reference	10.5.2.18	n -> ms	MF	3
Wait indication	10.5.2.24	n -> ms	MF	1
Request reference	10.5.2.18	n -> ms	MF	3
Wait indication	10.5.2.24	n -> ms	MF	1

TABLE 9.20/GSM 04.08
IMMEDIATE ASSIGNMENT REJECT message content

Note 1: A request reference information element and the following wait indication information element refer to the same mobile station. So it is possible to reject up to five channel requests with this message.

Note 2: If necessary the request reference information element and the wait indication information element can be duplicated to fill the message.

9.1.20 Measurement report

This message is sent on the SACCH by the mobile station to the network to report measurement results about the dedicated channel and about neighbour cells. See Table 9.21/GSM 04.08.

Message type: MEASUREMENT REPORT
Significance: dual
Direction: mobile station to network

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	ms -> n	MF	
Transaction identifier	10.3	ms -> n	MF	2
Message type	10.4	ms -> n	MF	
Measurement results	10.5.2.11	ms -> n	MF	16

TABLE 9.21/GSM 04.08
MEASUREMENT REPORT message content

9.1.21 Paging request type 1

This message is sent on the CCCH by the network to up to two mobile stations to trigger channel access by these. The mobile stations are identified by their TMSI or IMSI. See Table 9.22/GSM 04.08.

Message type: PAGING REQUEST TYPE 1
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Page mode	10.5.2.14	n -> ms	MF	1/2
Mobile identity 1)	10.5.1.4	n -> ms	MV	1-9
Mobile identity 1)2)	10.5.1.4	n -> ms	OV	2-10

TABLE 9.22/GSM 04.08
PAGING REQUEST TYPE 1 message content

Note 1: The mobile identity fields can not refer to IMEI.

Note 2: This information element appears if two mobile stations are paged.

9.1.22 Paging request type 2

This message is sent on the CCCH by the network to two or three mobile stations to trigger channel access by these.
Two of the mobile stations are identified by their TMSI while the third is identified by its TMSI or IMSI. See Table 9.23/GSM 04.08.

Message type: PAGING REQUEST TYPE 2
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Page mode	10.5.2.14	n -> ms	MF	1/2
TMSI	10.5.2.23	n -> ms	MF	4
TMSI	10.5.2.23	n -> ms	MF	4
Mobile identity 1) 2)	10.5.1.4	n -> ms	OV	2-10

TABLE 9.23/GSM 04.08.
PAGING REQUEST TYPE 2 message content

Note 1: The mobile identity information element cannot refer to IMEI.

Note 2:This information element appears if three mobile stations are paged.

9.1.23 Paging request type 3

This message is sent on the CCCH by the network to four mobile stations to trigger channel access by these. The mobile stations are identified by their TMSIs. See Table 9.24/GSM 04.08.

Message type: PAGING REQUEST TYPE 3
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Page mode	10.5.2.14	n -> ms	MF	1/2
TMSI	10.5.2.23	n -> ms	MF	4
TMSI	10.5.2.23	n -> ms	MF	4
TMSI	10.5.2.23	n -> ms	MF	4
TMSI	10.5.2.23	n -> ms	MF	4

TABLE 9.24/GSM 04.08
PAGING REQUEST TYPE 3 message content

9.1.24 Paging response

This message is sent on the main DCCH by the mobile station to the network in connection with establishment of the main signalling link as a response to the paging request message. See Table 9.25/GSM 04.08.

Message type: PAGING RESPONSE
Significance: dual
Direction: mobile station to network

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	ms -> n	MF	
Transaction identifier	10.3	ms -> n	MF	2
Message type	10.4	ms -> n	MF	
Ciphering key sequence number	10.5.1.2	ms -> n	MF	1/2
Mobile station classmark 2	10.5.1.6	ms -> n	MV	1-4
Mobile identity	10.5.1.4	ms -> n	MV	1-9

TABLE 9.25/GSM 04.08
PAGING RESPONSE message content

9.1.25 Partial release

This message is sent on the main DCCH by the network to the mobile station to deactivate part of the dedicated channels in use. See Table 9.26/GSM 04.08.

Message type: PARTIAL RELEASE
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Channel description 1)	10.5.2.5	n -> ms	MF	3

TABLE 9.26/GSM 04.08
PARTIAL RELEASE message content

Note 1: This information element describes the channel to be released.

9.1.26 Partial release complete

This message is sent on the main DCCH by the mobile station to the network to indicate that a part of the dedicated channels has been deactivated. See Table 9.27/GSM 04.08.

Message type: PARTIAL RELEASE COMPLETE
Significance: dual
Direction: mobile station to network

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	ms -> n	MF	
Transaction identifier	10.3	ms -> n	MF	2
Message type	10.4	ms -> n	MF	

TABLE 9.27/GSM 04.08
PARTIAL RELEASE COMPLETE message content

9.1.27 Physical information

This message is sent on the main DCCH by the network to the mobile station to stop the sending of access bursts from the mobile station and to activate the physical channels. See Table 9.28/GSM 04.08.

Message type: PHYSICAL INFORMATION
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Timing advance	10.5.2.22	n -> ms	MF	1

TABLE 9.28/GSM 04.08
PHYSICAL INFORMATION message content

9.1.27a RR-Status

This message is sent by the mobile station or the network at any time to report certain error conditions listed in section 8. See Table 9.28a/GSM 04.08.

Message type: RR-STATUS
Significance: local
Direction: both

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	both	MF	1
Transaction identifier	10.3	both	MF	2
Message type	10.4	both	MF	
RR-Cause	10.5.2.13	both	MF	1
Control state Note		both	OF	2

TABLE 9.28a/GSM 04.08
STATUS message content

Note: for further study.

9.1.28 Synchronisation channel information

This message is sent on the SCH, which is one of the broadcast channels (ref. Rec. GSM 05.02 section 3.3.2). Its purpose is to support the synchronisation of a MS to a BSS.
It does not follow the basic format. Its length is 25 bits.
The order of bit transmission is defined in Rec. GSM 04.04.
See Figure 9.3/GSM 04.08 and Table 9.29/GSM 04.08.

Message type : SYNCHRONISATION CHANNEL INFORMATION
Significance : dual
Direction : network to mobile station

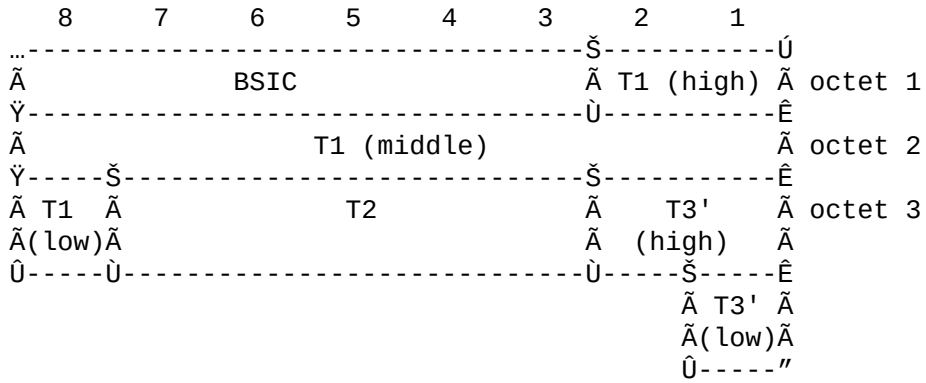


FIGURE 10.28/GSM 04.08
Frame synchronisation information element

BSIC, the base station identity code of the base station
T1, T2 and T3', the 3 parts of the reduced TDMA frame number (RFN) as specified in Rec. GSM 05.02 section 3.3.2.

TABLE 9.29/GSM 04.08
Synchronisation channel information message contents

9.1.29 System information type 1

This message is sent on the BCCH by the network to all mobile stations within the cell giving information of control of the RACH and of the cell allocation. See Table 9.30/GSM 04.08.

Message type: SYSTEM INFORMATION TYPE 1
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Cell channel description	10.5.2.1	n -> ms	MF	16
RACH control parameters	10.5.2.17	n -> ms	MF	3

TABLE 9.30/GSM 04.08
SYSTEM INFORMATION TYPE 1 message content

9.1.30 System information type 2

This message is sent on the BCCH by the network to all mobile stations within the cell giving information of control of the RACH and of the BCCH allocation in the neighbour cells. See Table 9.31/GSM 04.08.

Message type: SYSTEM INFORMATION TYPE 2
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	1
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Neighbour cells description	10.5.2.13	n -> ms	MF	16
PLMN permitted	10.5.2.15	n -> ms	MF	1
RACH control parameters	10.5.2.17	n -> ms	MF	3

TABLE 9.31/GSM 04.08
SYSTEM INFORMATION TYPE 2 message content

9.1.31 System information type 3

This message is sent on the BCCH by the network to all mobile stations within the cell giving information of control of the RACH, of location area identification, of cell identity and various other information about the cell. See Table 9.32/GSM 04.08.

Message type: SYSTEM INFORMATION TYPE 3
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	1
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Cell identity	10.5.1.1	n -> ms	MF	2
Location area identification	10.5.1.3	n -> ms	MF	5
Control channel description	10.5.2.8	n -> ms	MF	3
Cell options	10.5.2.3	n -> ms	MF	1
Cell selection parameters	10.5.2.4	n -> ms	MF	2
RACH control parameters	10.5.2.17	n -> ms	MF	3

TABLE 9.32/GSM 04.08
SYSTEM INFORMATION TYPE 3 message content

Note: Special requirements for the transmission of this message applies, see Rec. GSM 05.02.

9.1.32 System information type 4

This message is sent on the BCCH by the network to all mobile stations within the cell giving information of control of the RACH, of location area identification, of cell identity and various other information about the cell. See Table 9.33/GSM 04.08.

Message type: SYSTEM INFORMATION TYPE 4
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	1/2
Transaction identifier	10.3	n -> ms	MF	1/2
Message type	10.4	n -> ms	MF	1
Location area identification	10.5.1.3	n -> ms	MF	5
Cell selection parameters	10.5.2.4	n -> ms	MF	2
RACH control parameters	10.5.2.17	n -> ms	MF	3
(CBCH) Channel description	10.5.2.5	n -> ms	OF	4
(CBCH) mobile allocation	10.5.2.12	n -> ms	OV	2 - 6

TABLE 9.33/GSM 04.08
SYSTEM INFORMATION TYPE 4 message content

Note: Special requirements for the transmission of this message applies, see Rec. GSM 05.02.

9.1.33 System information type 5

This message is sent on the SACCH by the network to mobile stations within the cell giving information on the BCCH allocation in the neighbour cells. See Table 9.34/GSM 04.08.

Message type: SYSTEM INFORMATION TYPE 5
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Neighbour cells description	10.5.2.13	n -> ms	MF	16

TABLE 9.34/GSM 04.08
SYSTEM INFORMATION TYPE 5 message content

When received this information must be used as the list of neighbouring cells to be reported on. Any change in the neighbour cells description must overwrite any old data held by the MS. The MS must analyse all correctly received system information type 5 messages.

9.1.34 System information type 6

This message is sent on the SACCH by the network to mobile stations within the cell giving information of location area identification, of cell identity and various other information. See Table 9.35/GSM 04.08.

Message type: SYSTEM INFORMATION TYPE 6 (5)
Significance: dual
Direction: network to mobile station

Information element		Reference	Direction	Type	Length
Protocol discriminator		10.2	n -> ms	MF	Ú
Transaction identifier		10.3	n -> ms	MF	2
Message type		10.4	n -> ms	MF	″
Cell identity	(1)	10.5.1.1	n -> ms	MF	2
Location area identification	(2)	10.5.1.3	n -> ms	MF	5
Cell options	(3)	10.5.2.3	n -> ms	MF	1
PLMN permitted	(4)	10.5.2.15	n -> ms	MF	1

TABLE 9.35/GSM 04.08
SYSTEM INFORMATION TYPE 6 message content

Note 1: Not used by MS.

Note 2: Not used by MS.

Note 3: Overwrite existing values on Handover and assignment else ignored by the MS.

Note 4: As for neighbouring cell descriptions in system info type 5.

Note 5: If received correctly by the MS this message is treated as in Note 1 to 4.

9.2 Messages for mobility management

Table 9.38/GSM 04.08 summarizes the messages for mobility management.

Registration messages:	Reference
IMSI DETACH INDICATION	9.2.10
LOCATION UPDATING ACCEPT	9.2.11
LOCATION UPDATING REJECT	9.2.12
LOCATION UPDATING REQUEST	9.2.13
Security messages:	**Reference**
AUTHENTICATION REJECT	9.2.1
AUTHENTICATION REQUEST	9.2.2
AUTHENTICATION RESPONSE	9.2.3
IDENTITY REQUEST	9.2.8
IDENTITY RESPONSE	9.2.9
TMSI REALLOCATION COMMAND	9.2.14
TMSI REALlOCATION COMPLETE	9.2.15
Connection management messages:	**Reference**
CM SERVICE ACCEPT	9.2.5
CM SERVICE REJECT	9.2.6
CM SERVICE REQUEST	9.2.7
CM REESTABLISHMENT REQUEST	9.2.4
Miscellaneous message:	**Reference**
MM-STATUS	9.2.13a

TABLE 9.38/GSM 04.08
Messages for mobility management

9.2.1 Authentication reject

This message is sent by the network to the mobile station to indicate that authentication has failed (and that the receiving mobile station shall abort all activities). See Table 9.39/GSM 04.08.

Message type: AUTHENTICATION REJECT
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	both	MF	
Transaction identifier	10.3	both	MF	2
Message type	10.4	both	MF	

TABLE 9.39/GSM 04.08
AUTHENTICATION REJECT message content

9.2.2 Authentication request

This message is sent by the network to the mobile station to initiate authentication of the mobile station identity. See Table 9.40/GSM 04.08.

Message type: AUTHENTICATION REQUEST
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	1/2
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Ciphering key sequence number	10.5.1.2	n -> ms	MF	1/2
Auth. parameter RAND	10.5.3.1	n -> ms	MF	16

TABLE 9.40/GSM 04.08
AUTHENTICATION REQUEST message content

9.2.3 Authentication response

This message is sent by the mobile station to the network to deliver a calculated response to the network. See Table 9.41/GSM 04.08.

Message type: AUTHENTICATION RESPONSE
Significance: dual
Direction: mobile station to network

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	ms -> n	MF	
Transaction identifier	10.3	ms -> n	MF	2
Message type	10.4	ms -> n	MF	
Auth. parameter SRES	10.5.3.2	ms -> n	MF	4

TABLE 9.41/GSM 04.08
AUTHENTICATION RESPONSE message content

9.2.4 CM Re-establishment request

This message is sent by the mobile station to the network to request re-establishment of a connection if the previous one has failed. See table 9.42/GSM 04.08.

Message type: CM RE-ESTABLISHMENT REQUEST
Significance: dual
Direction: mobile station to network

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	ms -> n	MF	1/2
Transaction identifier	10.3	ms -> n	MF	2
Message type	10.4	ms -> n	MF	"
Ciphering key sequence number	10.5.1.2	ms -> n	MF	1/2
Mobile station classmark 2	10.5.1.6	ms -> n	MV	1-4
Mobile identity	10.5.1.4	ms -> n	MV	1-9
Location area identification 1)	10.5.1.3	ms -> n	OF	6

TABLE 9.42/GSM 04.08
CM RE-ESTABLISHMENT REQUEST message content

Note 1: This location area identification is needed to render the mobile identity non-ambiguous when a TMSI is used as identity. It is not necessarily the LAI where the call was last active.

9.2.5 CM service accept

This message is sent by the network to the mobile station to indicate that the requested service has been accepted. See Table 9.43/GSM 04.08.

Message type: CM SERVICE ACCEPT
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	both	MF	1/2
Transaction identifier	10.3	both	MF	2
Message type	10.4	both	MF	

TABLE 9.43/GSM 04.08
CM SERVICE ACCEPT message content

9.2.6 CM service reject

This message is sent by the network to the mobile station to indicate that the requested service cannot be provided. See Table 9.44/GSM 04.08.

Message type: CM SERVICE REJECT
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Reject cause	10.5.3.6	n -> ms	MF	1

TABLE 9.44/GSM 04.08
CM SERVICE REJECT message content

9.2.7 CM service request

This message is sent by the mobile station to the network to request a service for the connection management sublayer entities, e.g. circuit switched connection establishment, supplementary services activation, short message transfer. See Table 9.45/GSM 04.08.

Message type: CM SERVICE REQUEST
Significance: dual
Direction: mobile station to network

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	ms -> n	MF	1/2
Transaction identifier	10.3	ms -> n	MF	2
Message type	10.4	ms -> n	MF	
CM service type	10.5.3.3	ms -> n	MF	1/2
Ciphering key sequence number	10.5.1.2	ms -> n	MF	1/2
Mobile station classmark 2	10.5.1.6	ms -> n	MV	1-4
Mobile identity	10.5.1.4	ms -> n	MV	1-9

TABLE 9.45/GSM 04.08
CM SERVICE REQUEST message content

9.2.8 Identity request

This message is sent by the network to the mobile station to request a mobile station to submit the specified identity to the network. See Table 9.46/GSM 04.08.

Message type: IDENTITY REQUEST
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	1/2
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Identity type	10.5.3.4	n -> ms	MF	1/2

TABLE 9.46/GSM 04.08
IDENTITY REQUEST message content

9.2.9 Identity response

This message is sent by the mobile station to the network in response to an IDENTITY REQUEST message providing the requested identity. See Table 9.47/GSM 04.08.

Message type: IDENTITY RESPONSE
Significance: dual
Direction: mobile station to network

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	ms -> n	MF	
Transaction identifier	10.3	ms -> n	MF	2
Message type	10.4	ms -> n	MF	
Mobile identity 1)	10.5.1.4	ms -> n	MV	1-9

TABLE 9.47/GSM 04.08
IDENTITY RESPONSE message content

Note 1: The international mobile equipment identity (IMEI) shall only be transferred in ciphered mode.

9.2.10 IMSI detach indication

This message is sent by the mobile station to the network to set a deactivation indication in the network. See Table 9.48/GSM 04.08.

Message type: IMSI DETACH INDICATION
Significance: dual
Direction: mobile station to network

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	ms -> n	MF	
Transaction identifier	10.3	ms -> n	MF	2
Message type	10.4	ms -> n	MF	
Mobile station classmark 1	10.5.1.5	ms -> n	MF	1
Mobile identity	10.5.1.4	ms -> n	MV	1-9

TABLE 9.48/GSM 04.08
IMSI DETACH INDICATION message content

9.2.11 Location updating accept

This message is sent by the network to the mobile station to indicate that updating or IMSI attach in the network has been completed. See Table 9.49/GSM 04.08.

Message type: LOCATION UPDATING ACCEPT
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	1/2
Transaction identifier	10.3	n -> ms	MF	1/2
Message type	10.4	n -> ms	MF	
Location area identification	10.5.1.3	n -> ms	MF	5
Mobile identity 1)	10.5.1.4	n -> ms	OV	2-10

Note 1: This information element appearsin two cases:
a) a TMSI is sent to the Mobile Station: TMSI is used;
b) TMSI shall be deleted in the Mobile Station: IMSI is used.

TABLE 9.49/GSM 04.08
LOCATION UPDATING ACCEPT message content

9.2.12 Location updating reject

This message is sent by the network to the mobile station to indicate that updating or IMSI attach has failed. See Table 9.50/GSM 04.08.

Message type: LOCATION UPDATING REJECT
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Reject cause	10.5.3.6	n -> ms	MF	1

TABLE 9.50/GSM 04.08
LOCATION UPDATING REJECT message content

9.2.13 Location updating request

This message is sent by the mobile station to the network either to request update of its location file (normal updating or periodic updating) or to request IMSI attach. See Table 9.51/GSM 04.08.

Message type: LOCATION UPDATING REQUEST
Significance: dual
Direction: mobile station to network

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	ms -> n	MF	1/2
Transaction identifier	10.3	ms -> n	MF	2
Message type	10.4	ms -> n	MF	"
Location updating type	10.5.3.5	ms -> n	MF	1/2
Ciphering key sequence number	10.5.1.2	ms -> n	MF	1/2
Location area identification 1)	10.5.1.3	ms -> n	MF	5
Mobile station classmark 1	10.5.1.5	ms -> n	MF	1
Mobile identity	10.5.1.4	ms -> n	MV	1-9

TABLE 9.51/GSM 04.08
LOCATION UPDATING REQUEST message content

Note 1: The location area identification stored in the mobile station is used.

9.2.13a MM-Status

This message is sent by the mobile station or the network at any time to report certain error conditions listed in section 8. See Table 9.51a/GSM 04.08.

Message type: MM-STATUS
Significance: local
Direction: both

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	both	MF	
Transaction identifier	10.3	both	MF	2
Message Type	10.4	both	MF	
Reject Cause	10.5.3.5	both	MF	1
Control state (note)		both	OF	2

TABLE 9.51a/GSM 04.08
STATUS message content

Note: for further study.

9.2.14 TMSI-reallocation command

This message is sent by the network to the mobile station to reallocate a new TMSI. See Table 9.52/GSM 04.08.

Message type: TMSI-REALLOCATION COMMAND
Significance: dual
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	1/2
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Location area identification	10.5.1.3	n -> ms	MF	5
Mobile identity 1)	10.5.1.4	n -> ms	MV	1-9

TABLE 9.52/GSM 04.08
TMSI-REALLOCATION COMMAND message content

Note 1: The mobile identity information element is used in this message for transmission of the new TMSI.

9.2.15 TMSI reallocation complete

This message is sent by the mobile station to the network to indicate that reallocation of a new TMSI has taken place. See Table 9.53/GSM 04.08.

Message type: TMSI REALLOCATION COMPLETE
Significance: dual
Direction: mobile station to network

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	ms -> n	MF	
Transaction identifier	10.3	ms -> n	MF	2
Message type	10.4	ms -> n	MF	

TABLE 9.53/GSM 04.08
TMSI REALLOCATION COMPLETE message content

9.3 Messages for circuit-mode connections call control

Table 9.54/GSM 04.08 summarizes the messages for circuit- mode connections call control.

Call establishment messages:	Reference
ALERTING	9.3.1
CALL CONFIRMED 1)	9.3.2
CALL PROCEEDING	9.3.3
CONNECT	9.3.5
CONNECT ACKNOWLEDGE	9.3.6
EMERGENCY SETUP	9.3.8
PROGRESS	9.3.13
SETUP	9.3.16
Call information phase messages:	**Reference**
MODIFY 1)	9.3.9
MODIFY COMPLETE 1)	9.3.10
MODIFY REJECT 1)	9.3.11
USER INFORMATION	9.3.24
Call clearing messages:	**Reference**
DISCONNECT	9.3.7
RELEASE	9.3.14
RELEASE COMPLETE	9.3.15
Miscellaneous messages:	**Reference**
CONGESTION CONTROL	9.3.4
NOTIFY	9.3.12
START DTMF 1)	9.3.17
START DTMF ACKNOWLEDGE 1)	9.3.18
START DTMF REJECT 1)	9.3.19
STATUS	9.3.20
STATUS ENQUIRY	9.3.21
STOP DTMF 1)	9.3.22
STOP DTMF ACKNOWLEDGE 1)	9.3.23

TABLE 9.54/GSM 04.08
Messages for circuit-mode connections call control.

Note 1: not supported by CCITT Rec. Q.931;

9.3.1 Alerting

This message is sent by the network to the calling mobile station and by the called mobile station to the network, to indicate that the called user alerting has been initiated. See Table 9.55/GSM 04.08.

Message type: ALERTING
Significance: global
Direction: both

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	both	MF	Ú
Transaction identifier	10.3	both	MF	2
Message type	10.4	both	MF	″
Facility	1) Rec. GSM 04.10	both	OV	2-?
Progress indicator	2) 10.5.4.15	n -> ms	OV	4
User-user	3) 10.5.4.18	both	OV	2-35

TABLE 9.55/GSM 04.08
ALERTING message content

Note 1: May be used for functional operation of supplementary services.

Note 2: Included in the event of interworking or in connection with the provision of in-band information/patterns.

Note 3: Included in the called mobile station to network direction when the called mobile station wants to return information to the calling remote user, or in the network to calling mobile station direction if the called remote user included a user-user information element in the ALERTING message.

9.3.2 Call confirmed

This message is sent by the called mobile station to confirm an incoming call request. See Table 9.56/GSM 04.08.

Message type: CALL CONFIRMED
Significance: local
Direction: mobile station to network

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	ms -> n	MF	1
Transaction identifier	10.3	ms -> n	MF	2
Message type	10.4	ms -> n	MF	
Repeat Indicator 2)	10.5.4.16	ms -> n	OF	1
Bearer capabilities 1)	10.5.4.4	ms -> n	OV	3-11
Cause 3)	10.5.4.8	ms -> n	OV	4-32

TABLE 9.56/GSM 04.08
CALL CONFIRMED message content

Note 1: The Repeat Indicator information element is included immediately before the first bearer capability information when the Mobile Station is capable to support the in-call modification procedure and no bearer capability information element has been received in the SETUP message. It is also included if the repeat indicator info element is contained in the incoming setup, but the MS wants to change the bearer capability information element(s).

Note 2: Included if the mobile station wishes another bearer capability as given by the bearer capability information element of the incoming SETUP message or if the bearer capability information element is missing or not fully specified in the SETUP message.
These rules apply also in case of two consecutive bearer capability information element in order to support in-call modification.
If the bearer capability information element(s) of the incoming message is accepted, no bearer capability information element(s) shall be included in this message.

Note 3: Included if the mobile station is compatible but the user is busy.

9.3.3 Call proceeding

This message is sent by the network to the calling mobile station to indicate that the requested call establishment information has been received, and no more call establishment information will be accepted. See Table 9.57/GSM 04.08.

Message type: CALL PROCEEDING
Significance: local
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Repeat Indicator 1,2)	10.5.4.16	n -> ms	OF	
Bearer Capabilities 2)	10.5.4.4	n -> ms	OV	
Progress indicator 3)	10.5.4.15	n -> ms	OV	4

TABLE 9.57/GSM 04.08
CALL PROCEEDING message content

Note 1: Included if the Mobile Station sent two bearer capabilities and at least presented a choice.
Note 2: Included if the network has to specify the connection element
Note 3: Included in the event of interworking.

9.3.4 Congestion control

This message is sent by the mobile station or the network to indicate the establishment or termination of flow control on the transmission of USER INFORMATION messages. See table 9.58/GSM 04.08.

Message type: CONGESTION CONTROL
Significance: local 1)
Direction: both

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	both	MF	
Transaction identifier	10.3	both	MF	2
Message type	10.4	both	MF	"
Congestion level	10.5.4.9	both	MF	1/2
Cause 2)	10.5.4.8	both	OV	4-32

TABLE 9.58/GSM 04.08
CONGESTION CONTROL message content

Note 1: This message has local significance, but may carry information of global significance.

Note 2: Included if the user to user information has been discarded as a result of the congestion situation.

9.3.5 Connect

This message is sent by the called mobile station to the network and by the network to the calling mobile station to indicate call aceptance by the called user. See Table 9.59/GSM 04.08.

Message type: CONNECT
Significance: global
Direction: both

Information element		Reference	Direction	Type	Length
Protocol discriminator		10.2	both	MF	1/2
Transaction identifier		10.3	both	MF	2
Message type		10.4	both	MF	
Facility	1)	Rec. GSM 04.10	both	OV	2-?
Progress indicator	2)	10.5.4.15	n -> ms	OV	4
User-user	3)	10.5.4.18	both	OV	2-35

TABLE 9.59/GSM 04.08
CONNECT message content

Note 1: May be used for functional operation of supplementary services.

Note 2: Included in the event of interworking or in connection with provision of in-band information/patterns.

Note 3: Included in the called mobile station to network direction when the answering mobile station wants to return user information to the calling remote user. Included in the network to calling mobile station if the remote user awarded the call included a user- user information element in the CONNECT message.

9.3.6 Connect acknowledge

This message is sent by the network to the called mobile station to indicate that the mobile station has been awarded the call. It may also be sent by the calling mobile station to the network to allow symmetrical call control procedures. See Table 9.60/GSM 04.08.

Message type: CONNECT ACKNOWLEDGE
Significance: local
Direction: both

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	both	MF	1
Transaction identifier	10.3	both	MF	1 2
Message type	10.4	both	MF	

TABLE 9.60/GSM 04.08
CONNECT ACKNOWLEDGE message content

9.3.7 Disconnect

This message is sent by the mobile station to request the network to clear an end-to-end connection or is sent by the network to indicate that the end-to-end connection is cleared. See Table 9.61/GSM 04.08.

Message type: DISCONNECT
Significance: global
Direction: both

Information element		Reference	Direction	Type	Length
Protocol discriminator		10.2	both	MF	1
Transaction identifier		10.3	both	MF	2
Message type		10.4	both	MF	
Cause		10.5.4.8	both	MV	3-31
Facility	1)	Rec. GSM 04.10	both	OV	2-?
Progress indicator	2)	10.5.4.15	n -> ms	OV	4
User-user	3)	10.5.4.18	both	OV	2-35

TABLE 9.61/GSM 04.08
DISCONNECT message content

Note 1: May be used for functional operation of supplementary services, such as the user-user service.

Note 2: Included by the network if in-band tones are provided.

Note 3: Included in the mobile station to network direction when the mobile staion initiates call clearing and wants to pass user information to the remote user at call clearing time. Included in the network to mobile station direction when the remote user initiates call clearing and included a user-user information element in the DISCONNECT message.

9.3.8 Emergency setup

This message is sent from the mobile station to initiate emergency call establishment. See table 9.62/GSM 04.08.

Message type : EMERGENCY SETUP
Significance : global
Direction : mobile station to network

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	ms -> n	MF	
Transaction identifier	10.3	ms -> n	MF	2
Message type	10.4	ms -> n	MF	
Bearer capability 1)	10.5.4.4	ms -> n	OV	3-11

TABLE 9.62/GSM 04.08
EMERGENCY SETUP message content

Note 1: If this information element is included, it should indicate speech with the appropriate full/half rate speech coding selection. If the element is not included, the network shall assume speech and use the speech coding rate indicated in the mobile station classmark information element received at MM-connection establishment.

9.3.9 Modify

This message is sent by the mobile station to the network or by the network to the mobile station to request a change in bearer capability for a call. See Table 9.63/GSM 04.08.

Message type: MODIFY
Significance: global
Direction: both

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	both	MF	1
Transaction identifier	10.3	both	MF	2
Message type	10.4	both	MF	
Bearer capability	10.5.4.4	both	MV	2-10
Low layer comp. 1)	10.5.4.12	both	OV	3-15
High layer comp. 1)	10.5.4.10	both	OV	4-5

TABLE 9.63/GSM 04.08
MODIFY message content

Note 1: Included if used in the initial SETUP message.

9.3.10 Modify complete

This message is sent by the mobile station to the network or by the network to the mobile station to indicate completion of a request to change bearer capability for a call. See Table 9.64/GSM 04.08.

Message type: MODIFY COMPLETE
Significance: global
Direction: both

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	both	MF	1/2
Transaction identifier	10.3	both	MF	1/2
Message type	10.4	both	MF	1
Bearer capability	10.5.4.4	both	MV	2-10
Low layer comp. 1)	10.5.4.12	both	OV	3-15
High layer comp. 1)	10.5.4.10	both	OV	4-5

TABLE 9.64/GSM 04.08
MODIFY COMPLETE message content

Note 1: Included if used in the initial SETUP message.

9.3.11 Modify reject

This message is sent by the mobile station to the network or by the network to the mobile station to indicate failure of a request to change the bearer capability for a call. See Table 9.65/GSM 04.08.

Message type: MODIFY REJECT
Significance: global
Direction: both

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	both	MF	1
Transaction identifier	10.3	both	MF	2
Message type	10.4	both	MF	
Bearer capability	10.5.4.4	both	MV	2-10
Cause	10.5.4.8	both	MV	3-31
Low layer comp. 1)	10.5.4.12	both	OV	3-15
High layer comp. 1)	10.5.4.10	both	OV	4-5

TABLE 9.65/GSM 04.08
MODIFY REJECT message content

Note 1: Included if used in the initial SETUP message.

9.3.12 Notify

This message is sent either from the mobile station or from the network to indicate information pertaining to a call, such as user suspended. See Table 9.66/GSM 04.08.

Message type: NOTIFY
Significance: access
Direction: both

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	both	MF	
Transaction identifier	10.3	both	MF	2
Message type	10.4	both	MF	
Notification indicator	10.5.4.14	both	MF	1

TABLE 9.66/GSM 04.08
NOTIFY message content

9.3.13 Progress

This message is sent from the network to the mobile station to indicate the progress of a call in the event of interworking or in connection with the provision of in-band information/patterns. See Table 9.67/GSM 04.08.

Message type: PROGRESS
Significance: global
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Progress indicator	10.5.4.15	n -> ms	MV	3
User-to-user 1)	10.5.4.18	n -> ms	OV	2-35

TABLE 9.67/GSM 04.08
PROGRESS message content

Note 1: Included when the PROGRESS message is sent by the network to indicate that the call has been cleared by the remote user before it reached the active state and the remote user wants to pass user information at call clearing time.

9.3.14 Release

This message is sent, from either the mobile station or the network, to indicate that the equipment sending the message intends to release the transaction identifier, and that the receiving equipment should release the transaction identifier after sending RELEASE COMPLETE. See Table 9.68/GSM 04.08.

Message type: RELEASE
Significance: local 1)
Direction: both

Information element		Reference	Direction	Type	Length
Protocol discriminator		10.2	both	MF	1/2
Transaction identifier		10.3	both	MF	2
Message type		10.4	both	MF	"
Cause	2)	10.5.4.8	both	O	4-32
Facility	3)	Rec. GSM 04.10	both	O	2-?
User-user	4)	10.5.4.18	both	O	2-35

TABLE 9.68/GSM 04.08
RELEASE message content

Note 1: This message has local significance; however, it may carry information of global significance when used as the first call clearing message.

Note 2: Mandatory in the first call clearing message including when the RELEASE message is sent as a result of an error handling condition.

Note 3: May be included for functional operation of supplementary services.

Note 4: Included in the mobile station to network direction when the RELEASE message is the first call clearing message and the mobile station initiates call clearing and wants to pass user information to the remote user at call clearing time. Included in the network to mobile station direction when the RELEASE message is the first call clearing message and the remote user initiates call clearing and includes a user-user information element in the RELEASE message.

9.3.15 Release complete

This message is sent, from either the mobile station or the network, to indicate that the equipment sending the message has released the transaction identifier and the receiving equipment shall release the transaction identifier. See Table 9.69/GSM 04.08.

Message type: RELEASE COMPLETE
Significance: local 1)
Direction: both

Information element		Reference	Direction	Type	Length
Protocol discriminator		10.2	both	MF	Ú
Transaction identifier		10.3	both	MF	2
Message type		10.4	both	MF	″
Cause	2)	10.5.4.8	both	OV	4-32
Facility	3)	Rec. GSM 04.10	both	OV	2-?
User-user	4)	10.5.4.18	both	OV	2-35

TABLE 9.69/GSM 04.08
RELEASE COMPLETE message content

Note 1: This message has local significance; however, it may carry information of global significance when used as the first call clearing message.

Note 2: Mandatory in the first call clearing message, including when the RELEASE COMPLETE message is sent as a result of an error handling condition.

Note 3: May be included for functional operation of supplementary services.

Note 4: Included in the mobile station to network direction when the RELEASE COMPLETE message is the first call clearing message and the mobile station initiates call clearing and wants to pass user information to the remote user at call clearing time. Included in the network to mobile station direction when the RELEASE COMPLETE message is the first call clearing message and the remote user initiates call clearing and includes a user-user information element in the RELEASE COMPLETE message.

9.3.16 Setup

This message is sent, from either the mobile station or the network, to initiate call establishment. See Table 9.70/GSM 04.08.

Message type: SETUP
Significance: global
Direction: both

Information element		Reference	Direction	Type	Length
Protocol discriminator		10.2	both	MF	1/2
Transaction identifier		10.3	both	MF	1/2
Message type		10.4	both	MF	"
Repeat indicator	1)	10.5.4.16	both	OF	1
Bearer capabilities	2)	10.5.4.4	both	OV	3-11
Mobile identity	3)	10.5.1.4	ms -> n	OV	2-10
Facility	4)	Rec. GSM 04.10	both	OV	2-?
Progress indicator	5)	10.5.4.15	n -> ms	OV	4
Signal	6)	10.5.4.17	n -> ms	OF	2
Calling party BCD number	7)	10.5.4.7	n -> ms	OV	2-14
Calling party sub-address	7a)	10.5.4.7a	both	OV	2-23
Called party BCD number	8)	10.5.4.6	both	OV	2-13
Called party sub-address	8a)	10.5.4.6a	both	OV	2-23
Repeat indicator	9)	10.5.4.16	both	OF	1
Low layer compatibility	10)	10.5.4.12	both	OV	3-15
Repeat indicator	11)	10.5.4.16	both	OF	1
High layer compatibility	12)	10.5.4.10	both	OV	4-5
User-user	13)	10.5.4.18	both	OV	2-35

TABLE 9.70/GSM 04.08
SETUP message content

Note 1: The repeat indicator information element is included immediately before the first bearer capability information element when the in-call modification procedure is used.

Note 2: In the mobile station to network direction, at least one bearer capability information element must always be present. In the network to mobile station direction, the bearer capability information element may be omitted in the case where the mobile subscriber is allocated only one directory number for all services (ref.: Rec. GSM 09.07).

Note 3: May be included by the calling mobile station to identify the calling mobile station.

Note 4: May be included for functional operation of supplementary services.

Note 5: Included in the event of interworking or in connection with the provision of in-band information/patterns.

Note 6: Included if the network optionally provides additional information describing tones.

Note 7: May be included by the network to identify the calling user.

Note 7a: Included in the Mobile Station-to-network direction when the calling user wants to indicate its subaddress to the called user. Included in the network-to-Mobile Station direction if the calling user includes a calling party sub-address information element in the SETUP message.

Note 8: The called party BCD number information element is included by the network when called party number information is conveyed to the mobile station. The called party BCD number shall always be included in the mobile station to network direction.

Note 8a: Included in the Mobile Station-to-Network direction when the calling user wants to indicate the called party subaddress. Included in the Network-to_Mobile Station direction if the calling user includes a called party subaddress information element in the SETUP message.

Note 9: The repeat indicator information element is included when the in-call modification procedure is used and two low layer compatibility information elements are included in the message. The repeat indicator information element is not included when the optional low layer compatibility information elements are omitted.

Note 10: Included in the MS-to-network direction when the calling MS wants to pass low layer compatibility information to the called user. Included in the network-to-mobile station direction if the calling user included a low layer compatibility information element in the SETUP message. This information element may be repeated if the in-call modification procedure is used (see note 14).

Note 11: The repeat indicator information element is included when the in-call modification procedure is used and two high layer compatibility information elements are included in the message. The repeat indicator information element is not included when the optional high layer compatibility information elements are omitted.

Note 12: Included in the MS-to-network direction when the calling MS wants to pass high layer compatibility information to the called user. Included in the network-to-mobile station direction if the calling user included a high layer compatibility information element in the SETUP message. This information element may be repeated if the in-call modification procedure is used (see note 14).

Note 13: Included in the calling mobile station to network direction when the calling mobile station wants to pass user information to the called remote user. Included in the network to called mobile station direction when the calling remote user included a user-user information element in the SETUP message.

Note 14: Bearer capability, low layer compatibility, and high layer compatibility information elements may be used to describe a CCITT telecommunication service, if appropriate. These information elements may be repeated if the in-call modification is used. For in-call modification, a maximum of two bearer capability information elements may be included, the initial bearer capability and the alternate bearer capability.

9.3.17 Start DTMF

This message is sent by the mobile station to the network and contains the digit the network should reconvert back into a DTMF tone which is then applied towards the remote user. See Table 9.71/GSM 04.08.

Message type: START DTMF
Significance: local
Direction: mobile station to network

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	both	MF	1/2
Transaction identifier	10.3	both	MF	2
Message type	10.4	both	MF	
Keypad facility 1)	10.5.4.11	ms -> n	OF	2

TABLE 9.71/GSM 04.08
START DTMF message content

Note 1: When DTMF digit or symbol is contained in the message this information element is included.
The keypad information element will contain only 1 DTMF digit and has therefore a fixed length of 2 octet.

9.3.18 Start DTMF Acknowledge

This message is sent by the network to the mobile station to indicate the successful initiation of the action requested by the START DTMF message (conversion of the digit contained in this message into a DTMF tone). See Table 9.72/GSM 04.08.

Message type: START DTMF ACKNOWLEDGE
Significance: local
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	1
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Keypad facility Note 1	10.5.4.11	n -> ms	OF	2

TABLE 9.72/GSM 04.08
START DTMF ACKNOWLEDGE message content

Note 1: This information element contains the digit corresponding to the DTMF tone that the network applies towards the remote user.

9.3.19 Start DTMF reject

This message is sent by the network to the mobile station, if the network can not accept the START DTMF message. See Table 9.73/GSM 04.08.

Message type: START DTMF REJECT
Significance: local
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	
Cause	10.5.4.8	n -> ms	MV	3-31

TABLE 9.73/GSM 04.08
START DTMF REJECT message content

9.3.20 Status

This message is sent by the mobile station or the network at any time during a call to report certain error conditions listed in section 8. See Table 9.74/GSM 04.08.

Message type: STATUS
Significance: local
Direction: both

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	both	MF	
Transaction identifier	10.3	both	MF	2
Message type	10.4	both	MF	
Cause	10.5.4.8	both	MV	3-31
Call state	10.5.4.5	both	MF	1

TABLE 9.74/GSM 04.08
STATUS message content

9.3.21 Status enquiry

This message is sent by the mobile station or the network at any time to solicit a STATUS message from the peer layer 3 entity. Sending af STATUS message in response to a STATUS ENQUIRY message is mandatory. See Table 9.75/GSM 04.08.

Message type: STATUS ENQUIRY
Significance: local
Direction: both

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	both	M F	1
Transaction identifier	10.3	both	M F	1 2
Message type	10.4	both	M F	1

TABLE 9.75/GSM 04.08
STATUS ENQUIRY message content

9.3.22 Stop DTMF

This message is sent by a mobile station to the network and is used to stop the DTMF tone sent towards the remote user. See Table 9.76/GSM 04.08.

Message type: STOP DTMF
Significance: local
Direction: mobile station to network

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	both	M F	1
Transaction identifier	10.3	both	M F	2
Message type	10.4	both	M F	

TABLE 9.76/GSM 04.08
STOP DTMF message content

9.3.23 Stop DTMF acknowledge

This message is sent by the network to the mobile station to indicate that the sending of the DTMF tone has been stopped. See Table 9.77/GSM 04.08.

Message type: STOP DTMF ACKNOWLEDGE
Significance: local
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	both	MF	
Transaction identifier	10.3	both	MF	2
Message type	10.4	both	MF	

TABLE 9.77/GSM 04.08
STOP DTMF ACKNOWLEDGE message content

9.3.24 User information

This message is sent by the mobile station to the network to transfer information to the remote user. This message is also sent by the network to the mobile station to deliver information transfer from the remote user. This message is used if the user-to-user transfer is part of an allowed information transfer as defined in Recommendation GSM 04.10. See table 9.78/GSM 04.08.

Message type: USER INFORMATION
Significance: access
Direction: both

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	both	MF	1
Transaction identifier	10.3	both	MF	2
Message type	10.4	both	MF	"
User-user	1) 10.5.4.18	both	MV	2-130
More data	2) 10.5.4.13	both	OF	1

TABLE 9.78/GSM 04.08
USER INFORMATION message content

Note 1: Some networks may only support a maximum length of 35 octets. Procedures for interworking are not currently defined and are for further study.

Note 2: Included by the sending user to indicate that another USER INFORMATION message pertaining to the same message block will follow.

9.4 Messages for packet-mode access connection control

Table 9.79/GSM 04.08 summarizes the messages for packet-mode access connection control. The message tables in this paragraph should be used for case B (packet switched access to an ISDN virtual circuit service) as defined in section 6. For case A (circuit switched access to PSPDN services) the message tables in section 9.3 should be used.

Access establishment messages:	Reference
ALERTING	9.4.1
CALL CONFIRMED 1)	9.4.2
CALL PROCEEDING	9.4.3
CONNECT	9.4.4
CONNECT ACKNOWLEDGE	9.4.5
SETUP	9.4.9
Access connection clearing messages:	**Reference**
DISCONNECT	9.4.6
RELEASE	9.4.7
RELEASE COMPLETE	9.3.8
Miscellaneous messages:	**Reference**
STATUS	9.4.10
STATUS ENQUIRY	9.4.11

TABLE 9.79/GSM 04.08
Messages for packet-mode access connection control.

Note 1: Not supported by CCITT Rec. Q.931.

9.4.1 Alerting

This message is sent by the called mobile station to the network, to indicate that called user alerting has been initiated. See Table 9.80/GSM 04.08.

Message type: ALERTING
Significance: local
Direction: mobile station to network

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	ms -> n	MF	
Transaction identifier	10.3	ms -> n	MF	2
Message type	10.4	ms -> n	MF	

TABLE 9.80/GSM 04.08
ALERTING message content

9.4.2 Call confirmed

This message is sent by the called mobile station to confirm an incoming call request. See Table 9.81/GSM 04.08.

Message type: CALL CONFIRMED
Significance: local
Direction: mobile station to network

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	ms -> n	MF	
Transaction identifier	10.3	ms -> n	MF	2
Message type	10.4	ms -> n	MF	
Bearer capability	10.5.4.4	ms -> n	OV	3-11

TABLE 9.81/GSM 04.08
CALL CONFIRMED message content

9.4.3 Call proceeding

This message is sent by the network to the calling mobile station to indicate that the requested access connection establishment has been initiated. See Table 9.82/GSM 04.08.

Message type: CALL PROCEEDING
Significance: local
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	

TABLE 9.82/GSM 04.08
CALL PROCEEDING message content

9.4.4 Connect

This message is sent by the called mobile station to the network and by the network to the calling mobile station to indicate aceptance of the access connection. See Table 9.83/GSM 04.08.

Message type: CONNECT
Significance: local
Direction: both

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	both	MF	1
Transaction identifier	10.3	both	MF	2
Message type	10.4	both	MF	

TABLE 9.83/GSM 04.08
CONNECT message content

9.4.5 Connect acknowledge

This message is sent by the network to the called mobile station to indicate that the mobile station has been awarded the access connection. See Table 9.84/GSM 04.08.

Message type: CONNECT ACKNOWLEDGE
Significance: local
Direction: network to mobile station

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	n -> ms	MF	
Transaction identifier	10.3	n -> ms	MF	2
Message type	10.4	n -> ms	MF	

TABLE 9.84/GSM 04.08
CONNECT ACKNOWLEDGE message content

9.4.6 Disconnect

This message is sent by the mobile station to request the network to clear an access connection or is sent by the network to indicate that the access connection is cleared. See Table 9.85/GSM 04.08.

Message type: DISCONNECT
Significance: local
Direction: both

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	both	MF	
Transaction identifier	10.3	both	MF	2
Message type	10.4	both	MF	
Cause	10.5.4.8	both	MV	3-31
User-user 1)	10.5.4.18	ms -> n	OV	2-35

TABLE 9.85/GSM 04.08
DISCONNECT message content

Note 1: May be sent if the access connection has not yet reached the active state. However, user-user information is not sent after the access connection has reached the active state since X.25 procedures would be used for this information transfer (FS).

9.4.7 Release

This message is sent, from either the mobile station or the network, to indicate that the equipment sending the message intends to release the transaction identifier, and that the receiving equipment should release the transaction identifier after sending RELEASE COMPLETE. See Table 9.86/GSM 04.08.

Message type: RELEASE
Significance: local 1)
Direction: both

Information element		Reference	Direction	Type	Length
Protocol discriminator		10.2	both	MF	
Transaction identifier		10.3	both	MF	2
Message type		10.4	both	MF	"
Cause	2)	10.5.4.8	both	OV	4-32
User-user	3)	10.5.4.18	both	OV	2-35

TABLE 9.86/GSM 04.08
RELEASE message content

Note 1: This message has local significance; however, it may carry information of global significance when used as the first call clearing message.

Note 2: Mandatory in the first call clearing message including when the RELEASE message is sent as a result of an error handling condition.

Note 3: User-user information may be sent if RELEASE is the first clearing message and the access connection has not yet reached the active state and GSM 04.08/X.25 mapping service is provided by the network. However, user-user information is not sent if the access connection has reached the active state since X.25 procedures would be used for this information transfer (FS).

9.4.8 Release complete

This message is sent, from either the mobile station or the network, to indicate that the equipment sending the message has released the transaction identifier and the receiving equipment shall release the transaction identifier. See Table 9.87/GSM 04.08.

Message type: RELEASE COMPLETE
Significance: local 1)
Direction: both

Information element		Reference	Direction	Type	Length
Protocol discriminator		10.2	both	MF	
Transaction identifier		10.3	both	MF	2
Message type		10.4	both	MF	"
Cause	2)	10.5.4.8	both	OV	4-32
User-user	3)	10.5.4.18	both	OV	2-35

TABLE 9.87/GSM 04.08
RELEASE COMPLETE message content

Note 1: This message has local significance; however, it may carry information of global significance when used as the first call clearing message.

Note 2: Mandatory in the first call clearing message, including when the RELEASE COMPLETE message is sent as a result of an error handling condition.

Note 3: User-user information may be sent if RELEASE COMPLETE is the first clearing message and the access connection has not yet reached the active state and GSM 04.08/X.25 mapping service is provided by the network. However, user-user information is not sent if the access connection has reached the active state since X.25 procedures would be used for this information transfer (FS).

9.4.9 Setup

This message is sent, from the calling mobile station to the network or the network to the called mobile station, to initiate access connection establishment. See Table 9.88/GSM 04.08.

Message type: SETUP
Significance: local
Direction: both

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	both	MF	Ú
Transaction identifier	10.3	both	MF	2
Message type	10.4	both	MF	”
Bearer capability 2)	10.5.4.4	both	OV	3-11
Mobile identity 3)	10.5.1.4	ms -> n	OV	2-10
User-user 4)	10.5.4.18	n -> ms	OV	2-35

TABLE 9.88/GSM 04.08
SETUP message content 1)

Note 1: The inclusion of the information rate, end-end transit delay, transit delay selection and indication, packet layer binary parameters, packet layer window size, packet size, calling party BCD number, called party BCD number and redirecting number information elements needs further study.

Note 2: May be used to describe a CCITT telecommunication service involving packet-mode access connections, if appropriate.

Note 3: May be included by the calling mobile station to identify the calling mobile station.

Note 4: Included in the network to mobile station direction if the calling user included user information and the network implements X.25/GSM 04.08 information element mapping (FS).

9.4.10 Status

This message is sent by the mobile station or the network in response to a STATUS ENQUIRY message or at any time to report certain error conditions listed in section 8.See Table 9.89/GSM 04.08.

Message type: STATUS
Significance: local
Direction: both

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	both	MF	1
Transaction identifier	10.3	both	MF	2
Message type	10.4	both	MF	
Cause	10.5.4.8	both	MV	3-31
Call state	10.5.4.5	both	MF	1

TABLE 9.89/GSM 04.08
STATUS message content

9.4.11 Status enquiry

This message is sent by the mobile station or the network at any time to solicit a STATUS message from the peer layer 3 entity. Sending af STATUS message in response to a STATUS ENQUIRY message is mandatory. See Table 9.90/GSM 04.08.

Message type: STATUS ENQUIRY
Significance: local
Direction: both

Information element	Reference	Direction	Type	Length
Protocol discriminator	10.2	both	M F	1
Transaction identifier	10.3	both	M F	2
Message type	10.4	both	M F	

TABLE 9.90/GSM 04.08
STATUS ENQUIRY message content

10 GENERAL MESSAGE FORMAT AND INFORMATION ELEMENTS CODING

The figures and text in this section describe message contents. Within each octet, the bit designated "bit 1" is transmitted first, followed by bits 2, 3, 4, etc. Similarly, the octet shown at the top of each figure is sent first.

10.1 Overview

Within this protocol, every message shall consist of the following parts:

a) protocol discriminator;
b) transaction identifier;
c) message type;
d) other information elements, as required.

This organization is illustrated in the example shown in Figure 10.1/GSM 04.08.

All equipment should be able to ignore any extra information, present in a message, which is not required for the proper operation of that equipment. For example, a Mobile station may ignore the calling party BCD number if that number is of no interest to the Mobile Station when a SETUP message is received.

Unless specified otherwise, a particular information element may be present only once in a given message.

The term "default" implies that the value defined should be used in the absense of any assignment, or the negotiation of alternative values.

When a field extends over more than one octet, the order of bit values progressively decreases as the octet number increases. The least significant bit of the field is represented by the lowest numbered bit of the highest- numbered octet of the field.

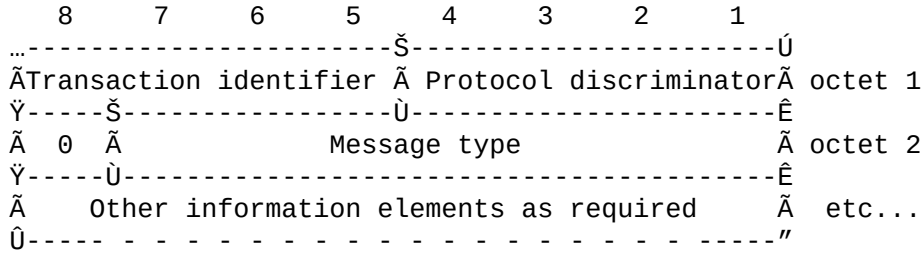


FIGURE 10.1/GSM 04.08
General message organization example

10.2 Protocol Discriminator

The purpose of the protocol discriminator is to distinguish between messages belonging to the following procedures:

- call control
- mobility management
- radio resources management
- other signalling procedures

The protocol discriminator is the first part of every message and occupies the first four bits of the first octet in a message. It is coded according to Figure 10.2/GSM 04.08.

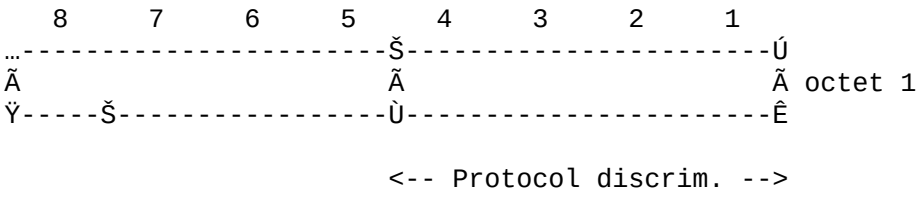


FIGURE 10.2/GSM 04.08
Protocol discriminator

The protocol discriminator value is taken from Table 10.1/GSM 04.08.

bits 4 3 2 1	
0 0 1 1	call control; packet-mode connection control and call related SS messages
0 1 0 1	mobility management messages
0 1 1 0	radio resources management messages
1 0 0 1	SMS messages
1 0 1 1	non call related SS messages
1 1 1 1	reserved for tests procedures described in relevant GSM Recs
All other values are reserved	

TABLE 10.1/GSM 04.08
Protocol discriminator

10.3 Transaction identifier

The purpose of the Transaction identifier (TI) is to distinguish multiple parallel activities (transactions) within one mobile station.

The TI is equivalent to the call reference defined in CCITT Rec. Q.931.

Mobility management messages and Radio resources management messages use the predefined transaction identifier value 0.

The transaction identifier is the second part of every message. The transaction identifier is coded as shown in Figure 10.3/GSM 04.08 and Table 10.2/GSM 04.08.

The TI includes the TI value and the TI flag.

The TI value and the TI flag occupy bits 5 - 7 and bit 8 of the first octet respectively.

TI values are assigned by the side of the interface initiating a transaction. At the beginning of a transaction a free TI value is chosen and assigned to this transaction.
It then remains fixed for the lifetime of the transaction.
After a transaction ends, the associated TI value is free and may be reassigned to a later transaction.

Two identical transaction identifier values within one mobile station may be used when each value pertains to a transaction originated at opposite ends of the interface. In this case the TI flag shall avoid ambiguity.The transaction identifier flag can take the values "0" or "1". The TI flag is used to identify which end of the radio interface originated a TI. The origination side always sets the TI flag to "0". The destination side always sets the TI flag to a "1".

Hence the TI flag identifies who allocated the TI value for this transaction and the only purpose of the TI flag is to resolve simultaneous attempts to allocate the same TI value.

The TI can be extended by using a reserved combination of bits in the TI value field.

At the first implementation of the GSM system the TI extension will not be used but may in future evolutions be used and thereby extend the TI value with at least one octet.

Since in other layer 3 protocol entities than CC (i.e. MM, RR) there is only one transaction active at a time, the TI will not be used for messages with the protocol discriminator coded as "0101" and "0110". For these messages bits 5, 6, 7 and 8 of the first octet are coded with a "0" each.

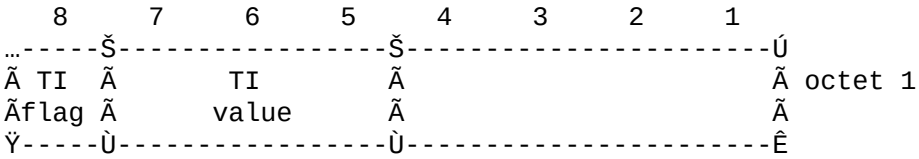


FIGURE 10.3/GSM 04.08
Transaction identifier

TI flag (octet 1)	
Bit	
8	
0	The message is sent from the side that originates the TI
1	The message is sent to the side that originates the TI
TI value (octet 1)	
Bits	
7 6 5	
0 0 0	TI value 0
0 0 1	- - 1
0 1 0	- - 2
0 1 1	- - 3
1 0 0	- - 4
1 0 1	- - 5
1 1 0	- - 6
1 1 1	Reserved for future extension.

TABLE 10.2/GSM 04.08
Transaction identifier

10.4 Message Type

The purpose of the message type is to identify the function of the message being sent.

The message type is the third part of every message . The message type is coded as shown in Figure 10.4/GSM 04.08 and Tables 10.3-10.5/GSM 04.08.

Bit 8 is reserved for possible future use as an extension bit.

Bit 7 in the MM- and CM-messages sent from the mobile station is reserved for the send sequence number N(SD) (see section 2.4.1) In all other messages bit 7 is set to 0.

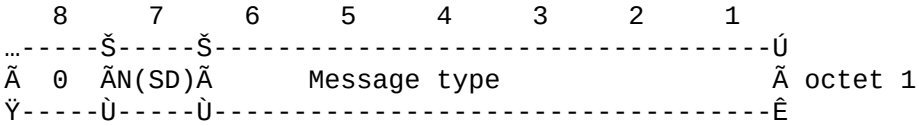


FIGURE 10.4/04.08
Message type

Messages with different protocol discriminators are permitted to have the same message type i.e. the function of a message is determined by the protocol discriminator and the message type together.

8	7	6	5	4	3	2	1	
0	0	1	1	1	-	-	-	Channel establishment messages:
					0	1	1	- ADDITIONAL ASSIGNMENT
					1	1	1	- IMMEDIATE ASSIGNMENT
					0	0	1	- IMMEDIATE ASSIGNMENT EXTENDED
					0	1	0	- IMMEDIATE ASSIGNMENT REJECT
0	0	1	1	0	-	-	-	Ciphering messages:
					1	0	1	- CIPHERING MODE COMMAND
					0	1	0	- CIPHERING MODE COMPLETE
0	0	1	0	1	-	-	-	Handover messages:
					1	1	0	- ASSIGNMENT COMMAND
					0	0	1	- ASSIGNMENT COMPLETE
					1	1	1	- ASSIGNMENT FAILURE
					0	1	1	- HANDOVER COMMAND
					1	0	0	- HANDOVER COMPLETE
					0	0	0	- HANDOVER FAILURE
					1	0	1	- PHYSICAL INFORMATION
0	0	0	0	1	-	-	-	Channel release messages:
					1	0	1	- CHANNEL RELEASE
					0	1	0	- PARTIAL RELEASE
					1	1	1	- PARTIAL RELEASE COMPLETE
0	0	1	0	0	-	-	-	Paging messages:
					0	0	1	- PAGING REQUEST TYPE 1
					0	1	0	- PAGING REQUEST TYPE 2
					1	0	0	- PAGING REQUEST TYPE 3
					1	1	1	- PAGING RESPONSE

TABLE 10.3/GSM 04.08 (page 1 of 2)
Message types for radio resources management

8	7	6	5	4	3	2	1	
0	0	0	1	1	-	-	-	System information messages:
					0	0	1	- SYSTEM INFORMATION TYPE 1
					0	1	0	- SYSTEM INFORMATION TYPE 2
					0	1	1	- SYSTEM INFORMATION TYPE 3
					1	0	0	- SYSTEM INFORMATION TYPE 4
					1	0	1	- SYSTEM INFORMATION TYPE 5
					1	1	0	- SYSTEM INFORMATION TYPE 6
0	0	0	1	0	-	-	-	Miscellaneous messages:
					0	0	0	- CHANNEL MODE MODIFY
					0	1	0	- RR-STATUS
					1	1	1	- CHANNEL MODE MODIFY ACKNOWLEDGE
					1	0	0	- FREQUENCY REDEFINITION
					1	0	1	- MEASUREMENT REPORT
					1	1	0	- CLASSMARK CHANGE

TABLE 10.3/GSM 04.08 (page 2 of 2)
Message types for radio resources management

Note: Bit 8 is reserved for possible future use as an extension bit.

8	7	6	5	4	3	2	1	
0	x	0	0	-	-	-	-	Registration messages:
				0	0	0	1	- IMSI DETACH INDICATION
				0	0	1	0	- LOCATION UPDATING ACCEPT
				0	1	0	0	- LOCATION UPDATING REJECT
				1	0	0	0	- LOCATION UPDATING REQUEST
0	x	0	1	-	-	-	-	Security messages:
				0	0	0	1	- AUTHENTICATION REJECT
				0	0	1	0	- AUTHENTICATION REQUEST
				0	1	0	0	- AUTHENTICATION RESPONSE
				1	0	0	0	- IDENTITY REQUEST
				1	0	0	1	- IDENTITY RESPONSE
				1	0	1	0	- TMSI REALLOCATION COMMAND
				1	0	1	1	- TMSI REALLOCATION COMPLETE
0	x	1	0	-	-	-	-	Connection management messages:
				0	0	0	1	- CM SERVICE ACCEPT
				0	0	1	0	- CM SERVICE REJECT
				0	1	0	0	- CM SERVICE REQUEST
				1	0	0	0	- CM REESTABLISHMENT REQUEST
0	x	1	1	-	-	-	-	Miscellaneous messages:
				0	0	0	1	- MM STATUS

TABLE 10.4/GSM 04.08
Message types for mobility management

Note 1: Bit 8 is reserved for possible future use as an extension bit.

Note 2: Bit 7 is reserved for the send sequence number in messages sent from the mobile station. In messages sent from the network, bit 7 is coded with a "0".

8	7	6	5	4	3	2	1	
0	x	0	0	0	0	0	0	escape to nationally specific message types ; see Note 1
0	x	0	0	-	-	-	-	Call establishment messages:
				0	0	0	1	- ALERTING
				1	0	0	0	- CALL CONFIRMED
				0	0	1	0	- CALL PROCEEDING
				0	1	1	1	- CONNECT
				1	1	1	1	- CONNECT ACKNOWLEDGE
				1	1	1	0	- EMERGENCY SETUP
				0	0	1	1	- PROGRESS
				0	1	0	1	- SETUP
0	x	0	1	-	-	-	-	Call information phase messages:
				0	1	1	1	- MODIFY
				1	1	1	1	- MODIFY COMPLETE
				0	0	1	1	- MODIFY REJECT
				0	0	0	0	- USER INFORMATION
0	x	1	0	-	-	-	-	Call clearing messages:
				0	1	0	1	- DISCONNECT
				1	1	0	1	- RELEASE
				1	0	1	0	- RELEASE COMPLETE
0	x	1	1	-	-	-	-	Miscellaneous messages:
				1	0	0	1	- CONGESTION CONTROL
				1	1	1	0	- NOTIFY
				1	1	0	1	- STATUS
				0	1	0	0	- STATUS ENQUIRY
				0	1	0	1	- START DTMF
				0	0	0	1	- STOP DTMF
				0	0	1	0	- STOP DTMF ACKNOWLEDGE
				0	1	1	0	- START DTMF ACKNOWLEDGE
				0	1	1	1	- START DTMF REJECT

TABLE 10.5/GSM 04.08
Messages types for call control

Note 1: When used, the message type is defined in the following octet(s), according to the national specification.

Note 2: Bit 8 is reserved for possible future use as an extension bit.

Note 3: Bit 7 is reserved for the send sequence number in messages sent from the mobile station. In messages sent from the network, bit 7 is coded with a "0".

10.5 Other information elements

When a message contains other information elements these can be split into two different kinds for that message:

a) information elements which are mandatory for the message;
b) information elements which are optional for the message.

Possible mandatory information elements are always sent before possible optional information elements. This organization is shown in Figure 10.5/GSM 04.08.

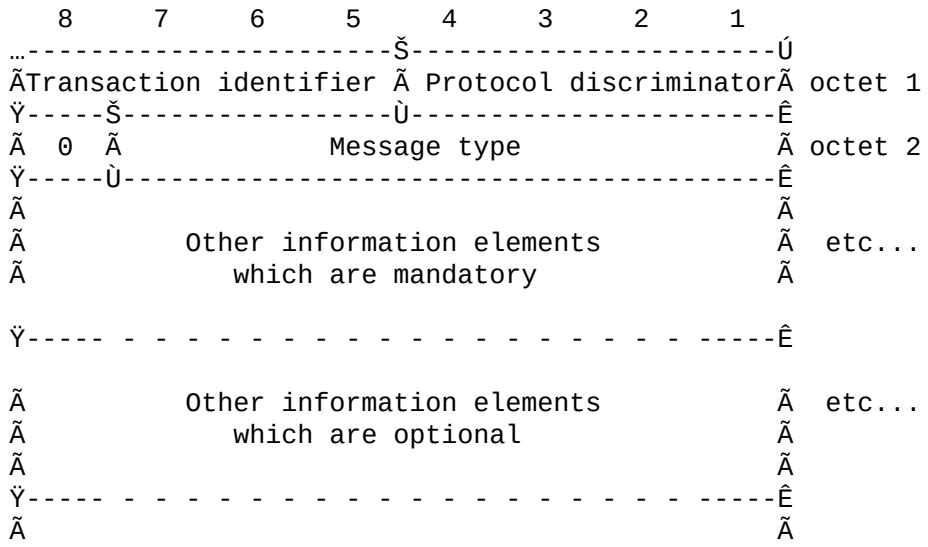


FIGURE 10.5/GSM 04.08.
Organization of other information elements.

When an information element which is optional for a given message is contained in the message it has to be identified by means of an information element identifier.

An information element which is mandatory for a given message does not have to be identified by means of an information element identifier as the presence and the order of the mandatory information elements are unambiguously determined by the protocol discriminator and the message type.

An information element can very well be mandatory for some messages and optional for other messages i.e. information elements always have to contain the information element identifier in their definition. When an information element is mandatory for a message the information element identifier is stripped off the information element in that message.

Two main categories of information elements are defined:

a) information elements with fixed length;

b) information elements with variable length.

An information element with variable length are provided with a length indicator of one octet which determines the length of content of that information element. It is the binary coding of the number of octets of content with bit 1 as the least significant bit.

In a message the length of content of a mandatory information element with fixed length is determined by the protocol discriminator and the message type of that message.

In a message the length of content of a mandatory information element with variable length is determined by the length indicator which is the first octet of the information element.
In a message the length of content of an optional information element with fixed length is determined by the information element identifier.

In a message the length of content of an optional information element with variable length is determined by the length indicator which is the second octet of the information element.

Totally four types of information elements are defined:

a') information elements with 1/2 octet of content (Type 1);

a'') information elements with 0 octets of content (Type 2); (Note 1)

a''') information elements with fixed length and at least one octet of content (Type 3);

b) information elements with variable length (Type 4).

Note 1: A type 2 information element can not be mandatory in a message.

Type 1 information elements provide the information element identifier in bit positions 7, 6, 5. The value "0 1 0" in these bit positions is reserved for type 2 information elements which together with this provide the information element identifier in bit positions 4, 3, 2, 1. Type 3 and 4 information elements provide the information element identifier in bit positions 7, 6, 5, 4, 3, 2, 1 in the first octet.

These information elements are shown in Figure 10.6 to 10.13/GSM 04.08 for both the case where the information element is optional in a message and mandatory in a message.
In the mentioned figures IEI is used as an abbreviation for Information Element Identifier, CIE as an abbreviation for Content of Information Element and LI as an abbreviation for Length Indicator.

Type 1 Information elements with 1/2 octet of content

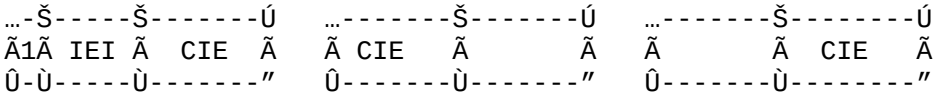


FIG.10.6/GSM 04.08 The information element is optional

FIG.10.7/GSM 04.08 The information element is mandatory

FIG.10.8/GSM 04.08 The information element is mandatory

Type 2 Information elements with 0 octet of content

FIG.10.9/GSM 04.08 The information element is optional

Type 3 Information elements with fixed length and at least one octet of content

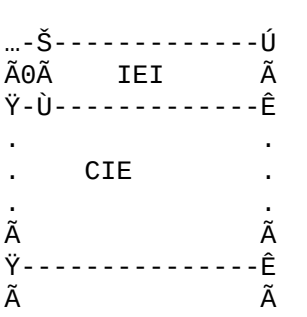


FIG.10.10/GSM 04.08
The information element is optional

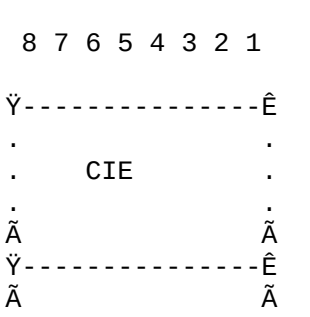


FIG.10.11/GSM 04.08
The information element is mandatory

Type 4 Information elements with variable length

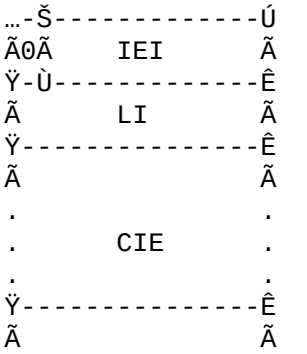


FIG.10.12/GSM 04.08
The information element is optional

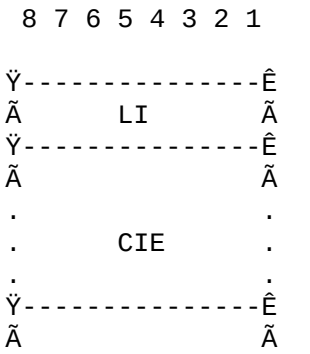


FIG.10.13/GSM 04.08
The information element is mandatory

The information elements which are common for at least two of the three sublayers are listed in section 10.5.1.
The information elements for the sublayers radio resources management, mobility management and call control are listed in sections 10.5.2, 10.5.3 and 10.5.4 respectively. The coding of the information element identifier bits is summarized in Tables 10.6/GSM 04.08, 10.13/GSM 04.08, 10.38/GSM 04.08 and 10.45/GSM 04.08.

Different information elements may have the same information element identifier if they belong to different sublayers.

The descriptions of the information elements are organized in alphabetical order. However, there is a particular order of appearance for each information element in a message.

The order of appearance for each information element which is mandatory in a message is laid down in the definition of the message (see section 9).

The order of the mandatory information elements should be chosen so that information elements with 1/2 octet of content (type 1) go together in succession. The first type 1 information element occupies bits 1 to 4 of octet N, the second bits 5 to 8 of octet N, the third bits 1 to 4 of octet N+1 etc. If the number of type 1 information elements is odd then bits 5 to 8 of the last octet occupied by these information elements should be treated as spare bits i.e. coded with a "0" in each.

The order of appearance in a message for each optional information element with fixed length (type 3) or with variable length (type 4) is determined by the information element identifier. The code values of the information element identifier for these formats are assigned in ascending numerical order, according to the actual order of appearance of each information element in the message. This allows the receiving equipment to detect the presence or absence of a particular optional information element of one of these two formats (types 3 and 4) without scanning through an entire message.
Unrecognized information element identifiers shall be assumed to belong to an information element of type 4. For the detailed handling of unrecognized information element see section 8.
Optional information elements with 1/2 octet or 0 octet of content (types 1 and 2) may appear at any point among the optional information elements in a message.

Where the description of information elements in this recommendation contains spare bits, these bits are indicated as being set to "0". In order to allow compatibility with future implementation, messages should not be rejected simply because a spare bit is set to "1".

An optional variable length information element may be present, but empty. For example, a SETUP message may contain a called party BCD number information element, the content of which is of zero length. This should be interpreted by the receiver as equivalent to that information element being absent. Similarly, an absent information element should be interpreted by the receiver as equivalent to that information element being empty.

The following rules apply for the coding of variable length information elements:

a) The first digit in the octet number identifies one octet or a group of octets.

b) Each octet group is a self contained entity. The internal structure of an octet group may be defined in alternative ways.

c) An octet group is formed by using some extension mechanism. The preferred extension mechanism is to extend an octet (N) through the next octet(s) (Na, Nb, etc.) by using bit 8 in each octet as an extension bit.
The bit value "0" indicates that the octet continues through the next octet. The bit value "1" indicates that this octet is the last octet. If one octet (Nb) is present, also the preceeding octets (N and Na) must be present.

In the format descriptions appearing in section 10.5.1 to 10.5.4, bit 8 is marked "0/1 ext" if another octet follows. Bit 8 is marked "1 ext" if this is the last octet in the extension domain.

Additional octets may be defined later ("1 ext" changed to "0/1 ext") and equipments shall be prepared to receive such additional octets although the equipment need not be able to interprete or act upon the content of these octets.

d) In addition to the extension mechanism defined above, an octet (N) may be extended through the next octet(s) (N.1, N.2 etc.) by indications in bits 7-1 (of octet N).

e) The mechanisms in c)and d) may be combined.

f) Optional octets are marked with asterisks (*).

10.5.1 Common information elements.

For the common information elements listed below, the coding of the information element identifier bits is summarized in Table 10.6/GSM 04.08.

8 7 6 5 4 3 2 1		Reference section	Length in octets 1)
1 : : : - - - -	Type 1 info elements		
1 1 1 - - - -	Ciphering key sequence number	10.5.1.2	F1
0 : : : : : : :	Type 3 & 4 info elements		
0 0 1 0 0 0 1	Cell identity	10.5.1.1	F3
0 0 1 0 0 1 1	Location area identification	10.5.1.3	F6
0 0 1 0 1 1 1	Mobile identity	10.5.1.4	Max. 10
0 0 1 1 0 0 0	Mobile station classmark 1	10.5.1.5	F2
0 0 1 1 1 1 1	Mobile station classmark 2	10.5.1.6	Max. 4
All other values are reserved 2)			

TABLE 10.6/GSM 04.08
Information element identifier coding for common information elements

Note 1: For fixed length information elements the length is indicated as F length value e.g. F3. For variable length information elements the length is indicated as Max length value e.g. Max 10.
The indicated length is the length included information element identifier and a possible length indicator. When an information element is mandatory in a message the length is reduced with 1 octet as the information element identifier is stripped off.

Note 2: The reserved value with bits 5-8 coded "0000" are for future information elements for which comprehension by the receiver is required (see section 8.8.1 Unrecognized information element).

10.5.1.1 Cell identity

The purpose of the cell identity information element is to identify the cells within a location area.

The cell identity information element is coded as shown in Figure 10.14/GSM 04.08 and Table 10.7/GSM 04.08.

The cell identity is a type 3 information element with 3 octets length.

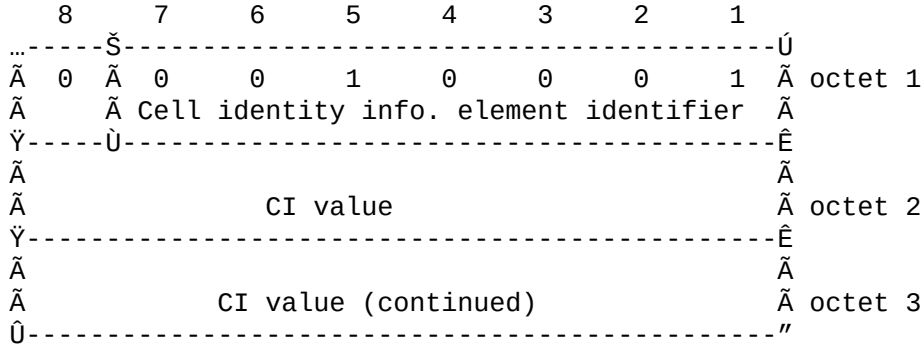


FIGURE 10.14/GSM 04.08
Cell identity information element

CI value, Cell identity value (octet 2 and 3)
In the CI value field bit 8 of octet 2 is the most significant bit and bit 1 of octet 3 the least significant bit.
The coding of the cell identity is the responsibility of each administration. Coding using full hexadecimal representation may be used. The cell identity consists of 2 octets maximal.
If an administration has chosen N bits for the cell identity where N < 16 then the additional bits up to 16 are coded with a "0" in each in the following way:
If 8 < N < 16 the bits 8 through N-7 of octet 2 is coded with a "0" in each.
If N = 8 then octet 2 is coded with a "0" in each bit.
If N < 8 then octet 2 is coded with a "0" in each bit and bits 8 through N+1 of octet 3 is coded with a "0" in each.

TABLE 10.7/GSM 04.08
Cell identity information element

10.5.1.2 Ciphering key sequence number

The purpose of the ciphering key sequence number information element is to make it possible for the network to identify the ciphering key Kc which is stored in the Mobile Station without invoking the authentication procedure. The ciphering key sequence number is allocated by the network and sent with the AUTHENTICATION REQUEST message to the Mobile Station where it is stored together with the calculated ciphering key Kc.

The ciphering key sequence number information element is coded as shown in Figure 10.15/GSM 04.08 and Table 10.8/GSM 04.08.

The ciphering key sequence number is a type 1 information element.

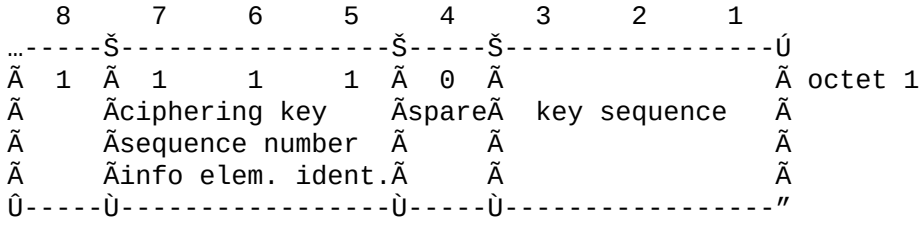


FIGURE 10.15/GSM 04.08
Ciphering key information element

Key sequence (octet 1)	
Bits	
3 2 1	
0 0 0 through 1 1 0	Possible values for the ciphering key sequence number
1 1 1	No key is available (MS to network); Reserved (network to MS)

TABLE 10.8/GSM 04.08
Ciphering key information element

10.5.1.3 Location area identification

The purpose of the location area identification information element is to provide an unambiguous identification of location areas within the area covered by the GSM system.
The location area identification information element will be sent by the network to the mobile station in SYSTEM INFORMATION TYPE 3 messages on the BCCH. The mobile station will use this information element to decide when location registration needs to take place.

The location area identification information element is coded as shown in Figure 10.16/GSM 04.08 and Table 10.9/GSM 04.08.

The location area identification is a type 3 information element with 6 octets length.

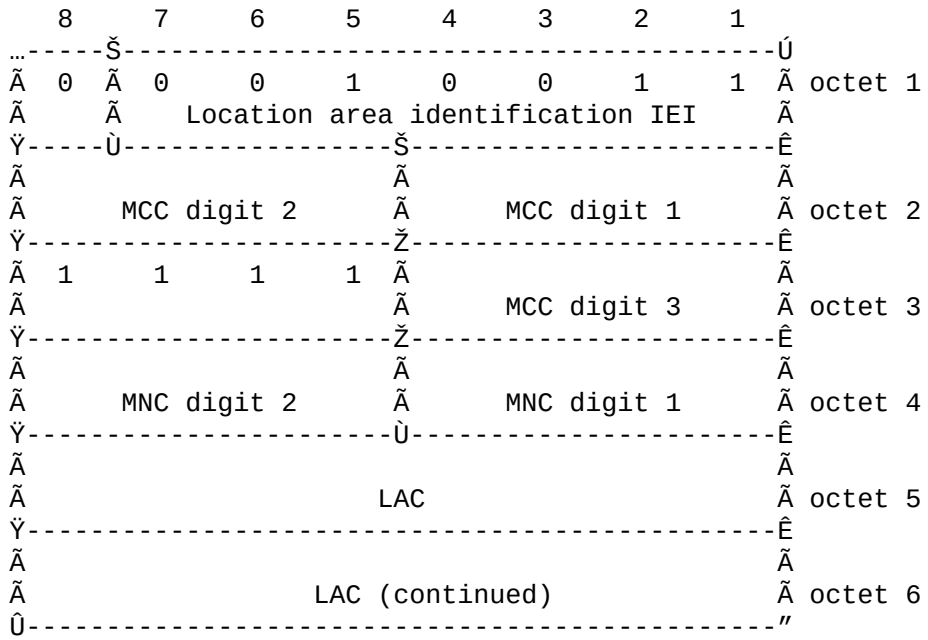


FIGURE 10.16/GSM 04.08
Location area identification information element

MCC, Mobile country code (octet 2 and 3) The MCC field is coded as in CCITT Rec. E212, Annex A. If no valid LAI exists as indicated by LAC and the LAI has been deleted the MCC and MNC shall take the value from the deleted LAI. MNC, Mobile network code (octet 4) The coding of this field is the responsibility of each administration but BCD coding shall be used. If an administration decides to include only one digit in the MNC then bits 5 to 8 of octet 4 are coded as "1111".   LAC, Location area code (octet 5 and 6) In the LAC field bit 8 of octet 5 is the most significant bit and bit 1 of octet 6 the least significant bit. The coding of the location arera code is the responsibility of each administration except one marking the LAC and hence the LAI as deleted. Coding using full hexadecimal representation may be used. The location area code consists of 2 octets maximal. If an administration has chosen N bits for the location area code where N < 16 then the additional bits up to 16 are coded with a "0" in each in the following way: - If 8 < N < 16 the bits 8 through N-7 of octet 5 is coded with a "0" in each. - If N = 8 then octet 5 is coded with a "0" in each bit. - If N < 8 then octet 5 is coded with a "0" in each bit and bits 8 through N+1 of octet 6 is coded with a "0" in each. In case of a deleted or non-existent LAI, both octets of the location area code shall be coded with zeroes

TABLE 10.9/GSM 04.08
Location area identification information element

10.5.1.4 Mobile identity

The purpose of the mobile identity information element is to provide either the international mobile subscriber identity, IMSI, the temporary mobile subscriber identity, TMSI or the international mobile station identity, IMEI.

The IMSI shall not exceed 15 digits, the maximum length of the TMSI is 4 octets, and the IMEI is composed of 15 digits (see Rec. GSM 03.03).

For all transactions except emergency call establishment and the identification procedure the mobile station and the network shall select the mobile identity type with the following priority:

1- TMSI: The TMSI should be used if it is available.

2- IMSI: The IMSI should be used in cases where no TMSI is available.

For emergency call establishment the mobile station shall select the mobile identity type with the following priority:

1- TMSI: The TMSI should be used if it is available.

2- IMSI: The IMSI should be used in cases where no TMSI is available.

3- IMEI: The IMEI should be used in cases where no IMSI or TMSI is available.

In the identification procedure the mobile station shall select the mobile identity type which was requested by the network.

The mobile identity information element is coded as shown in Figure 10.17/GSM 04.08 and Table 10.10/GSM 04.08.

The mobile identity is a type 4 information element with 10 octets length maximal.

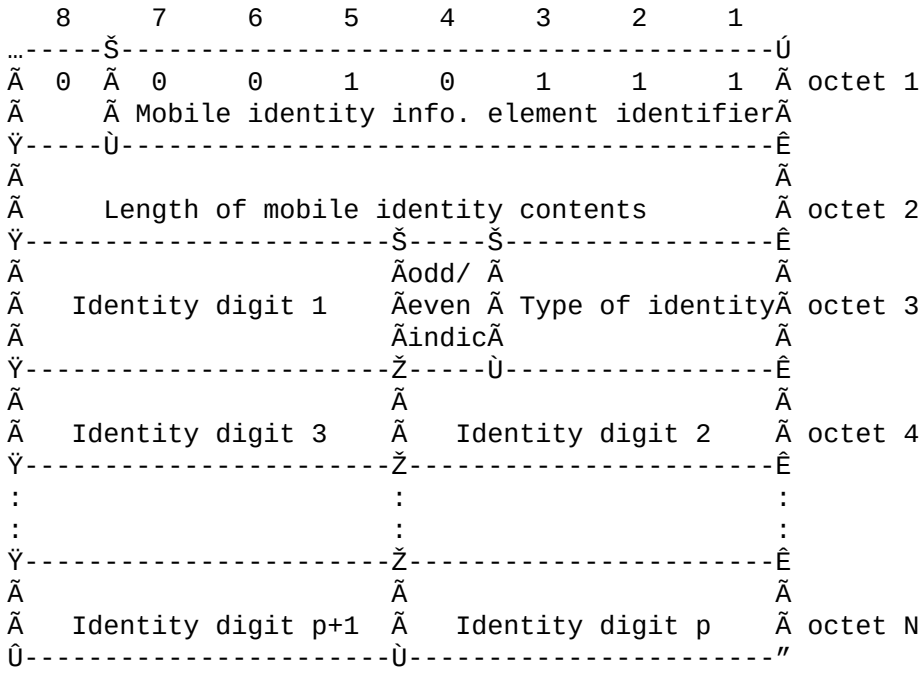


FIGURE 10.17/GSM 04.08
Mobile identity information element

Type of identity (octet 3)
Bits
3 2 1
0 0 1 IMSI
0 1 0 IMEI
1 0 0 TMSI
0 0 0 No Identity note 1)
All other values are reserved.
Odd/even indication (octet 3)
Bit
4
0 even number of identity digits; should be used in the TMSI case too
1 odd number of identity digits
Identity digits (octet 3 etc)
For the IMSI and the IMEI this field is coded using BCD coding. If the number of identity digits is even then bits 5 to 8 of the last octet shall be filled with an end mark coded as "1111".
If the mobile identity is the TMSI then bits 5 to 8 of octet 3 is coded as "1111" and bit 8 of octet 4 is the most significant bit and bit 1 of the last octet the least significant bit. The coding of the TMSI is left open for each administration. If an administration has chosen fewer than 4 octets for the length of the TMSI then if necessary the TMSI should be filled with zeroes ahead of the most significant bit so that the TMSI consists of an integral number of octets.

TABLE 10.10/GSM 04.08
Mobile identity information element

Note 1: This can be used in the case when a fill paging message without any valid identity has to be sent on the paging subchannel

10.5.1.5 Mobile station classmark 1

The purpose of the mobile station classmark 1 information element is to provide the network with information concerning aspects of high priority of the mobile station equipment. This affects the manner in which the network handles the operation of the mobile station.

The mobile station classmark 1 information element is coded as shown in Figure 10.18/GSM 04.08 and Table 10.11/GSM 04.08.

The mobile station classmark 2 is a type 3 information element with 2 octets length.

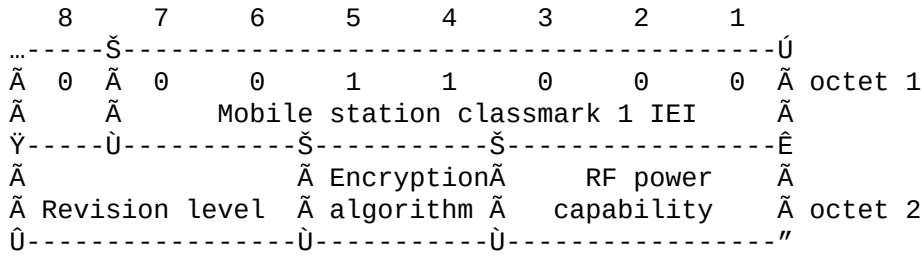


FIGURE 10.18/GSM 04.08
Mobile station classmark 1 information element

Revision level (octet 2)
Bits
8 7 6
0 0 0
All other values are reserved for future use
Encryption algorithm (octet 2)
Bits
5 4
0 0 Algorithm A5
All other values are reserved.
RF power capability (octet 2)
Bits
3 2 1
0 0 0 class 1, vehicle and portable
0 0 1 class 2, portable
0 1 0 class 3, handheld
0 1 1 class 4, handheld
1 0 0 class 5, handheld

TABLE 10.11/GSM 04.08
Mobile station classmark 1 information element

10.5.1.6 Mobile station classmark 2

The purpose of the mobile station classmark 2 information element is to provide the network with information concerning aspects of both high and low priority of the mobile station equipment. This affects the manner in which the network handles the operation of the mobile station.

The mobile station classmark 2 information element is coded as shown in Figure 10.19/GSM 04.08 and Table 10.12/GSM 04.08.

The mobile station classmark 2 is a type 4 information element with 5 octets length maximal.

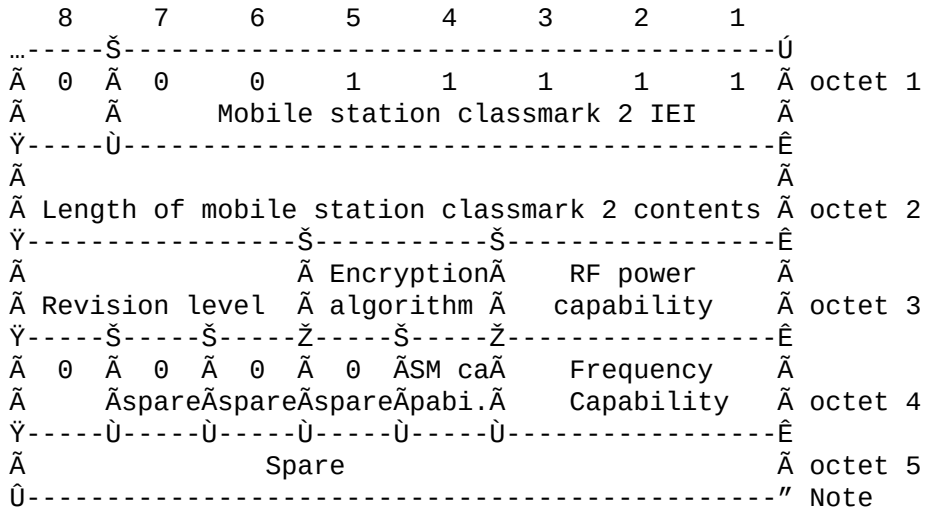


FIGURE 10.19/GSM 04.08
Mobile station classmark 2 information element

Note: This octet is reserved for future use and may be omitted.

Revision level (octet 2)
Bits
8 7 6
0 0 0
All other values are reserved for future use
Encryption algorithm (octet 3)
Bits
5 4
0 0 algorithm A5
All other values are reserved.
RF power capability (octet 3)
Bits
3 2 1
0 0 0 class 1, vehicle and portable
0 0 1 - 2, portable
0 1 0 - 3, handheld
0 1 1 - 4, handheld
1 0 0 - 5, handheld
SM capability (short message capability) (octet 4)
Bit 4
0 SM capability not present
1 SM capability present
Frequency Capabiltiy (octet 4)
bits
3 2 1
0 0 0 band number 0
All other values are reserved.

TABLE 10.12/GSM 04.08
Mobile station classmark 2 information element

10.5.2 Radio resources management information elements.

For the radio resources management information elements listed below, the coding of the information element identifier bits is summarized in Table 10.13/GSM 04.08.

8 7 6 5 4 3 2 1		Reference section	Length in octets 1)	
1 : : : - - - -	Type 1 info elements			
0 0 1 - - - -	Cipher mode setting	10.5.2.7	F1	
0 1 1 - - - -	Page mode	10.5.2.14	F1	
1 0 1 - - - -	Synchronisation indication	10.5.2.21	F1	
0 : : : : : :	Type 3 & 4 info elements			
1 1 0 0 0 0 1	Cell description	10.5.2.2	F3	
1 1 0 0 0 1 0	Cell channel description	10.5.2.1	F17	
1 1 0 0 0 1 1	Channel mode	10.5.2.6	F2	
1 1 0 0 1 0 0	Channel description	10.5.2.5	F4	
1 1 0 0 1 1 0	Channel mode 2	10.5.2.6a	F2	
1 1 0 1 0 0 0	Control channel description	10.5.2.8	F4	
1 1 0 1 0 0 1	Frequency channel sequence	10.5.2.9	F10	
1 1 0 1 0 1 0	Handover reference	10.5.2.10	F2	
1 1 0 1 0 1 1	Cell options	10.5.2.3	F2	
1 1 0 1 1 0 0	Cell selection parameters	10.5.2.4	F3	

TABLE 10.13/GSM 04.08 (page 1 of 2)
Information element identifier coding for radio resources management information elements

8 7 6 5 4 3 2 1		Reference section	Length in octets 1)
1 1 1 0 0 0 1	Measurement results	10.5.2.11	F17
1 1 1 0 0 1 0	Mobile allocation	10.5.2.12	Max. 10
1 1 1 0 1 0 0	Neighbour cells description	10.5.2.13	F17
1 1 1 0 1 0 1	Power command	10.5.2.16	F2
1 1 1 0 1 1 0	PLMN permitted	10.5.2.15	F2
1 1 1 1 0 0 0	RACH control param.	10.5.2.17	F4
1 1 1 1 0 0 1	Request reference	10.5.2.18	F4
1 1 1 1 0 1 0	RR cause	10.5.2.19	F2
1 1 1 1 1 0 0	Starting time	10.5.2.20	F3
1 1 1 1 1 0 1	Timing advance	10.5.2.22	F2
1 1 1 1 1 1 0	TMSI	10.5.2.23	F5
1 1 1 1 1 1 1	Wait indication	10.5.2.24	F2
All other values are reserved 2)			

TABLE 10.13/GSM 04.08 (page 2 of 2)
Information element identifier coding for radio resources management information elements

Note 1: For fixed length information elements the length is indicated as F length value e.g. F3. For variable length information elements the length is indicated as Max length value e.g. Max 10.
The indicated length is the length included information element identifier and a possible length indicator. When an information element is mandatory in a message the length is reduced with 1 octet as the information element identifier is stripped off.

Note 2: The reserved value with bits 5-8 coded "0000" are for future information elements for which comprehension by the receiver is required (see section 8.8.1 Unrecognized information element).

10.5.2.1 Cell channel description

The purpose of the cell channel description information element is to provide the absolute radio frequency channel numbers used in a cell.

The cell channel description information element is coded as shown in Figure 10.20/GSM 04.08 and Table 10.14/GSM 04.08.

The cell channel description is a type 3 information element with 17 octets length.

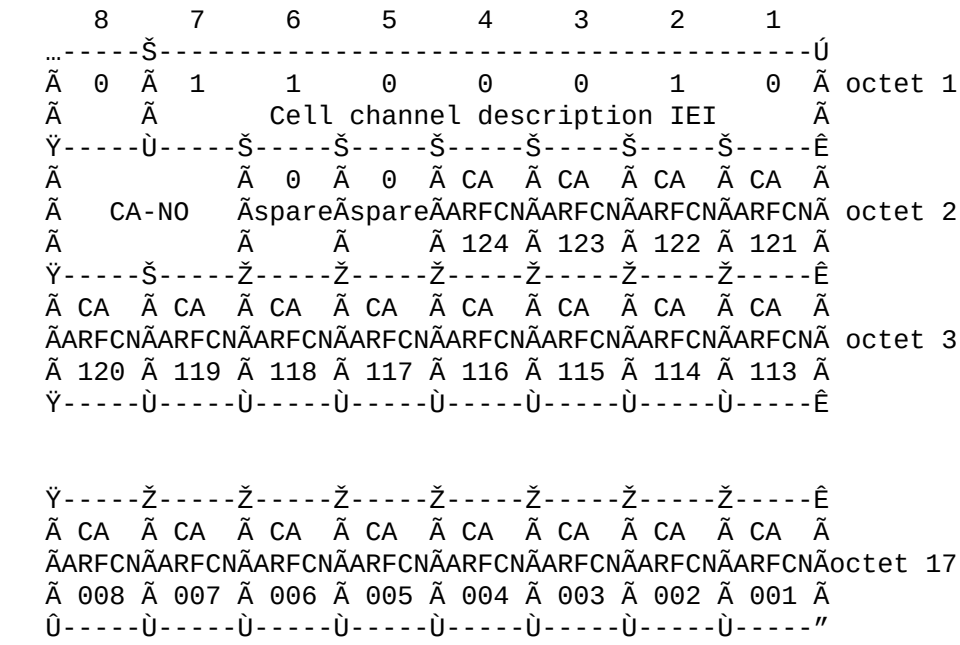


FIGURE 10.20/GSM 04.08
Cell Channel description information element.

CA-NO, Cell allocation number (octet 2)
Bits
8 7
0 0 Band number 0
All other values are reserved
CA ARFCN N, Cell Allocation Absolute RF Channel Number N (octet 2 etc.)
For a RF channel with ARFCN = N belonging to the cell allocation the CA ARFCN N bit is coded with a "1"; N = 1, 2, .. , 124.
For a RF channel with ARFCN = N not belonging to the cell allocation the CA ARFCN N bit is coded with a "0"; N = 1, 2 .. , 124.

TABLE 10.14/GSM 04.08
Cell channel description information element

10.5.2.2 Cell description

The purpose of the cell description information element is to provide a minimum description of a cell, e.g. to allow the mobile station to use its preknowledge about synchronization.

The cell description information element is coded as shown in Figure 10.21/GSM 04.08 and Table 10.15/GSM 04.08.

The cell description is a type 3 information element with 3 octets length.

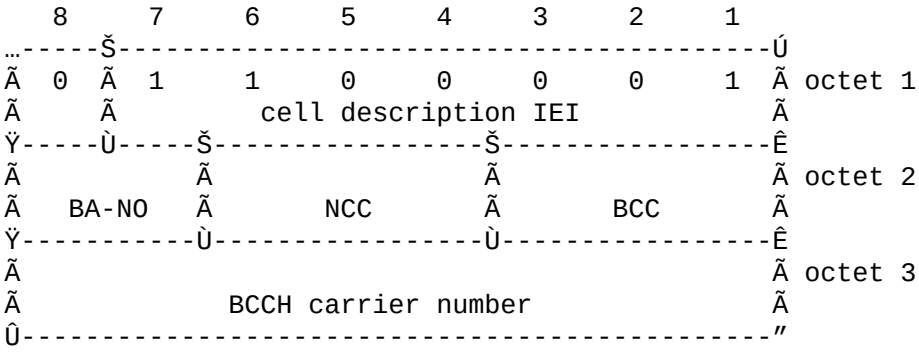


FIGURE 10.21/GSM 04.08
Cell description information element

BA-NO, BCCH allocation number (octet 2)
Bits
8 7
0 0 Band number 0
All other values are reserved
NCC, PLMN colour code (octet 2)
The NCC field is coded as the binary representation of the PLMN colour code (see Rec. GSM 03.03)
BCC, BS colour code (octet 2)
The BCC field is coded as the binary representation of the BS colour code (see Rec. GSM 03.03).
BCCH carrier number (octet 3)
The BCCH carrier number field is coded as the binary representation of the BCCH carriers absolute RF channel number.
Range: 1 to 124.
All other values are reserved.

TABLE 10.15/GSM 04.08
Cell description information element

10.5.2.3 Cell options

The purpose of the cell options information element is to provide a variety of information about a cell.

The cell options information element is coded as shown in Figure 10.22/GSM 04.08 and Table 10.16/GSM 04.08.

The cell options is a type 3 information element with 2 octets length.

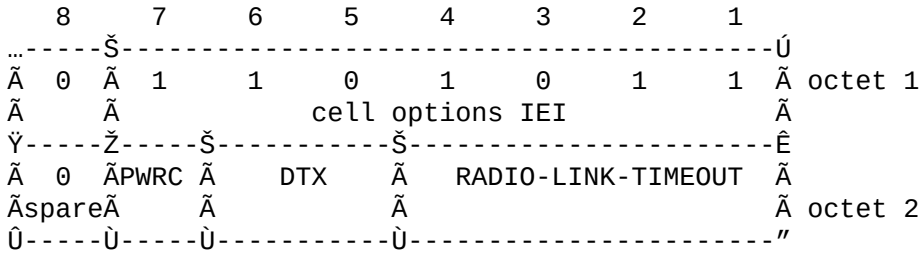


FIGURE 10.22/GSM 04.08
Cell options information element

PWRC Power control indicator (octet 2) Note 2
bit 7
0 PWRC is not set
1 PWRC is set
DTX, DTX indicator (octet 2)
Bit
6 5
0 0 The MSs may use discontinuous transmission
0 1 The MSs shall use discontinuous transmission
1 0 The MS shall not use discontinuous transmission
RADIO-LINK_TIMEOUT (octet 2) Note 1
Bits
4 3 2 1
0 0 0 0 4
0 0 0 1 8
0 0 1 0 12
.
.
.
1 1 1 0 60
1 1 1 1 64

TABLE 10.16/GSM 04.08
cell options information element

Note 1: the precise meaning of RADIO-LINK-TIMEOUT parameter can be found in Rec. GSM 05.08

Note 2: The precise meaning of the PWRC parameter can be found in Rec. GSM 05.08.

10.5.2.4 Cell selection parameters

The purpose of the cell selection parameters information element is to provide a variety of information about a cell.

The cell selection parameters information element is coded as shown in Figure 10.23/GSM 04.08 and Table 10.17/GSM 04.08.

The cell selection parameters information element is a type 3 information element with 3 octets length.

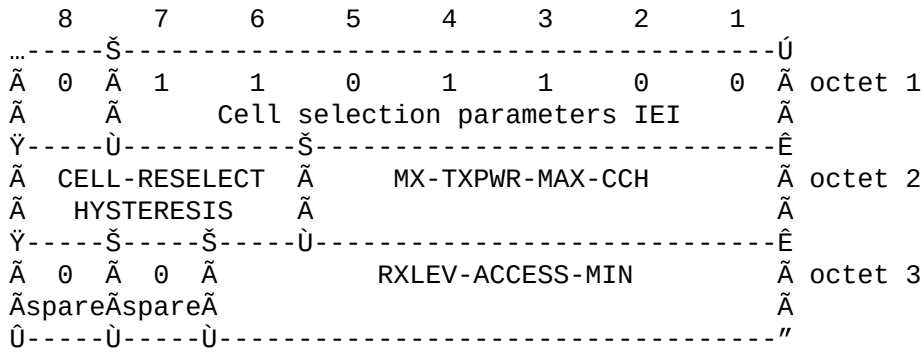


TABLE 10.23/GSM 04.08
Cell selection parameters information element

CELL-RESELECT-HYSTERESIS (octet 2)	
Bits	
8 7 6	
0 0 0	0 dB RXLEV hysteresis for cell re-selection
0 0 1	2 dB RXLEV hysteresis for cell re-selection
0 1 0	4 dB RXLEV hysteresis for cell re-selection
0 1 1	6 dB RXLEV hysteresis for cell re-selection
1 0 0	8 dB RXLEV hysteresis for cell re-selection
1 0 1	10 dB RXLEV hysteresis for cell re-selection
1 1 0	12 dB RXLEV hysteresis for cell re-selection
1 1 1	14 dB RXLEV hysteresis for cell re-selection

MS-TXPWR-MAX-CCH (octet 2)

The MS-TXPWR-MAX-CCH field is coded as the binary representation of the maximum TX power level an MS may use when accessing on a CCH.

Range: 0 to 31.

RXLEV-ACCESS-MIN (octet 3)

The RXLEV-ACCESS-MIN field is coded as the binary representation of the minimum received signal level at the MS for which it is permitted to access the system.

Range: 0 to 63. (See Rec. GSM 05.08).

TABLE 10.17/GSM 04.08
Cell selection parameters information element

10.5.2.5 Channel description

The purpose of the channel description information element is to provide a description of an allocatable channel together with its SACCH.

The channel description information element is coded as shown in Figure 10.24/GSM 04.08 and Table 10.18/GSM 04.08.

The channel description is a type 3 information element with 4 octets length.

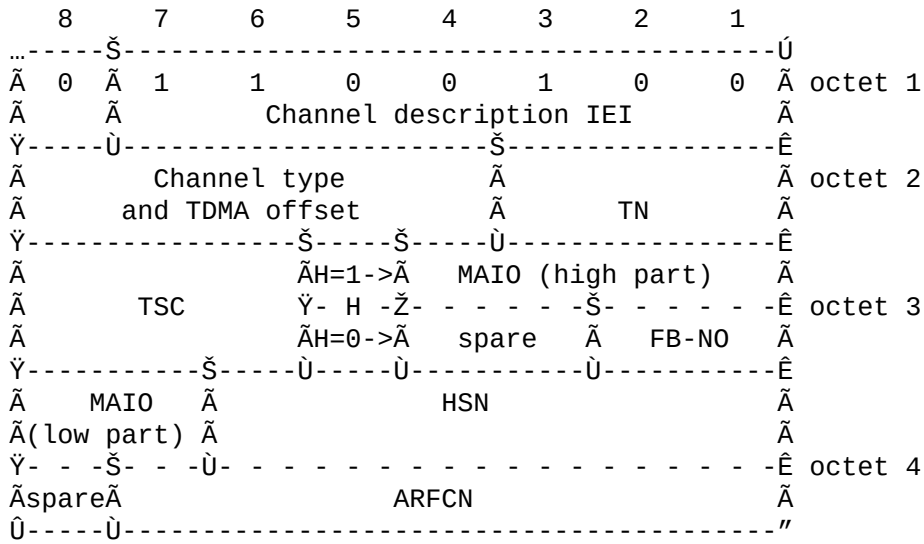


FIGURE 10.24/GSM 04.08
Channel description information element

Channel type and TDMA offset (octet 2)

Bits

8	7	6	5	4	
0	0	0	0	1	Bm + ACCHs
0	0	0	1	T	Lm + ACCHs
0	0	1	T	T	SDCCH/4 + SACCH/C4 or CBCH (SDCCH/4)
0	1	T	T	T	SDCCH/8 + SACCH/C8 or CBCH (SDCCH/8)

The T bits indicate the subchannel number coded in binary.

All other values are reserved.

TN, Timeslot number (octet 2)

The TN field is coded as the binary representation of the timeslot number.

Range: 0 to 7.

TSC, Training Sequence Code (octet 3)

The TSC field is coded as the binary representation of the Training Sequence code

H, Hopping channel (octet 3)

Bit

5

0	Single RF channel
1	RF hopping channel

Note: The value of H affects the semantics of the channel selector field

Channel selector (octet 3 and 4)

H = "0": The channel selector field consists of the cell allocation number, FB-NO and the absolute RF channel number

Octet 3

Bits

4	3	
0	0	Spare

FB-NO, (octet 3)

bits

2	1	
0	0	Band number 0

All other values are reserved.

Octet 4

bit

8	
0	Spare

TABLE 10.18/GSM 04.08

Channel description information element

ARFCN, (octet 4 bit 7 to 1) The ARFCN is coded as the binary representation of the absolute RF channel number Range: 1 to 124. All other values are reserved.
H = "1": The channel selector field consists of the mobile allocation index offset, MAIO, and the hopping sequence number, HSN. MAIO, (octet 3 bit 4 to 1 high part and octet 4 bit 8 to 7 low part) The MAIO field is coded as the binary representation of the mobile allocation index offset. Range: 0 to 63. All other values are reserved. HSN, (octet 4 bit 6 to 1) The HSN field is coded as the binary representation of the hopping sequence number. Range 0 to 63.

TABLE 10.18/GSM 04.08
Channel description information element (continued)

10.5.2.6 Channel mode

The channel mode information element gives information of the mode of coding/decoding and transcoding.

The channel mode information element is coded as shown in Figure 10.25/GSM 04.08 and Table 10.19/GSM 04.08.

The channel mode is a type 3 information element with 2 octets length.

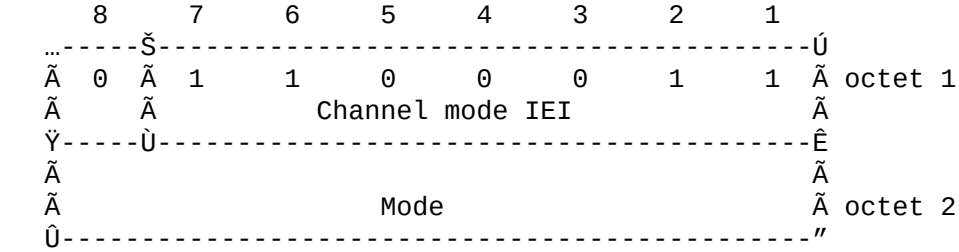


FIGURE 10.25/GSM 04.08
Channel mode information element

The mode field is encoded as follows: (octet 2)	
Bits 8 7 6 5 4 3 2 1	
0 0 0 0 0 0 0 0	signalling only
0 0 0 0 0 0 0 1	speech full rate
0 0 0 0 0 0 1 0 1	speech half rate
0 0 0 0 0 0 0 1 1	data 9.6 Kb/s
0 0 0 0 0 1 0 1 1	data 4.8 Kb/s full rate
0 0 0 0 0 1 1 1 1	data 4.8 Kb/s half rate
0 0 0 0 1 0 0 1 1	data 2.4 Kb/s full rate
0 0 0 0 1 0 1 1 1	data 2.4 Kb/s half rate

Other values are reserved for future use.

Note: The "full rate" or "half rate" indication refers to the coding scheme, not to the type of channel used.

TABLE 10.19/GSM 04.08
Channel mode information element

10.5.2.6a Channel mode 2

The channel mode 2 information element gives information of the mode of coding/decoding and transcoding.

The channel mode 2 information element is coded as shown in Figure 10.25a/GSM 04.08 and Table 10.19a/GSM 04.08.

The channel mode is a type 3 information element with 2 octets length.

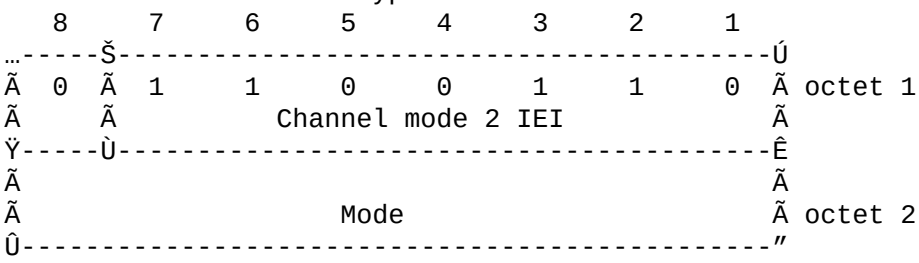


FIGURE 10.25a/GSM 04.08
Channel mode 2 information element

The mode field is encoded as follows:
(octet 2)

Bits 8 7 6 5 4 3 2 1	
0 0 0 0 0 0 0 0	signalling only
0 0 0 0 0 1 0 1	speech half rate
0 0 0 0 1 1 1 1	data 4.8 Kb/s half rate
0 0 0 1 0 1 1 1	data 2.4 Kb/s half rate

Other values are reserved for future use.

Note: The "half rate" indication refers to the coding scheme, not to the type of channel used

TABLE 10.19a/GSM 04.08
Channel mode 2 information element

10.5.2.7 Cipher mode setting

The purpose of the cipher mode setting information element is to indicate whether stream ciphering shall be started or not.

The cipher mode setting information element is coded as shown in Figure 10.26/GSM 04.08 and Table 10.20/GSM 04.08.

The cipher mode setting is a type 1 information element.

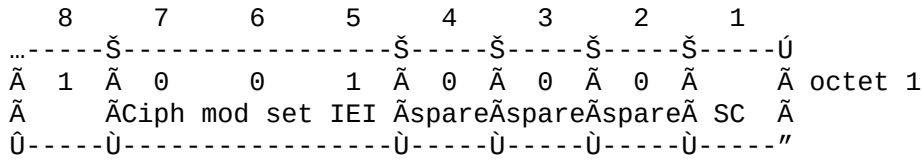


FIGURE 10.26/GSM 04.08
Cipher mode setting information element

SC (octet 1) Bit	
1	
0	No ciphering
1	Start ciphering

TABLE 10.20/GSM 04.08.
Cipher mode setting information element

10.5.2.8 Control channel description

The purpose of the control channel description information element is to provide a variety of information about a cell.

The control channel description information element is coded as shown in Figure 10.27/GSM 04.08 and Table 10.21/GSM 04.08.

The control channel description is a type 3 information element with 4 octets length.

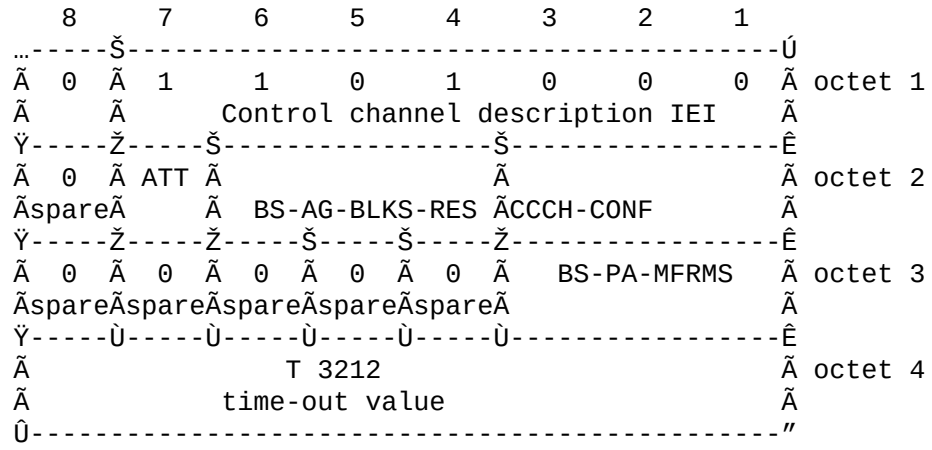


FIGURE 10.27/GSM 04.08
Control channel description information element

ATT, Attach-detach allowed (octet 2)	
Bit	
7	
0	MSs in the cell are not allowed to apply IMSI attach and detach.
1	MSs in the cell should apply IMSI attach and detach.
BS-AG-BLKS-RES (octet 2)	
The BS-AG-BLKS-RES field is coded as the binary representation of the number of blocks reserved for access grant.	
Range 0 to 2 if CCCH-CONF = "001"	
0 to 7 for other values of CCCH-CONF	
All other values are reserved in the first case	
CCCH-CONF (octet 2)	
bits	
3 2 1	
0 0 0	1 basic physical channel used for CCCH, not combined with SDCCHs
0 0 1	1 basic physical channel used for CCCH, combined with SDCCHs
0 1 0	2 basic physical channel used for CCCH, not combined with SDCCHs
1 0 0	3 basic physical channel used for CCCH, not combined with SDCCHs
1 1 0	4 basic physical channels used for CCCH, not combined with SDCCHs

TABLE 10.21/GSM 04.08
Control channel description information element

BS-PA-MFRMS (octet 3)	
Bits	
3 2 1	
0 0 0	2 multiframes period for transmission of PAGING REQUEST messages to the same paging subgroup
0 0 1	3 multiframes period for transmission of PAGING REQUEST messages to the same paging subgroup
0 1 0	4 multiframes period for transmission of PAGING REQUEST messages to the same paging subgroup
.	.
.	.
.	.
1 1 1	9 multiframes period for transmission of PAGING REQUEST messages to the same paging subgroup

Note: The number of different paging subchannels in the CCCH is :

(9 - BS-AG-BLKS-RES) * BS-PA-MFRMS
if BS-CCCH-SDCCH-COMB="0"

MAX(1,(3 - BS-AG-BLKS-RES)) * BS-PA-MFRMS
if BS-CCCH-SDCCH-COMB="1"

T3212 timeout value (octet 4)

The T3212 timeout value field is coded as the binary representation of the timeout value for periodic updating in decihours.

Range: 1 to 255

The value 0 is reserved for infinite timeout value i.e. periodic updating should not be used within the cell.

TABLE 10.21/GSM 04.08
Control channel description information element (continued)

10.5.2.9 Frequency channel sequence

The purpose of the frequency channel sequence is to provide the absolute radio frequency channel numbers used in the mobile hopping sequence. This information element can only be used for radio frequency channels in GSM band 0.

The frequency channel sequence information element is coded as shown in Figure 10.28/GSM 04.08 and Table 10.22/GSM 04.08.

The frequency channel sequence is a type 3 information element with 10 octets length.

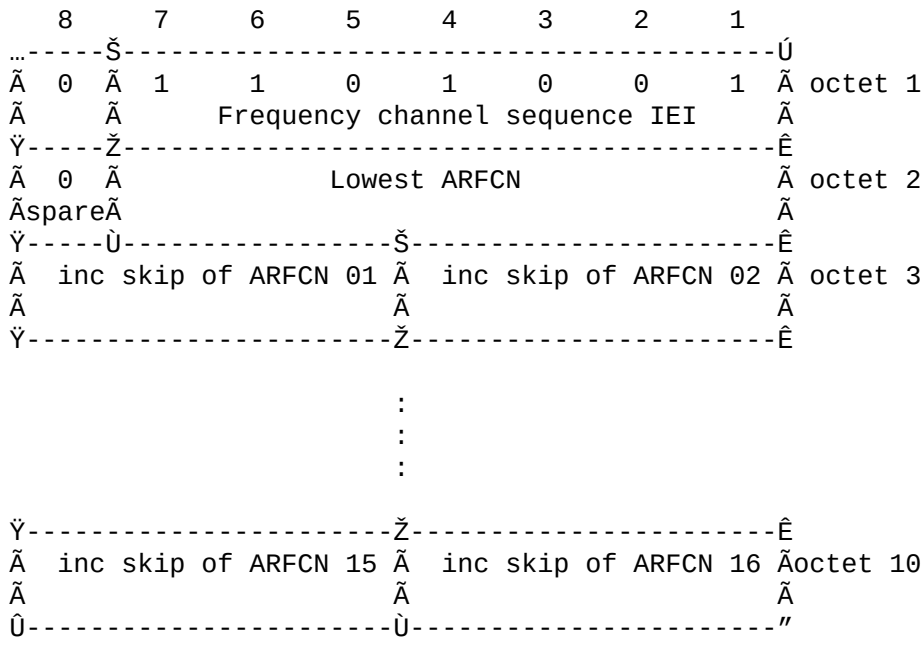


FIGURE 10.28/GSM 04.08
Frequency channel sequence information element

Lowest ARFCN (octet 2) The lowest ARFCN field is coded as the binary representation of the lowest absolute RF channel number appearing in the sequence of channels used in the frequency hopping. Range: 1 to 124 All other values are reserved.   Increment skip ARFCN n (octet 3 to 10) The increment skip ARFCN n is coded as the binary representation of the increment of the preceding absolute RF channel number appearing in the sequence of channels used in the frequency hopping: n = 1,...,16. Range: 0 to 15 The value 0 indicates that the increment value is 15 but the concerned channel is not used and the next field, i.e. Increment skip ARFCN n+1 (if present) must be added to the increment to determine the next absolute RF channel number in the sequence of channels used in the frequency hopping.

TABLE 10.22/GSM 04.08
Frequency channel sequence information element

10.5.2.10 Handover reference

The purpose of the handover reference information element is to provide a handover reference value used for access identification.

The handover reference information element is coded as shown in Figure 10.29/GSM 04.08 and Table 10.23/GSM 04.08.

The Handover reference is a type 3 information element with 2 octets length.

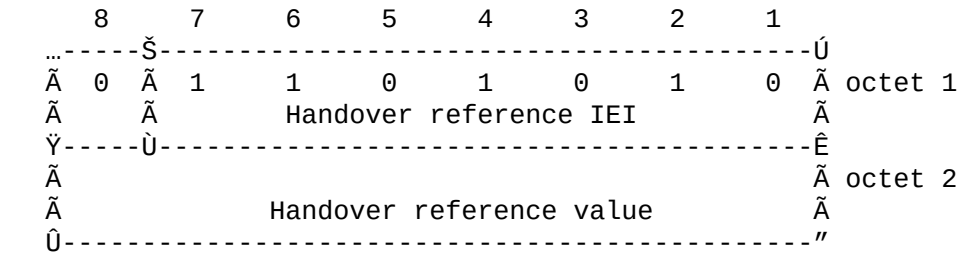


FIGURE 10.29/GSM 04.08
Handover reference information element

Handover reference value (octet 2) The handover reference value field is coded using binary representation. Range: 0 to 255.

TABLE 10.23/GSM 04.08
Handover reference information element

10.5.2.11 Measurement results

The purpose of the measurement results information element is to provide the results of the measurements made by the mobile station on the serving cell and the neighbour cells.

The measurement results information element is coded as shown in Figure 10.30/GSM 04.08 and Table 10.24/GSM 04.08.

The measurement results is a type 3 information element with 17 octets length.

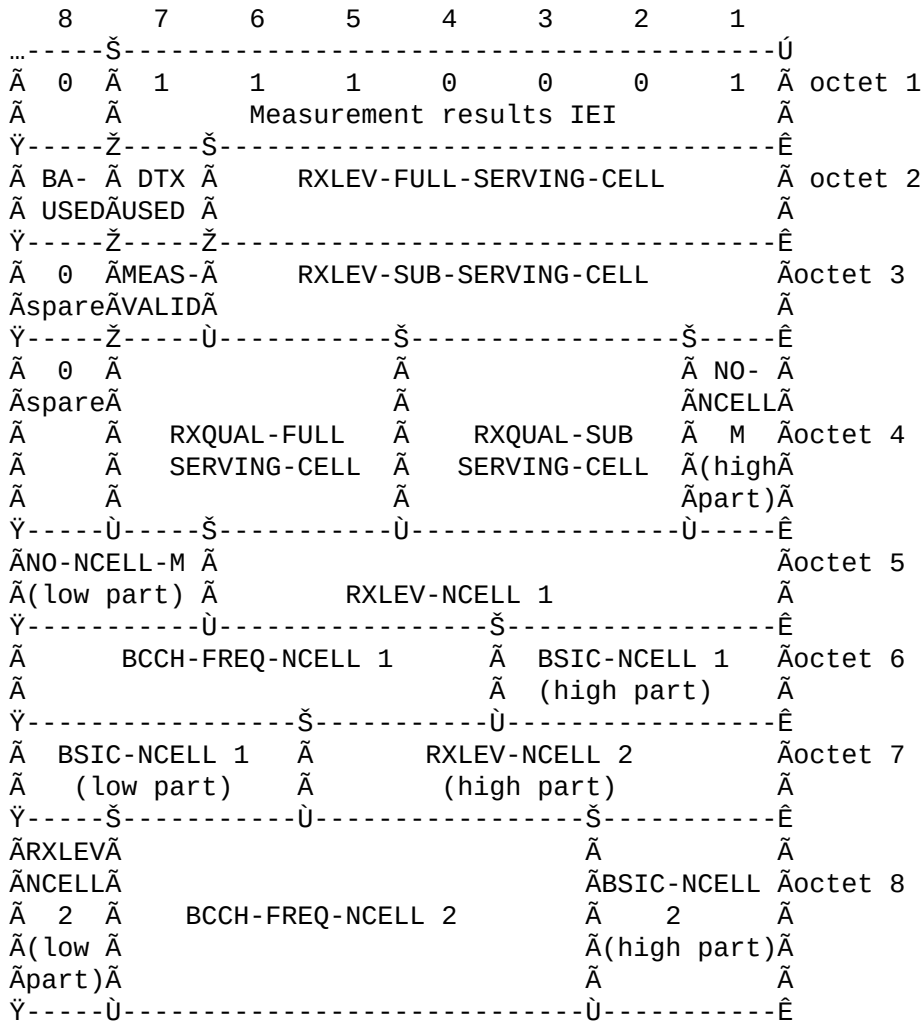


FIGURE 10.30/GSM 04.08
Measurement results information element

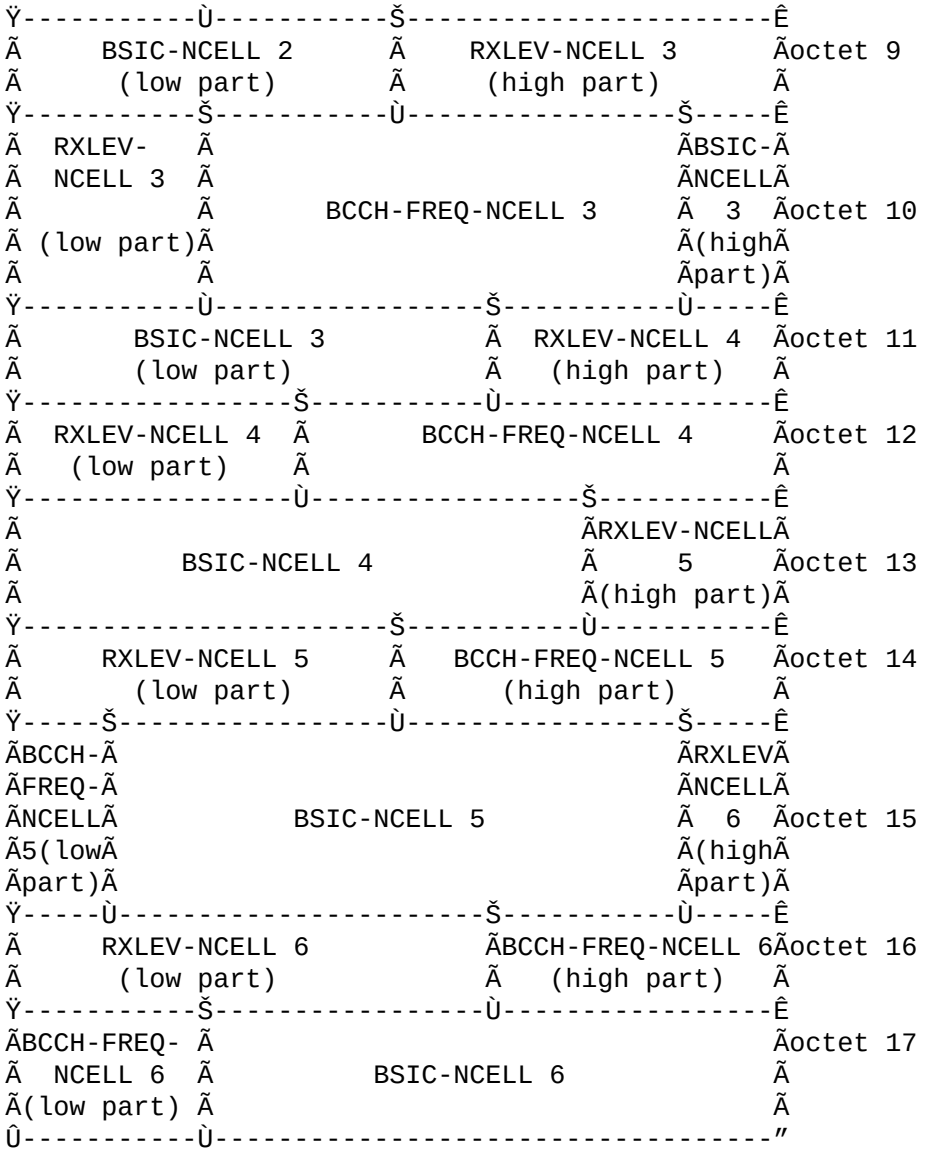


FIGURE 10.30/GSM 04.08
Measurement results information element (continued)

BA-USED (octet 2), the value of the BA-IND field of the neighbour cells description information element defining the BCCH allocation used for the coding of BCCH-FREQ-NCELL fields. Range 0 to 1
DTX-USED (octet 2) This bit indicates whether or not the MS used DTX during the previous measurement period. Bit 7 0 DTX was not used 1 DTX was used
RXLEV-FULL-SERVING-CELL and RXLEV-SUB-SERVING-CELL, Received signal strength on serving cell, measured respectively on all slots and on a subset of slots (see Rec. GSM 05.08) (octets 2 and 3) The RXLEV-FULL-SERVING-CELL and RXLEV-SUB-SERVING-CELL fields are coded as the binary representation of a value N. N corresponds according to the mapping defined in Rec. GSM 05.08 to the received signal strength on the serving cell. Range: 0 to 63
MEAS-VALID (octet 3) This bit indicates if the measurement results for the dedicated channel are valid or not bit 7 0 The measurement results are valid 1 the measurement results are not valid
RXQUAL-FULL-SERVING-CELL and RXQUAL-SUB-SERVING-CELL received signal quality on serving cell, measured respectively on all slots and on a subset of the slots (see Rec. GSM 05.08) (octet 4)

TABLE 10.24/GSM 04.08
Measurement results information element

The RXQUAL-FULL-SERVING-CELL and RXQUAL-SUB-SERVING-CELL fields are coded as the binary representation of the received signal quality on the serving cell.
Range. 0 to 7 (See Rec. GSM 05.08)
NO-NCELL-M, Number of neighbouring cell measurements (octets 4 and 5)

Bits	
1 8 7	
0 0 0	No neighbour cell measurement result
0 0 1	1 " " " "
0 1 0	2 " " " "
0 1 1	3 " " " "
1 0 0	4 " " " "
1 0 1	5 " " " "
1 1 0	6 " " " "
1 1 1	Neighbour cell information not available for serving cell

TABLE 10.24/GSM 04.08
Measurement results information element (continued)

RXLEV-NCELL i, Received signal strength on the i'th neighbouring cell (octet 5, 7, 8, 9, 10, 11, 12, 13, 14, 15 and 16) The RXLEV-NCELL field is coded as the binary representation of a value N. N corresponds according to the mapping defined in Rec. GSM 05.08 to the received signal strength on the i'th neighbouring cell. See note 1 & 2. Range: 0 to 63.
BCCH-FREQ-NCELL i, BCCH carrier of the i'th neighbouring cell (octet 6, 8, 10, 12, 14, 15, 16 and 17) The BCCH-FREQ-NCELL i field is coded as the binary representation of of the position of the i'th neighbouring cells BCCH carrier in the BCCH channel list. The BCCH channel list is the list of absolute RF channel numbers for which the BA ARFCN bit in the neighbour cells description information element is coded with a "1". The absolute RF channel numbers is placed in increasing order in the list with the lowest frequency in position 0. See note 1 & 2. Range: 0 to 31.
BSIC-NCELL i, Base station identity code of the i'th neighbouring cell (octet 6, 7, 8, 9, 10, 11, 13, 15 and 17) The BSIC-NCELL i field is coded as the binary representation of the base station identity code of the i'th neighbouring cell. See note 1 & 2. Range: 0 to 63.
Note 1: If the field extends over two octets the highest numbered bit of the lowest numbered octet is the most significant and the lowest numbered bit of the highest numbered octet is the least significant.
Note 2: If NO-NCELL-M < 6 the remaining RXLEV-NCELL i, BS- FREQ-NCELL i and BSIC-NCELL i fields (NO-NCELL-M < i <= 6) should be coded with a "0" in each bit.

TABLE 10.24/GSM 04.08
Measurement results information element (continued)

10.5.2.12 Mobile allocation

The purpose of the mobile allocation information element is to provide that part of the RF channels belonging to the cell allocation (coded with a "1" in the cell channel description information element) which is used in the mobile hopping sequence.

The mobile allocation information element is coded as shown in Figure 10.31/GSM 04.08 and Table 10.25/GSM 04.08.

The mobile allocation is a type 4 information element with 10 octets length maximal.

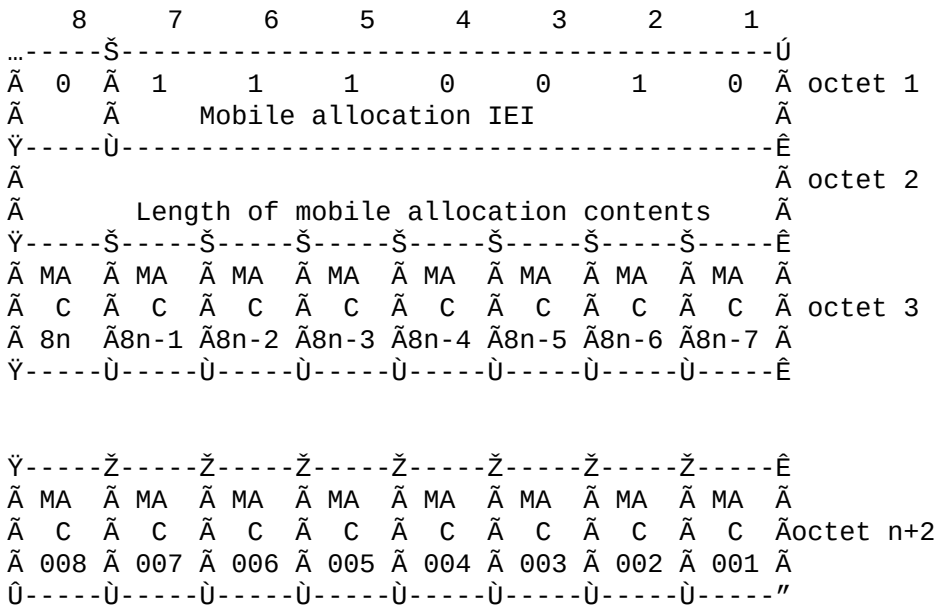


FIGURE 10.31/GSM 04.08
Mobile allocation information element.

MA C i, Mobile allocation RF channel i (octet 3 etc.) The RF channels represented in the MA C i bit fields are those which in the cell channel description information element are coded with "1"s in the CA ARFCN N bit fields. If NF denotes the number of frequencies in the mobile allocation field then : MA C i = CA ARFCN N(i); i = 1, 2,..., NF. N(i) is an increasing function of i, i.e. the order of appearance of the RF channels in the mobile allocation field is the same as in the cell allocation field in the cell channel description information element. For a RF channel belonging to the mobile allocation the MA C i bit is coded with a "1"; i = 1, 2,..., NF. For a RF channel not belonging to the mobile allocation the MA C i bit is coded with a "0"; i = 1, 2,..., NF. If NF mod 8 <> 0 then bits NF to 8n in octet 3 must be coded with a "0" in each.

TABLE 10.25/GSM 04.08
Mobile allocation information element

10.5.2.13 Neighbour cells description

The purpose of the neighbour cells description information element is to provide the absolute radio frequency channel numbers of the BCCH carriers to be monitored by the MSs in the cell.

The neighbour cells description information element is coded as shown in Figure 10.32/GSM 04.08 and Table 10.26/GSM 04.08.

The neighbour cells description is a type 3 information element with 17 octets length.

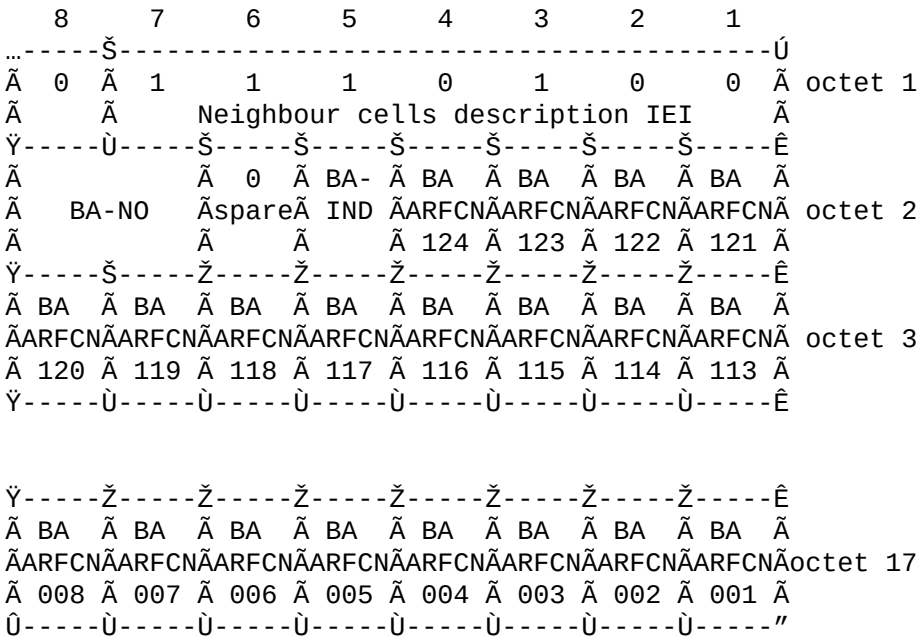


FIGURE 10.32/GSM 04.08
Neighbour cells description information element

BA-NO, BCCH allocation number (octet 2)
Bits
8 7
0 0 Band number 0
All other values are reserved
BA-IND , BCCH allocation sequence number indication (octet 2) Range 0 to 1
BA ARFCN N, BCCH Allocation Absolute RF Channel Number N (octet 2 etc.)
For a RF channel with ARFCN = N belonging to the BCCH allocation the BA ARFCN N bit is coded with a "1"; N = 1, 2, .. , 124.
For a RF channel with ARFCN = N not belonging to the BCCH allocation the BA ARFCN N bit is coded with a "0"; N = 1, 2 .. , 124.

TABLE 10.26/GSM 04.08
Neighbour cells description information element

10.5.2.14 Page mode

The purpose of the page mode information element is to control the action of the Mobile Station belonging to the paging subgroup corresponding to the paging subchannel.

The page mode information element is coded as shown in Figure 10.33/GSM 04.08 and Table 10.29/GSM 04.08.

The page mode is a type 1 information element.

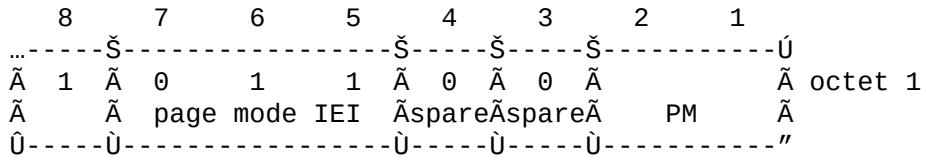


FIGURE 10.33/GSM 04.08
Page mode information element

PM (octet 1) Bits	
2 1	
0 0	Normal paging.
0 1	Extended paging.
1 0	Paging reorganization.
1 1	Same as before.

TABLE 10.27/GSM 04.08
Page mode information element

10.5.2.15 PLMN permitted

The purpose of the PLMN permitted information element is to provide a definition of the allowed NCCs on the BCCH carriers to be monitored by the MSs in the cell.

The PLMN permitted information element is coded as shown in Figure 10.34/GSM 04.08 and Table 10.28/GSM 04.08.

The PLMN permitted is a type 3 information element with 2 octets length.

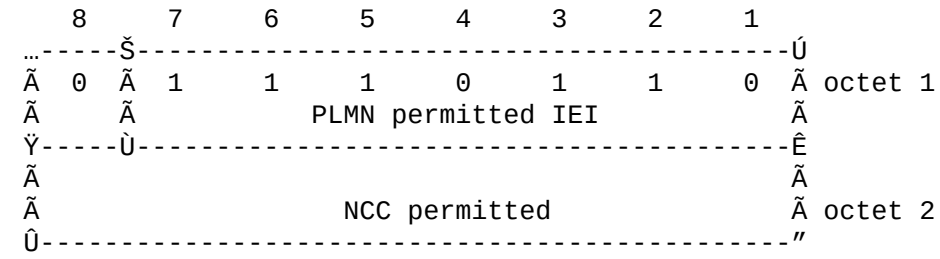


FIGURE 10.34/GSM 04.08
PLMN permitted information element

NCC permitted (octet 2)
The NCC permitted field is coded as a bit map, i.e. bit N is coded with a "0" if the PLMN with NCC = N-1 is not permitted and with a "1" if the PLMN with NCC = N-1 is permitted; N = 1,2,..,8.

TABLE 10.28/GSM 04.08
PLMN permitted information element

10.5.2.16 Power command

The purpose of the power command information element is to provide the power level for the mobile station.

The power command information element is coded as shown in Figure 10.35/GSM 04.08 and Table 10.29/GSM 04.08.

The power command is a type 3 information element with 2 octets length.

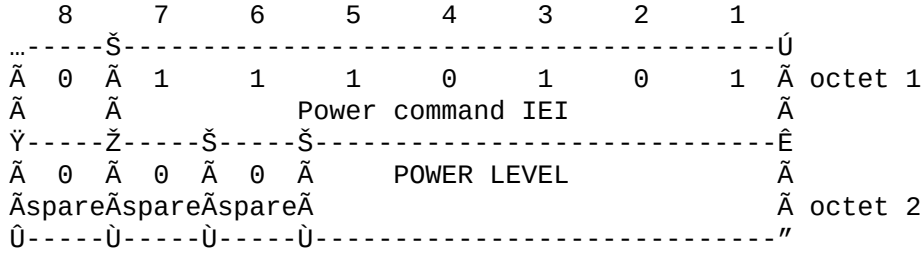


FIGURE 10.35/GSM 04.08
Power command information element

Power level (octet 2) The power level field is coded as the binary representation of the power control level. Range: 0 to 31.

TABLE 10.29/GSM 04.08
Power command information element

10.5.2.17 RACH control parameters

The purpose of the RACH control parameters information element is to provide parameters used to control the RACH utilization. The information element is contained in every SYSTEM INFORMATION message broadcasted to all mobile stations within a cell.

The RACH control parameters information element is coded as shown in Figure 10.36/GSM 04.08 and Table 10.30/GSM 04.08.

The RACH control parameters is a type 3 information element with 4 octets length.

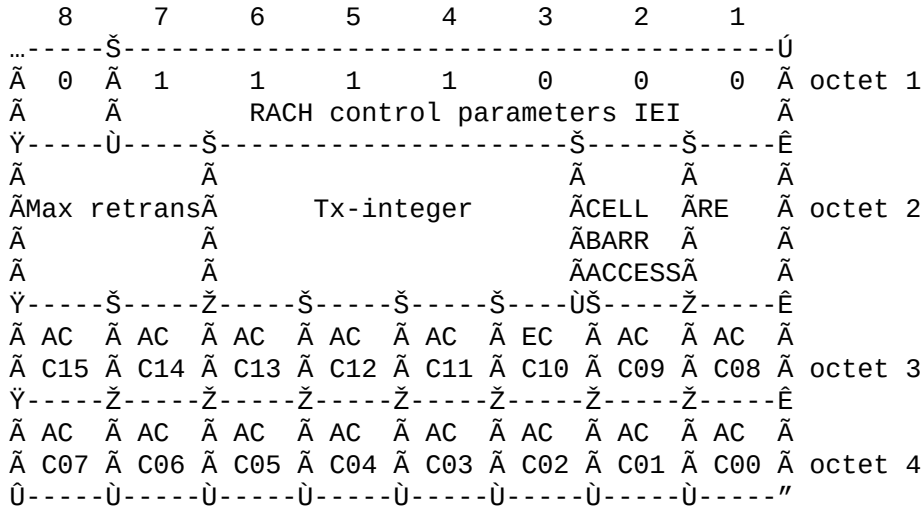


FIGURE 10.36/GSM 04.08
RACH control parameters information element

Max retrans, Maximum number of retransmissions (octet 2)				
Bits				
8	7			
0	0	Maximum [1] retransmission		
0	1	Maximum [2] retransmissions		
1	0	Maximum [4] retransmissions		
1	1	Maximum [7] retransmissions		

Tx-integer, Number of slots to spread transmission (octet 2)				
Bits				
6	5	4	3	
0	0	0	0	[3] slots used to spread transmission
0	0	0	1	[4] slots used to spread transmission
0	0	1	0	[5] slots used to spread transmission
0	0	1	1	[6] slots used to spread transmission
0	1	0	0	[7] slots used to spread transmission
0	1	0	1	[8] slots used to spread transmission
0	1	1	0	[9] slots used to spread transmission
0	1	1	1	[10] slots used to spread transmission
1	0	0	0	[11] slots used to spread transmission
1	0	0	1	[12] slots used to spread transmission
1	0	1	0	[14] slots used to spread transmission
1	0	1	1	[16] slots used to spread transmission
1	1	0	0	[20] slots used to spread transmission
1	1	0	1	[25] slots used to spread transmission
1	1	1	0	[32] slots used to spread transmission
1	1	1	1	[50] slots used to spread transmission

TABLE 10.30/GSM 04.08
RACH control parameters information element

B CELL_BAR_ACCESS, Cell Barred for Access (octet 2)
Bit
2
0 The cell is not barred, see Rec. GSM 05.08
1 The cell is barred, see Rec. GSM 05.08
RE, Call reestablishment allowed (octet 2)
Bit
1
0 Call Reestablishment allowed in the cell
1 Call Reestablishment not allowed in the cell
EC Emergency Call allowed (octet 3 bit 3)
3
0 Emergency call aloowed in the cell to all MSs
1 Emergency call not allowed in the cell except for the MSs that belong to one of the classes between 11 to 15
AC CN, Access Control Class N (octet 3(except bit 3) and octet 4)
For a mobile station with AC C = N access is not barred if the AC CN bit is coded with a "0"; N = 0, 1, .. 9,11, .., 15.

TABLE 10.30/GSM 04.08
RACH control parameters information element (continued)

10.5.2.18 Request reference

The purpose of the request reference information element is to provide the random access information used in the channel request and the frame number, FN modulo 42432 in which the channel request was received.

The request reference information element is coded as shown in Figure 10.37/GSM 04.08 and Table 10.31/GSM 04.08.

The request reference is a type 3 information element with 4 octets length.

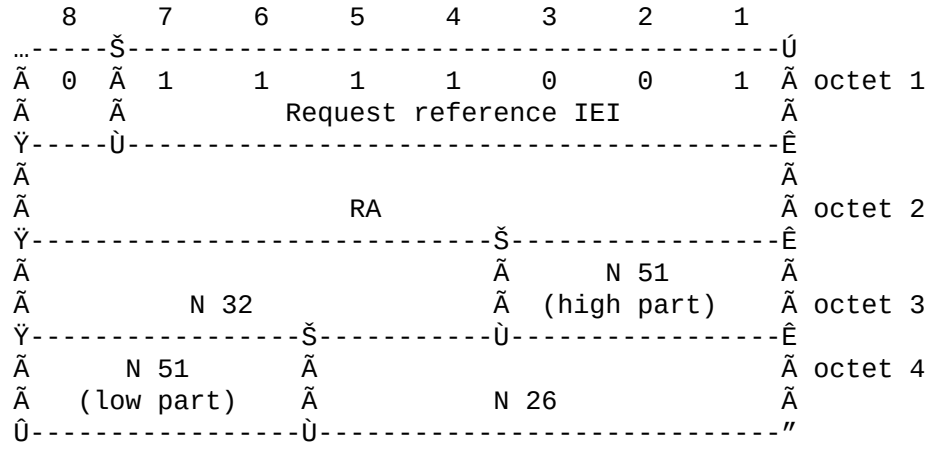


FIGURE 10.37/GSM 04.08
Request reference information element

RA, Random Access Information (octet 2) This is an unformatted 8 bit field. Typically the contents of this field is coded the same as the CHANNEL REQUEST message shown in Table 9.9, section 9.1.8
N32, N51, N26 (octet 3 and 4) The N32-, N51- and N26-fields are coded as in the starting time information element.

TABLE 10.31/GSM 04.08
Request reference information element

10.5.2.19 RR cause

The purpose of the RR cause information element is to provide the reason for release.

The RR cause information element is coded as shown in Figure 10.38/GSM 04.08 and Table 10.32/GSM 04.08.

The RR cause is a type 3 information element with 2 octets length.

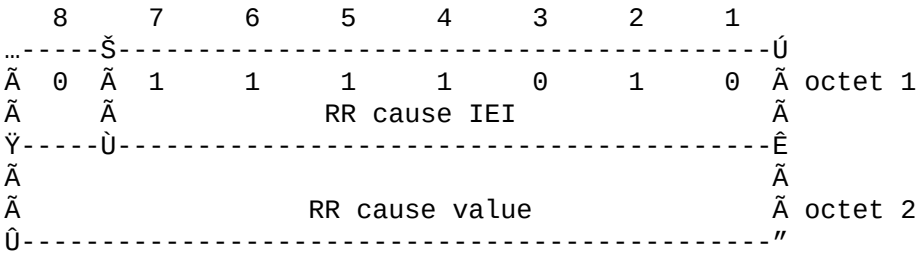


FIGURE 10.38/GSM 04.08
RR cause information element

RR cause value (octet 2)	
Bits	
8 7 6 5 4 3 2 1	
0 0 0 0 0 0 0 0	Normal release
0 0 0 0 0 0 0 1	Abnormal release, unspecified
0 0 0 0 0 0 1 0	Abnormal release, channel unacceptable
0 0 0 0 0 0 1 1	Abnormal release, timer expired
0 0 0 0 0 1 0 0	Abnormal release, no activity on the radio path
0 0 0 0 0 1 0 1	Preemptive release
0 1 0 0 0 0 0 1	Call already cleared
0 1 0 1 1 1 1 1	Invalid message, unspecified
0 1 1 0 0 0 0 1	Message type non-existent or not implemented
0 1 1 0 0 0 1 0	Message type not compatible with control state or non-existent or not implemented
0 1 1 0 0 1 0 0	Invalid information element content
0 1 1 0 0 1 0 1	No cell allocation available
0 1 1 0 1 1 1 1	Protocol error unspecified
The listed RR cause values are defined in Annex F.	

TABLE 10.32/GSM 04.08
RR cause information element

10.5.2.20 Starting time

The purpose of the starting time information element is to provide the start TDMA frame number, FN modulo 42432.

The starting time information element is coded as shown in Figure 10.39/GSM 04.08 and Table 10.33/GSM 04.08.

The starting time is a type 3 information element with 3 octets length.

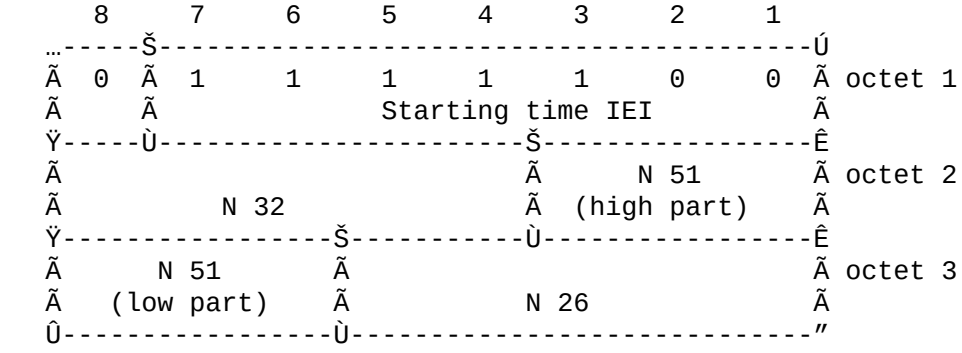


FIGURE 10.39/GSM 04.08
Starting time information element

N32 (octet 2)
The N32 field is coded as the binary representation of (FN div 1326) mod 32.
N51 (octet 2 and 3)
The N51 field is coded as the binary representation of FN mod 51. Bit 3 of octet 2 is the most significant bit and bit 6 of octet 3 is the least significant bit.
N26 (octet 3)
The N26 field is coded as the binary representation of FN mod 26.
Note 1: The frame number, FN modulo 42432 can be calculated as 51x((N51-N26) mod 26)+N51+51x26xN32.
Note 2: The fact that the mobile station only receives the frame number, FN modulo 42432 as starting time means that the maximum time the mobile station can be ordered to wait before starting transmission is 42431 frame periods = 195.8 seconds.

TABLE 10.33/GSM 04.08
Starting time information element

10.5.2.21 Synchronization indication

The purpose of synchronization indication information element is to indicate whether the new cell is synchronized with the old cell or not in connection with handover.

The synchronization indication information element is coded as shown in Figure 10.40/GSM 04.08 and Table 10.34/GSM 04.08.

The synchronization indication is a type 1 information element.

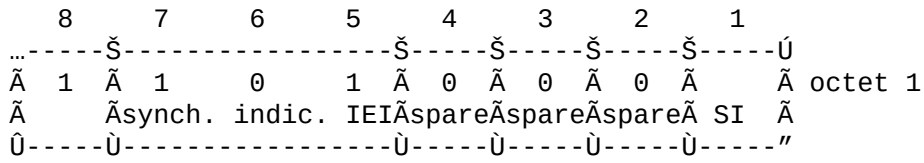


FIGURE 10.40/GSM 04.08
Synchronization indication information element

SI (octet 1) Bit
1
0 Non-synchronized
1 Synchronized

TABLE 10.34/GSM 04.08
Synchronization indication information element

10.5.2.22 Timing advance

The purpose of the timing advance information element is to provide the timing advance value.

The timing advance information element is coded as shown in Figure 10.41/GSM 04.08 and Table 10.35/GSM 04.08

The timing advance is a type 3 information element with 2 octets length.

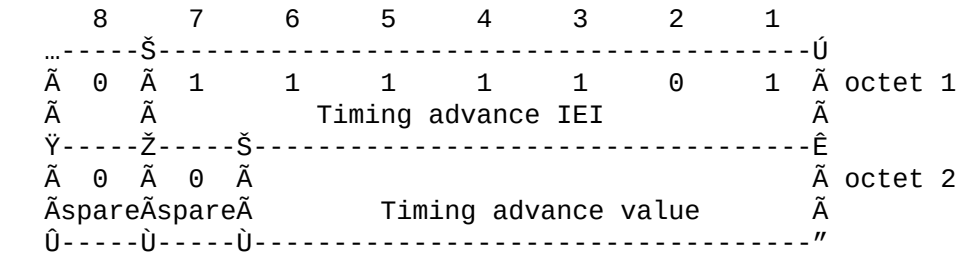


FIGURE 10.41/GSM 04.08
Timing advance information element

Timing advance value (octet 2) The coding of the timing advance value field is the binary representation of the timing advance in bit periods; 1 bit period = 48/13 s.

TABLE 10.35/GSM 04.08
Timing advance information element

10.5.2.23 TMSI

The purpose of the TMSI information element is to provide the Temporary Mobile Subscriber Identity for paging purposes.

The TMSI information element is coded as shown in Figure 10.42/GSM 04.08 and Table 10.36/GSM 04.08.

The TMSI is a type 3 information element with 5 octets length.

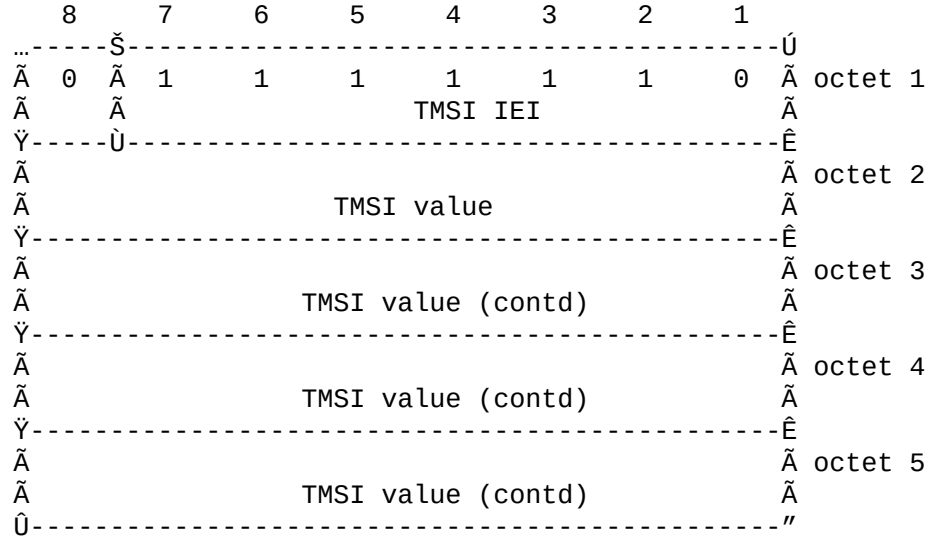


FIGURE 10.42/GSM 04.08
TMSI information element

TMSI value (octet 2, 3, 4 and 5) Bit 8 of octet 2 is the most significant bit and bit 1 of octet 5 is the least significant bit. The coding of the TMSI is left open for each administration and the maximal length is 4 octets. If an administration has chosen less than 4 octets for the TMSI then the TMSI should be filled with zeroes ahead of the most significant bit so that the TMSI consists of 4 octets. Note: For purposes other than paging the TMSI should be provided using the mobile identity information element.

TABLE 10.36/GSM 04.08
TMSI information element

10.5.2.24 Wait indication

The purpose of the wait indication information element is to provide the time the mobile station should wait before attempting another channel request.

The wait indication information element is coded as shown in Figure 10.43/GSM 04.08 and Table 10.37/GSM 04.08.

The wait indication is a type 3 information element with 2 octets length.

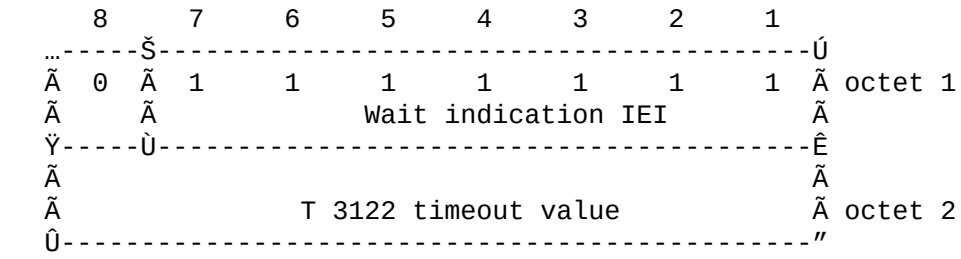


FIGURE 10.43/GSM 04.08
Wait indication information element

T3122 timeout value (octet 2)

This field is coded as the binary representation of the T3122 timeout value in seconds.

TABLE 10.37/GSM 04.08
Wait indication information element

10.5.3 Mobility management information elements.

For the mobility management information elements listed below, the coding of the information element identifier bits is summarized in Table 10.38/GSM 04.08.

8 7 6 5 4 3 2 1		Reference section	Length in octets 1)
	Type 1 info elements		
0 0 1 - - - -	CM service type	10.5.3.3	F1
1 0 0 - - - -	Identity type	10.5.3.4	F1
1 1 0 - - - -	Location updating type	10.5.3.5	F1
	Type 3 & 4 info elements		
1 0 0 0 0 0 1	Authentication parameter RAND	10.5.3.1	F17
1 0 0 0 0 1 0	Authentication parameter SRES	10.5.3.2	F5
1 0 0 0 1 0 0	Reject cause	10.5.3.6	F2
All other values are reserved 2)			

TABLE 10.38/GSM 04.08
Information element identifier coding for mobility management information elements

Note 1: For fixed length information elements the length is indicated as F length value e.g. F3. For variable length information elements the length is indicated as Max length value e.g. Max 10.
The indicated length is the length included information element identifier and a possible length indicator. When an information element is mandatory in a message the length is reduced with 1 octet as the information element identifier is stripped off.

Note 2: The reserved value with bits 5-8 coded "0000" are for future information elements for which comprehension by the receiver is required (see section 8.8.1 Unrecognized information element).

10.5.3.1 Authentication parameter RAND

The purpose of the authentication parameter RAND information element is to provide the mobile station with a non- predictable number to be used to calculate the authentication response signature SRES and the ciphering key Kc.

The authentication parameter RAND information element is coded as shown in Figure 10.44/GSM 04.08 and Table 10.39/GSM 04.08.

The authentication parameter RAND is a type 3 information element with 17 octets length.

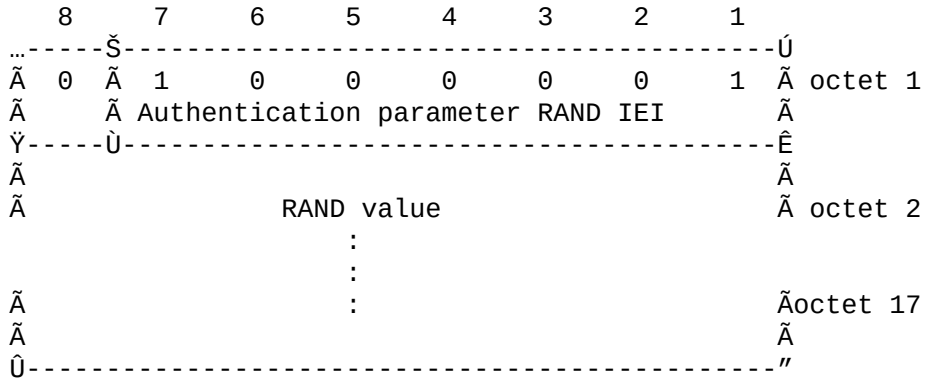


FIGURE 10.44/GSM 04.08
Authentication parameter RAND information element

RAND value (octet 2, 3,... and 17) The RAND value consists of 128 bits. Bit 8 of octet 2 is the most significant bit while bit 1 of octet 17 is the least significant bit.

TABLE 10.39/GSM 04.08
Authentication parameter RAND information element

10.5.3.2 Authentication parameter SRES

The purpose of the authentication parameter SRES information element is to provide the network with the authentication response signature calculated in the mobile station.

The authentication parameter SRES information element is coded as shown in Figure 10.45/GSM 04.08 and Table 10.40/GSM 04.08.

The authentication parameter SRES is a type 3 information element with 5 octets length.

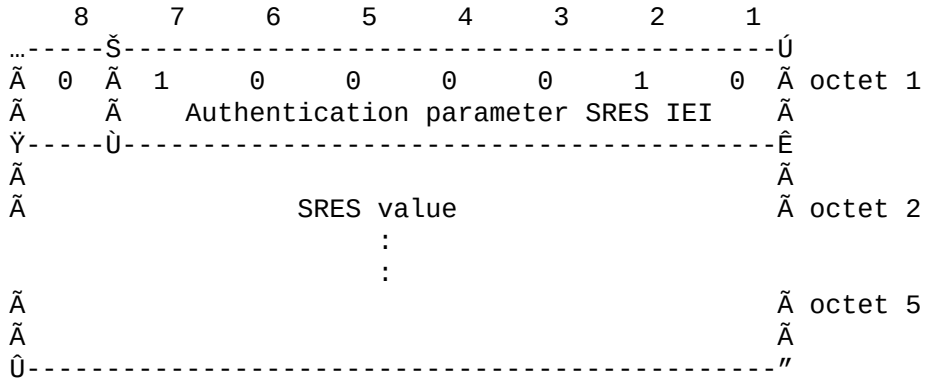


FIGURE 10.45/GSM 04.08
Authentication parameter SRES information element

SRES value (octet 2, 3, 4 and 5) The SRES value consists of 32 bits. Bit 8 of octet 2 is the most significant bit while bit 1 of octet 5 is the least significant bit.

TABLE 10.40/GSM 04.08
Authentication parameter SRES information element

10.5.3.3 CM service type

The purpose of the CM service type information element is to specify which service is requested from the network.

The CM service type information element is coded as shown in Figure 10.46/GSM 04.08 and Table 10.41/GSM 04.08.

The CM service type is a type 1 information element .

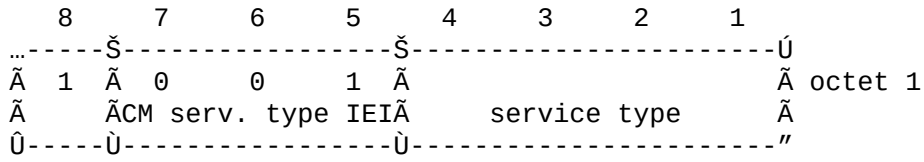


FIGURE 10.46/GSM 04.08
CM service type information element

Service type (octet 1) Bits 4 3 2 1	
0 0 0 1	Mobile originating call establishment or packet mode connection establishment
0 0 1 0	Emergency call establishment
0 1 0 0	Short message transfer
1 0 0 0	Supplementary service activation
All other values are reserved.	

TABLE 10.41/GSM 04.08
CM service type information element

10.5.3.4 Identity type

The purpose of the identity type information element is to specify which identity is requested.

The identity type information element is coded as shown in Figure 10.47/GSM 04.08 and Table 10.42/GSM 04.08.

The identity type is a type 1 information element .

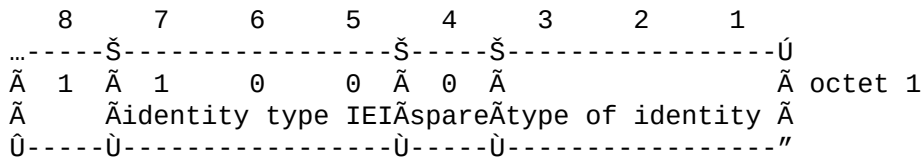


FIGURE 10.47/GSM 04.08
Identity type information element

Type of identity (octet 1)	
Bits	
3 2 1	
0 0 1	IMSI
0 1 0	IMEI
1 0 0	TMSI
All other values are reserved.	

TABLE 10.42/GSM 04.08
Identity type information element

10.5.3.5 Location updating type

The purpose of the location updating type information element is to indicate whether a normal updating, a periodic updating or an IMSI attach is wanted.

The location updating type information element is coded as shown in Figure 10.48/GSM 04.08 and Table 10.43/GSM 04.08.

The location updating type is a type 1 information element.

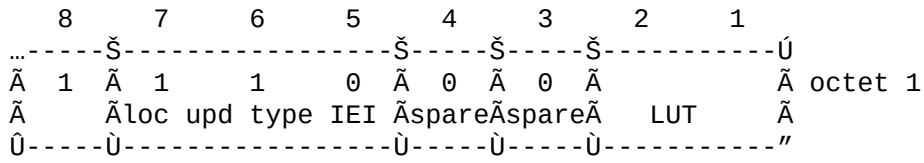


FIGURE 10.48/GSM 04.08
Location updating type information element

LUT (octet 1) Bits	
2 1	
0 0	Normal location updating
0 1	Periodic updating
1 0	IMSI attach
1 1	Reserved

TABLE 10.43/GSM 04.08
Location updating type information element

10.5.3.6 Reject cause

The purpose of the reject cause information element is to indicate the reason why a request from the mobile station is rejected by the network.

The reject cause information element is coded as shown in Figure 10.49/GSM 04.08 and Table 10.44/GSM 04.08.

The reject cause is a type 3 information element with 2 octets length.

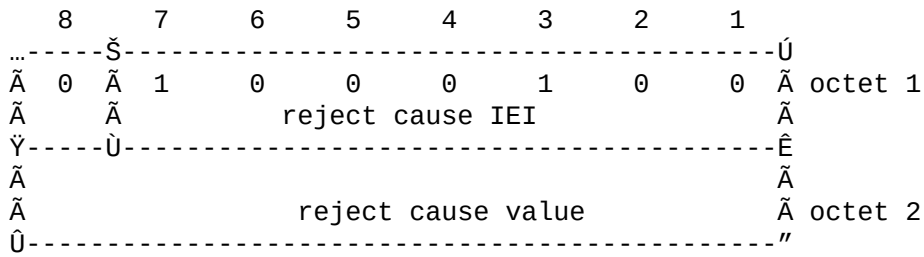


FIGURE 10.49/GSM 04.08
Reject cause information element

Reject cause value (octet 2)	
Bits	
8 7 6 5 4 3 2 1	
0 0 0 0 0 0 0 1	Unallocated TMSI
0 0 0 0 0 0 1 0	IMSI unknown in HLR
0 0 0 0 0 0 1 1	Illegal MS
0 0 0 0 0 1 0 0	IMSI unknown in VLR
0 0 0 0 0 1 0 1	IMEI not accepted
0 0 0 0 1 0 1 1	PLMN not allowed
0 0 0 0 1 1 0 0	Location Area not allowed
0 0 0 1 0 0 0 1	Network failure
0 0 0 1 0 1 1 0	Congestion
0 0 1 0 0 0 0 0	Service option not supported
0 0 1 0 0 0 0 1	Requested service option not subscribed
0 0 1 0 0 0 1 0	Service option temporarily out of order
0 0 1 0 0 1 1 0	Call cannot be identified
0 1 0 1 1 1 1 1	Invalid message, unspecified
0 1 1 0 0 0 0 0	Mandatory information element error
0 1 1 0 0 0 0 1	Message type non-existent or not implemented
0 1 1 0 0 0 1 0	Message not compatible with the call state or not implemented
0 1 1 0 0 0 1 1	Information element non-existent or not implemented
0 1 1 0 0 1 0 0	Invalid information element contents
0 1 1 0 0 1 0 1	Message not compatible with the call state
0 1 1 0 1 1 1 1	Protocol error, unspecified
All other values are reserved.	
Note: The listed reject cause values are defined in Annex G.	

TABLE 10.44/GSM 04.08
Reject cause information element

10.5.4 Call control information elements.

For the call control information elements listed below, the coding of the information element identifier bits is summarized in Table 10.45/GSM 04.08.

8 7 6 5 4 3 2 1		Reference section	Length in octets 1)
1 : : : - - - -	Type 1 info elements		
0 0 0	reserved		
0 0 1 - - - -	shift	10.5.4.2 and .3	F1
0 1 1 - - - -	congestion level	10.5.4.9	F1
1 0 1 - - - -	repeat indicator	10.5.4.16	F1
1 0 1 0 : : : :	Type 2 information elements		
0 0 0 0	more data	10.5.4.13	F1
0 : : : : : : :	Type 3 & 4 info elements		
0 0 0 0 1 0 0	Bearer capability	10.5.4.4	Max 11
0 0 0 1 0 0 0	Cause	10.5.4.8	Max 32
0 0 1 0 1 0 0	Call state	10.5.4.5	F2
0 0 1 1 1 0 0	Facility	Rec. GSM 04.10	Max ?
0 0 1 1 1 1 0	Progress indicator	10.5.4.15	Max 4
0 1 0 0 1 1 1	Notification indic.	10.5.4.14	F2
0 1 0 1 1 0 0	Keypad facility 2)	10.5.4.11	F2
1 0 1 1 1 0 0	Calling party BCD number	10.5.4.7	Max 14
1 0 1 1 1 0 1	Calling party subad	10.5.4.7a	Max 23
1 0 1 1 1 1 0	Called party BCD number	10.5.4.6	Max 13
1 1 0 1 1 0 1	Called party subad	10.5.4.6a	Max 23
1 1 1 1 1 0 0	Low layer compatib.	10.5.4.12	Max 15
1 1 1 1 1 0 1	High layer compatib.	10.5.4.10	Max 5
0 1 1 0 1 0 0	Signal	10.5.4.17	F2
1 1 1 1 1 1 0	User-user	10.5.4.18	Max 131
1 1 1 1 1 1 1	reserved		
All other values are reserved 3)			

TABLE 10.45/GSM 04.08
Information element identifier coding for call control information elements

Note 1: For fixed length information elements the length is indicated as F length value e.g. F3. For variable length information elements the length is indicated as Max length value e.g. Max 10.
The indicated length is the length included information element identifier and a possible length indicator. When an information element is mandatory in a message the length is reduced with 1 octet as the information element identifier is stripped off.

Note 2: For the time being the only purpose of this information element is to transfer one DTMF digit.

Note 3: The reserved value with bits 5-8 coded "0000" are for future information elements for which comprehension by the receiver is required (see section 8.8.1 Unrecognized information element).

10.5.4.1 Extentions of codesets

There is a certain number of possible information element identifier values using the formatting rules described in sect. 10.5: 128 from the type 3 & 4 information element format and at least 8 from the type 1 & 2 information element format.

One value in the type 1 format is specified for shift operations described below. One other value in both the type 3 & 4 and type 1 format is reserved. This leaves 133 information element identifier values available for assignment.

It is possible to expand this structure to eight codesets of 133 information element identifier values each. One common value in the type 1 format is employed in each codeset to facilitate shifting from one codeset to another. The contents of this shift information element identifies the codeset to be used for the next information element or elements. The codeset in use at any given time is referred to as the "active codeset". By convention, codeset 0 is the initially active codeset.

Two codeset shifting procedures are supported: locking shift and non-locking shift.

Codeset 5 is reserved for information elements reserved for national use.
Codeset 6 is reserved for information elements specific to the local network (either public or private).
Codeset 7 is reserved for user-specific information elements.

The coding rules specified in section 10.5 shall apply for information elements belonging to any active codeset.
Transitions from one active codeset to another (i.e. by means of the locking shift procedure) may only be made to a codeset with a higher numerical value than the codeset being left.

An information element belonging to codeset 5, 6 or 7 may appear together with information elements belonging to codeset 0, by using the non-locking shift procedure (see section 10.5.4.3).

A user or network equipment shall have the capability to recognise a shift information element and to determine the length of the following information element, although the equipment need not be able to interpret and act on the content of the information element. This enables the equipment to determine the start of the subsequent information element.

10.5.4.2 Locking shift procedure

The locking shift procedure employs an information element to indicate the new active codeset. The specified codeset remains active until another locking shift information element is encountered which specifies the use of another codeset. For example, codeset 0 is active at the start of message content analysis. If a locking shift to codeset 7 is encountered, the next information elements will be interpreted according to the information element identifiers assigned in codeset 7, until another shift information element is encountered. This procedure is used only to shift to a higher order codeset than the one being left.

The locking shift is valid only within that message which contains the locking shift information element. At the start of every message content analysis, the active codeset is codeset 0.

The locking shift information element uses the type 1 information element format and coding shown in Figure 10.50/GSM 04.08 and Table 10.46/GSM 04.08.

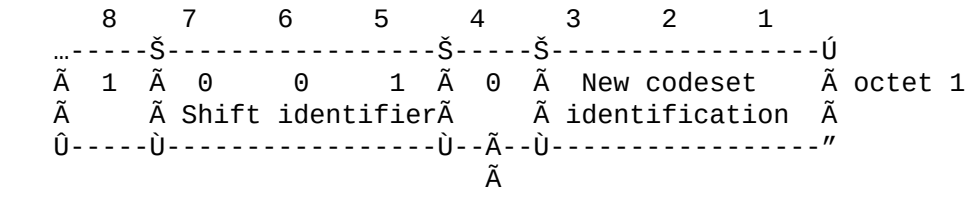


FIGURE 10.50/GSM 04.08
Locking shift element

Codeset identification (octet 1):			
bits	3	2	1
	0	0	0
	0	0	1
to	1	0	0
	1	0	1
	1	1	0
	1	1	1

not applicable
reserved
codeset 5: information elements for national use
codeset 6: information elements specific to the local network (either public or private)
codeset 7: user-specific information elements

TABLE 10.46/GSM 04.08
Locking shift element

10.5.4.3 Non-locking shift procedure

The non-locking shift procedure provides a temporary shift to the specified lower or higher codeset. The non-locking shift procedure uses a type 1 information element to indicate the codeset to be used to interpret the next information element. After the interpretation of the next information element, the active codeset is again used for interpreting any following information elements. For example, codeset 0 is active at the beginning of message content analysis. If a non-locking shift to codeset 6 is encountered, only the next information element is interpreted according to the information element identifiers assigned in codeset 6. After this information element is interpreted, codeset 0 will again be used to interpret the following information elements. A non-locking shift information element indicating the current codeset shall not be regarded as an error.
A locking shift information element shall not follow directly a non-locking shift information element. If this combination is received, it shall be interpreted as though a locking shift information element had been received.

The non-locking shift information element uses the type 1 information format and coding shown in Figure 10.51/GSM 04.08 and Table 10.47/GSM 04.08.

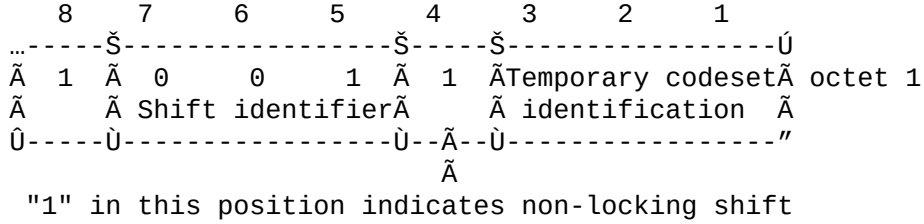


FIGURE 10.51/GSM 04.08
Non-locking shift element

Codeset identification (octet 1):			
bits 3 2 1			
0 0 0	codeset 0 (initially active): Rec. GSM 04.08 information elements		
0 0 1			
to 1 0 0	reserved		
1 0 1	codeset 5: information elements for national use		
1 1 0	codeset 6: information elements specific to the local network (either public or private)		
1 1 1	codeset 7: user-specific information elements.		

TABLE 10.47/GSM 04.08
Non-locking shift element

10.5.4.4 Bearer capability

The purpose of the bearer capability information element is to indicate a requested bearer service to be provided by the network. It contains only information which may be used by the network. The use of the bearer capability information element in relation to compatibility checking is described in Annex B.

The bearer capability information element is coded as shown in Figure 10.52/GSM 04.08 and Tables 10.48a/GSM 04.08 to 10.48h/GSM 04.08.

No default bearer capability may be assumed by the absence of this information element.

The bearer capability is a type 4 information element with 11 octets length maximal.

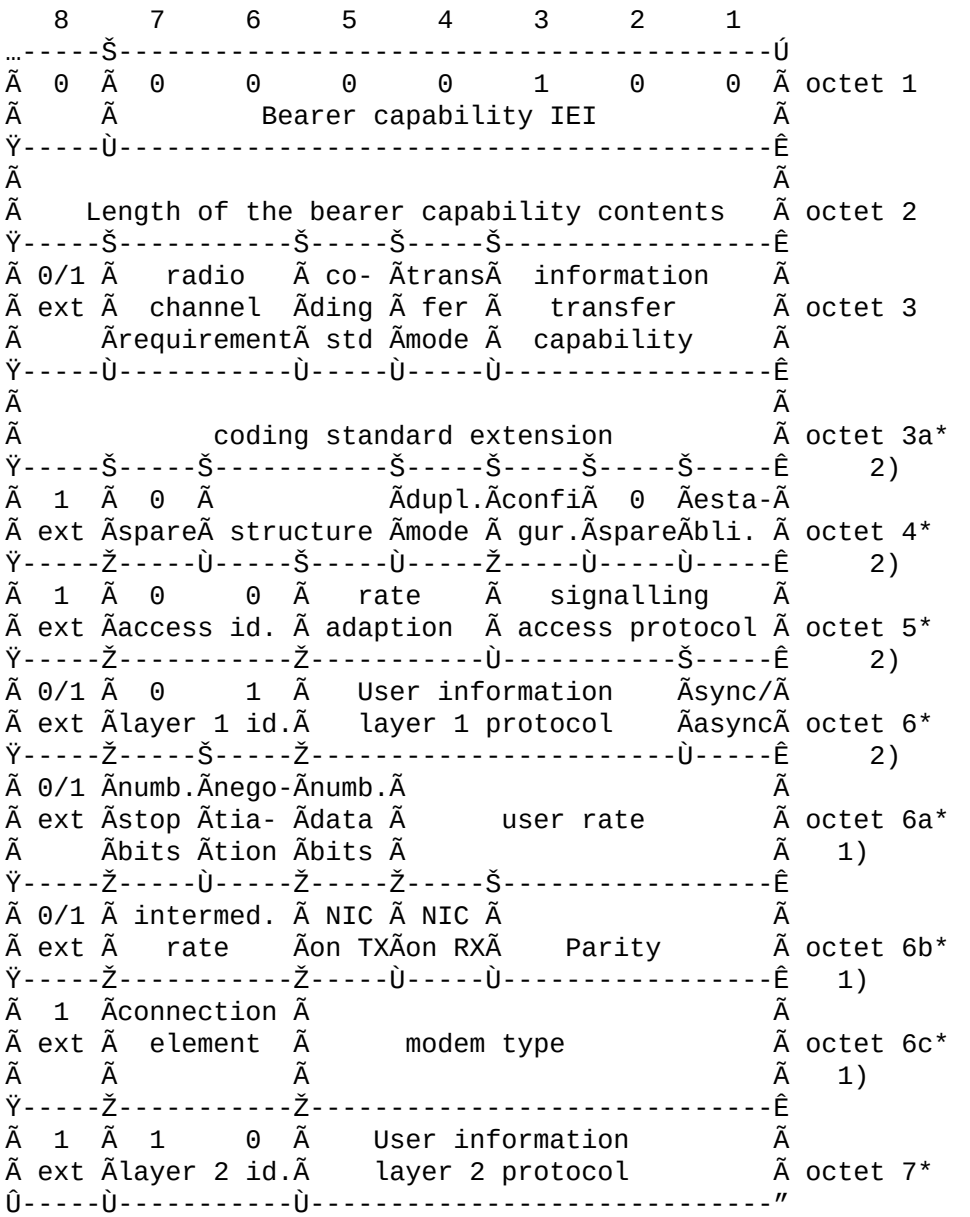


FIGURE 10.52/GSM 04.08
Bearer capability information element

Note: The coding of the octets of the bearer capability information element is not conforming to rec. CCITT Q.931.

Note 1: This octet shall be present if and only if octet 5 is present and indicates CCITT standardized rate adaption V.110/X.30, "No rate adaption" or X.31 flagstuffing (see GSM 07.01).

Note 2: This octet shall be present only if octet 3 does not indicate speech.

Radio channel requirement (octet 3) (note 1)	
Bits	
7 6	
0 0	half rate channel
0 1	full rate channel
1 0	dual rate/half rate preferred
1 1	dual rate/full rate preferred
Coding standard (octet 3)	
Bit	
5	
0	GSM standardized coding as described below
1	other coding as, specified in octet 3a
Transfer mode (octet 3)	
Bit	
4	
0	circuit mode
1	packet mode

TABLE 10.48a/GSM 04.08
Bearer capability information element

Note 1: this parameter is only significant in the MS to network direction (i.e. it shall be ignored when received by the MS).

Information transfer capability (octet 3)	
Bits	
3 2 1	
0 0 0	speech
0 0 1	unrestricted digital information
0 1 0	3.1 kHz audio, ex PLMN
0 1 1	fascimile group 3 (note 1)
1 0 0	speech followed by unrestricted digital information
1 1 1	reserved, to be used in the network. The meaning is: alternate speech/facsimile group 3- starting with speech (note 1/ note 2)
All other values are reserved.	

Note 1: If fascimile group 3 or alternate speech/facsimile group 3 - starting with speech is selected then no modem type should be selected (octet 6c).

Note 2:this value applies for transport of a single BC in MAP operations only. The indication of this value implies a full rate channel for the speech phase

Editors note: The Bearer services
- Alternate speech/group 3 fascimile,
- Alternate speech/unrestricted digital information,
- Speech then unrestricted digital information

are realized by GSM 04.08 in-call modification procedure (sequential selection).

Coding standard extension (octet 3a)	
All values are reserved.	

Structure (octet 4)	
Bits	
6 5	
0 0	service data unit integrity
1 1	unstructured
All other values are reserved.	

Duplex mode (octet 4)	
Bit 4	
0	half duplex
1	full duplex

TABLE 10.48b/GSM 04.08
Bearer capability information element

Configuration (octet 4)	
Bit	
3	
0	point-to-point
All other values are reserved.	
Establishment (octet 4)	
Bit	
7	
0	demand
All other values are reserved	
Rate adaption (octet 5)	
Bits	
5 4	
0 0	no rate adaption
0 1	V.110/X.30 rate adaption
1 0	CCITT X.31 flag stuffing
All other values are reserved.	

TABLE 10.48c/GSM 04.08
Bearer capability information element

Signalling access protocol (octet 5)	
Bits	
3 2 1	
0 0 1	I.440/450
0 1 0	X.21
0 1 1	X.28 - dedicated PAD, individual NUI
1 0 0	X.28 - dedicated PAD, universal NUI
1 0 1	X.28 - non dedicated PAD
1 1 0	X.32
All other values are reserved.	
User information layer 1 protocol (octet 6)	
Bits	
5 4 3 2	
0 0 0 0	default layer 1 protocol
All other values reserved.	

TABLE 10.48d/GSM 04.08
Bearer capability information element

Synchronous/asynchronous (octet 6)
Bit
1
0 synchronous
1 asynchronous
Number of Stop Bits (octet 6a)
Bit
7
0 1 bit (note)
1 2 bits
Note : This is also used in case of synchronous mode.
Negotiation (octet 6a)
Bit
6
0 in-band negotiation not possible
Note - See rec. V.110 and X.30
All other values are reserved
Number of data bits excluding parity bit if present (octet 6a)
Bit
5
0 7 bits
1 8 bits (note)
Note - This code 1 is also used in case of bit oriented protocols.
User rate (octet 6a)
Bits
4 3 2 1
0 0 0 1 0.3 kbit/s Recommendation X.1 and V.110
0 0 1 0 1.2 kbit/s Recommendation X.1 and V.110
0 0 1 1 2.4 kbit/s Recommendation X.1 and V.110
0 1 0 0 4.8 kbit/s Recommendation X.1 and V.110
0 1 0 1 9.6 kbit/s Recommendation X.1 and V.110
0 1 1 0 12.0 kbit/s transparent (non compliance with X.1 and V.110)
0 1 1 1 1.2 kbit/s/75 bit/s Recommendation V.23, (asymmetric) X.1,V.110.
All other values are reserved.
Note: for facsimile group 3 calls the user rate indicates the first and maximum speed the mobile station is using.

TABLE 10.48e/GSM 04.08
Bearer capability information element

Octet 6b for V.110/X.30 rate adaption
Intermediate rate (octet 6b)
Bits
7 6
0 0 not used
0 1 4 kbit/s
1 0 8 kbit/s
1 1 16 kbit/s
Network independent clock (NIC) on transmission (Tx)
(octet 6b)
Bit
5
0 does not require to send data with
network independent clock
1 requires to send data with network
independent clock
Note - See Rec. V.110 and X.30
Network independent clock (NIC) on reception (Rx)
(octet 6b)
Bit
4
0 cannot accept data with network independent
clock (i.e. sender does not support this
optional procedure)
1 can accept data with network independent
clock (i.e. sender does support this
optional procedure)
Note - See Rec. V.110 and X.30.
Parity information (octet 6b)
Bits
3 2 1
0 0 0 odd
0 1 0 even
0 1 1 none
1 0 0 forced to 0
1 0 1 forced to 1
All other values are reserved.

TABLE 10.48f/GSM 04.08
Bearer capability information element

Connection element (octet 6c) (Note 1)	
Bit	
7 6	
0 0	transparent
0 1	non transparent (RLP)
1 0	both, transparent preferred
1 1	both, non transparent preferred

Note 1 : The requesting end (e.g. the one sending the SETUP message) should use the 4 values depending on its capabilities to support the different modes. The answering party should only use the codings 00 or 01, based on its own capabilities and the proposed choice if any. If both MS and network support both transparent and non transparent, priority should be given to the MS preference.

Modem type (octet 6c)	
Bits	
5 4 3 2 1	
0 0 0 0 0	none
0 0 0 0 1	V.21
0 0 0 1 0	V.22
0 0 0 1 1	V.22 bis
0 0 1 0 0	V.23
0 0 1 0 1	V.26 ter
0 0 1 1 0	V.32
0 0 1 1 1	modem for undefined interface
0 1 0 0 0	autobauding type 1 (note 2)

All other values are reserved.

Note 2: "Autobauding type 1" should only be used in conjunction with the "non transparent" "Connection element" (octet 6c, bit 6: set to 1).

TABLE 10.48g/GSM 04.08
Bearer capability information element

User information layer 2 protocol (octet 7)	
Bits	
5 4 3 2 1	
0 0 1 1 0	recommendation X.25, link level
0 1 0 0 0	IA5
0 1 0 0 1	X.75 layer 2 modified (teletex)
0 1 0 1 0	videotex profile 1
0 1 0 1 1	fascimile group 3
0 1 1 0 0	videotex profile 3
All other values are reserved.	
Note: If the transfer mode is "packet mode", octet 7 shall be present. For other cases, if the user layer 2 protocol is to be identified to the network, then octet 7 shall be present, otherwise octet 7 shall be omitted.	

TABLE 10.48h/GSM 04.08
Bearer capability information element

10.5.4.5 Call state

The purpose of the call state information element is to describe the current status of a call, (see section 5.1), or the state of an access connection (see section 6.2).

The call state information element is coded as shown in Figure 10.53/GSM 04.08 and Table 10.49/GSM 04.08.

The call state is a type 3 information element with 2 octets length.

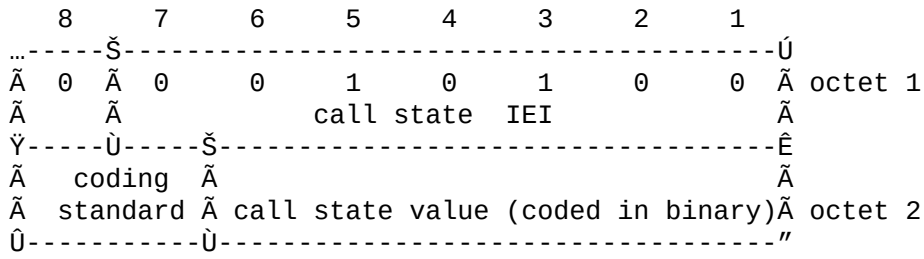


FIGURE 10.53/GSM 04.08
Call state information element

Coding standard (octet 2)		
Bits		
8 7		
0 0	standardized coding as described in CCITT Rec. Q.931 (Note)	
0 1	reserved for other international standards (Note)	
1 0	national standard (Note)	
1 1	standard defined for the GSM/PLMNS as described below	
Note: These other coding standards should be used only when the desired call state cannot be represented with the GSM standardized coding.		
Call state value (octet 2)		
Bits		
0 0 0 0 0 0	UO - null	NO - null
0 0 0 0 1 0	U0.1- MM-connection pending	N0.1- MM-connection pending
0 0 0 0 0 1	U1 - call initiated	N1 - call initiated
0 0 0 0 1 1	U3 - mobile originating call proceeding	N3 - mobile originating call proceeding
0 0 0 1 0 0	U4 - call delivered	N4 - call delivered
0 0 0 1 1 0	U6 - call present	N6 - call present
0 0 0 1 1 1	U7 - call received	N7 - call received
0 0 1 0 0 0	U8 - connect request	N8 - connect request
0 0 1 0 0 1	U9 - mobile terminating call proceeding	N9 - mobile terminating call proceeding
0 0 1 0 1 0	U10- active	N10- active
0 0 1 0 1 1	U11- disconnect request	N11- disconnect request
0 0 1 1 0 0	U12- disconnect indication	N12-disconnect indication
0 1 0 0 1 1	U19- release request	N19- release request
0 1 1 0 1 0	U26- mobile originating modify	N26- mobile originating modify
0 1 1 0 1 1	U27- mobile terminating modify	N27- mobile terminating modify
0 1 1 1 0 0		N28- connect indication
0 1 1 1 1 0		Npa- assignment pending (p=3,4,7 or 9)

TABLE 10.49/GSM 04.08
Call state information element

10.5.4.6 Called party BCD number

The purpose of the called party BCD number information element is to identify the called party.

The called party BCD number information element is coded as shown in Figure 10.54/GSM 04.08 and Table 10.50/GSM 04.08.

The called party BCD number is a type 4 information element with 13 octets length maximal.

If the called party BCD number information element is included in a SETUP message for emergency call establishment, the length indicator will be set to 0.

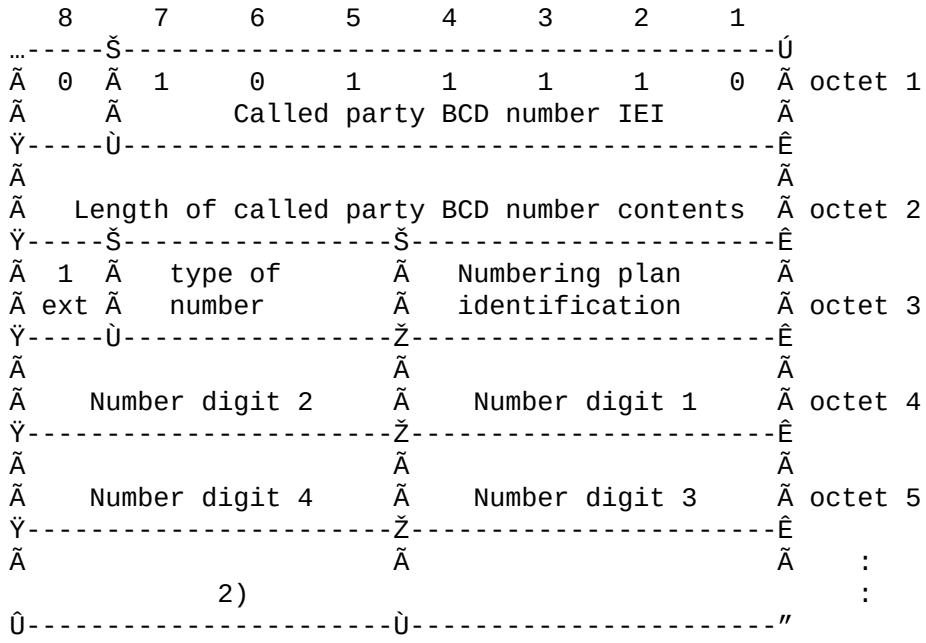


FIGURE 10.50/GSM 04.08
Called party BCD number information element

Note 1: The number digit(s) in octet 4 precedes the digit(s) in octet 5 etc. The number digit which would be entered first is located in octet 4.

Note 2: If the called party BCD number contains an odd number of digits, bits 5 to 8 of the last octet shall be filled with an end mark coded as "1111".

Since the information element must contain the complete called party BCD number there is no need of an additional complete-indication.

Type of number (octet 3)	
Bits	
7 6 5	
0 0 0	unknown (Note 2)
0 0 1	international number (Note 3, Note 5)
0 1 0	national number (Note 3)
0 1 1	network specific number (Note 4)
1 0 0	dedicated PAD access, short code
1 0 1	reserved
1 1 0	reserved
1 1 1	reserved for extension

TABLE 10.50/GSM 04.08
Called party BCD number

Note 1: For the definition of "number" see CCITT Recommendation I.330 and Rec. GSM 03.03.

Note 2: The type of number "unknown" is used when the user or the network has no knowledge of the type of number, e.g. international number, national number, etc. In this case the number digits field is organized according to the network dialling plan , e.g. prefix or escape digits might be present.

Note 3: Prefix or escape digits shall not be included.

Note 4: The type of number "network specific number" is used to indicate administration/service number specific to the serving network, e.g. used to access an operator.

Note 5: The international format shall also be accepted by the MSC also when the call is destined to a destination in the same country as the MSC.

Numbering plan identification (octet 3)	
Number plan (applies for type of number = 000, 001, 010 and 100)	
Bits	
4 3 2 1	
0 0 0 0	unknown (note)
0 0 0 1	ISDN/telephony numbering plan (Rec. E.164/E.163)
0 0 1 1	data numbering plan (Recommendation X.121)
0 1 0 0	telex numbering plan (Recommendation F.69)
1 0 0 0	national numbering plan
1 0 0 1	private numbering plan
1 1 1 1	reserved for extension
All other values are reserved.	

TABLE 10.50/GSM 04.08
Called party BCD number (continued)

Note: The numbering plan "unknown" is used when the user or network has no knowledge of the numbering plan. In this case the number digits field is organized according to the network dialling plan; e.g. prefix or escape digits might be present.

Number digits (octets 4, etc.)	
Bits	Number digit value
4 3 2 1 or	
8 7 6 5	
0 0 0 0	0
0 0 0 1	1
0 0 1 0	2
0 0 1 1	3
0 1 0 0	4
0 1 0 1	5
0 1 1 0	6
0 1 1 1	7
1 0 0 0	8
1 0 0 1	9
In accordance with Recommendations E.164 and I.330, only the decimal digits 0-9 shall be used in number information.	
1 0 1 0	*
1 0 1 1	#
1 1 0 0	a
1 1 0 1	b
1 1 1 0	c
1 1 1 1	used as endmark in case of an odd number information

TABLE 10.50/GSM 04.08
Called party BCD number (continued)

10.5.4.6a Called party subaddress

The purpose of the Called party subaddress is to identify the subaddress of the called party of a call. For the definition of a subaddress see Rec. CCITT I.330.
The Called party subaddress information element is coded as shown in Figure 10.55a/GSM 04.08 and Table10.55a/GSM 04.08
The maximum length of this information element is 23 octets

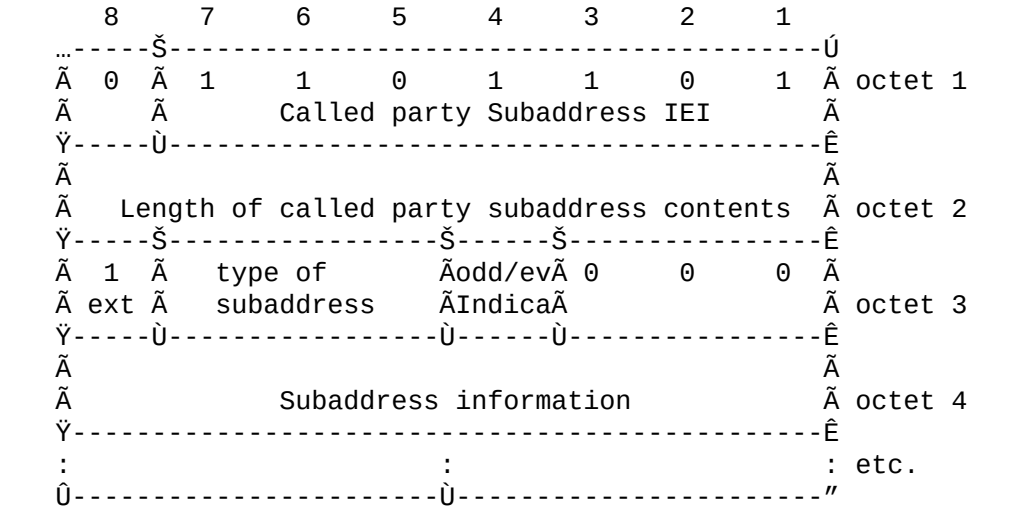


FIGURE 10.55a/GSM 04.08
Called party subaddress

Type of subaddress (octet 3)
Bits
7 6 5
0 0 0 NSAP (X.213/ISO 8348 AD2)
0 1 0 User specified
All other values are reserved
Odd/even indicator (octet 3)
Bit
4
0 even number of address signals
1 odd number of address signals
Note: The odd/even indicator is used when the type of subaddress is "user specified and the coding is BCD
Subaddress information (octet 4, etc...)
The NSAP X.213/ISO8348AD2 address shall be formated as specified by octet 4 which contains the Authority and Format Identifier (AFI). The encoding is made according to the "preferred binary encoding" as defined in X.213/ISO8348AD2. For the definition of this type of this type of subaddress, see Rec. CCITT I.332.

TABLE 10.55a/GSM 04.08
Called party subaddress

Coding examples are given in ANNEX E.
For User-specific subaddress, this field is encoded according to the user specification, subject to a maximum length of 20 octets. When interworking with X.25 networks BCD coding should be applied.
Note: It is recommended that users apply NSAP subaddress type since this subaddress type allows the use of decimal, binary and IA5 characters in a standardised manner.

Table 10.55a/GSM 04.08 (continued)

10.5.4.7 Calling party BCD number

The purpose of the calling party BCD number information element is to identify the origin of a call.

The calling party BCD number information element is coded as shown in Figure 10.55/GSM 04.08 and Table 10.51/GSM 04.08.

The calling party BCD number is a type 4 information element with 14 octets length maximal.

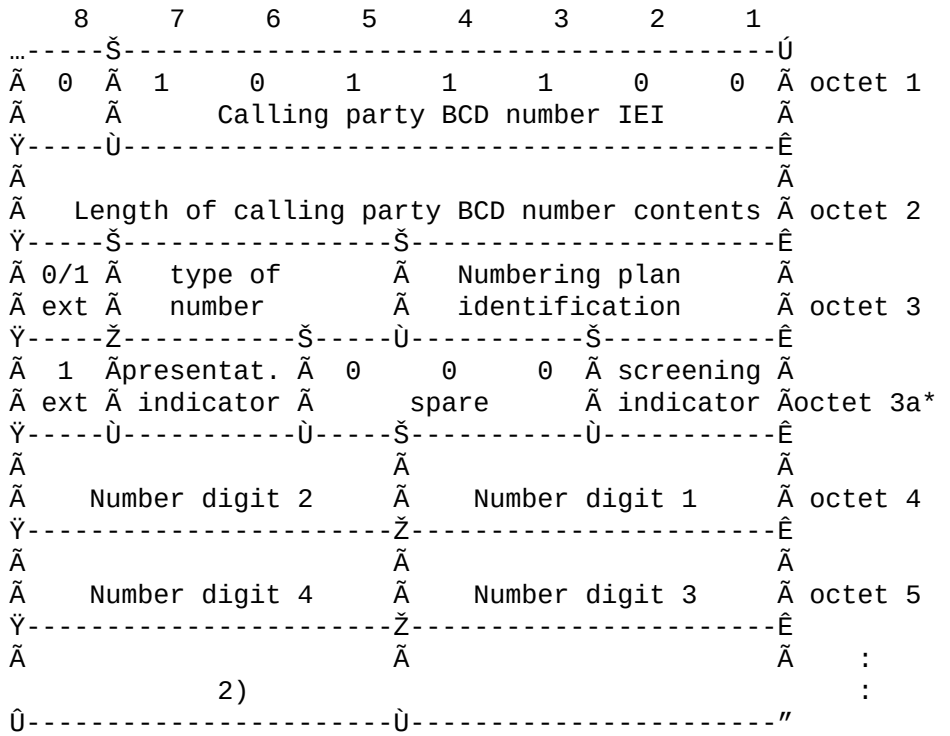


FIGURE 10.55/GSM 04.08
Calling party BCD number information element

Note 1: The contents of octets 3, 4, etc. are coded as shown in Table 10.50. The coding of octet 3a is defined in Table 10.51 below.

Note 2: If the called party BCD number contains an odd number of digits, bits 5 to 8 of the last octet shall be filled with an end mark coded as "1111".

Presentation indicator (octet 3a)
Bits
7 6
0 0 Presentation allowed
0 1 Presentation restricted
1 0 Number not available due to interworking
1 1 Reserved
Note: In the mobile originating case, the presentation indicator is used for indicating the intention of the calling mobile station for the presentation of the calling party number to the called user. This may also be requested on a subscription basis. If octet 3a is omitted, and the network does not support subscription information for the calling party number information restrictions, the value "00 - presentation allowed" is assumed.
Screening indicator (octet 3a)
Bits
2 1
0 0 User-provided, not screened
0 1 User-provided, verified and passed
1 0 User-provided, verified and failed
1 1 Network provided
Note : If octet 3a is omitted, "0 0 - User provided not screened" is assumed.

TABLE 10.51/GSM 04.08
Calling party BCD number

10.5.4.7a Calling party subaddress

The purpose of the Calling party subaddress is to identify a subaddress associated with the origin of a call. For the definition of a subaddress see Rec. CCITT I.330.
The Calling party subaddress information element is coded as shown in Figure 10.50a/GSM 04.08 and Table10.50b/GSM 04.08
The maximum length of this information element is 23 octets

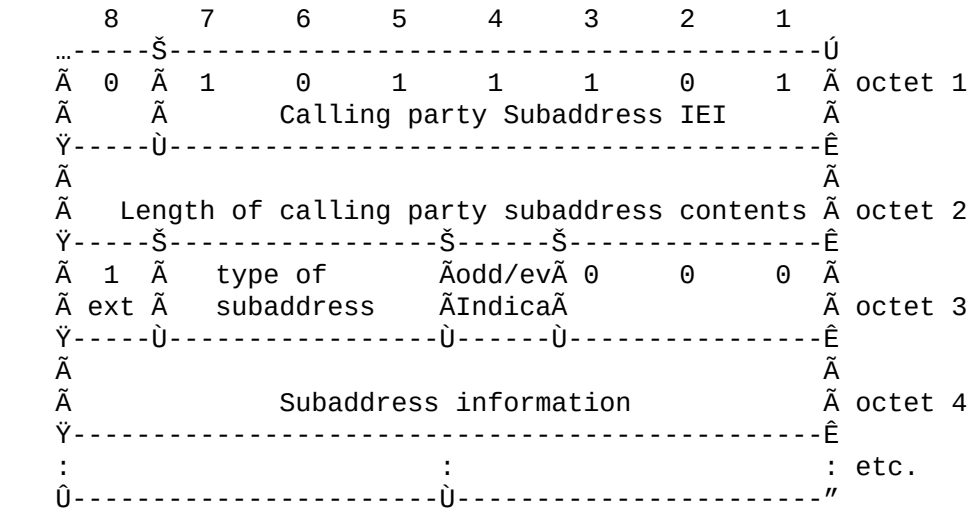


FIGURE 10.50a/GSM 04.08
Calling party subaddress

Type of subaddress (octet 3)
Bits
7 6 5
0 0 0 NSAP (X.213/ISO 8348 AD2)
0 1 0 User specified
All other values are reserved
Odd/even indicator (octet 3)
Bit
4
0 even number of address signals
1 odd number of address signals
Note: The odd/even indicator is used when the type of subaddress is "user specified" and the coding is BCD
Subaddress information (octet 4, etc...)
The NSAP X.213/ISO8348AD2 address shall be formated as specified by octet 4 which contains the Authority and Format Identifier (AFI). The encoding is made according to the "preferred binary encoding" as defined in X.213/ISO8348AD2. For the definition of this type of this type of subaddress, see Rec. CCITT I.332.

TABLE 10.50a/GSM 04.08
Calling party subaddress

Coding examples are given in ANNEX E.
For User-specific subaddress, this field is encoded according to the user specification, subject to a maximum length of 20 octets. When interworking with X.25 networks BCD coding should be applied.
Note: It is recommended that users apply NSAP subaddress type since this subaddress type allows the use of decimal, binary and IA5 characters in a standardised manner.

Table 10.50a/GSM 04.08 (continued)

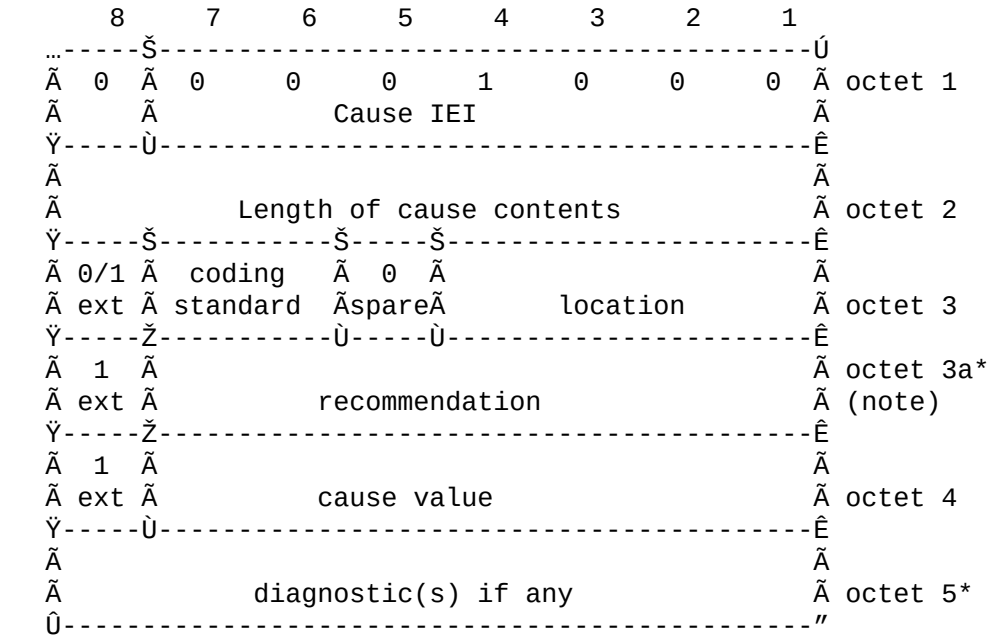
10.5.4.8 Cause

The purpose of the cause information element is to describe the reason for generating certain messages, to provide diagnostic information in the event of procedural errors and to indicate the location of the cause originator.

The cause information element is coded as shown in Figure 10.57/GSM 04.08 and Tables 10.53-10.54/GSM 04.08.

The cause is a type 4 information element with [32] octets length maximal.

The cause information element may be repeated in a message.



Note: if the default value applies for the recommendation field, octet 3a shall be omitted.

FIGURE 10.57/GSM 04.08
Cause information element

Coding standard (octet 3)	
Bits	
7 6	
0 0	Standard as described in CCITT Rec. Q.931 (Note 1)
0 1	Reserved for other international standards (Note 1)
1 0	National standard (Note 1)
1 1	Standard defined for the GSM PLMNS as described below (Note 2)
Note 1:	These other coding standards shall be used only when the desired cause cannot be represented with the GSM standardized coding.
Note 2:	This coding standard is used for CEPT standardized cause values as described in Table 10.53/GSM 04.08.
Location (octet 3)	
Bits	
4 3 2 1	
0 0 0 0	user
0 0 0 1	private network serving the local user
0 0 1 0	public network serving the local user
0 0 1 1	transit network
0 1 0 0	public network serving the remote user
0 1 0 1	private network serving the remote user
0 1 1 1	international network
1 0 1 0	network beyond interworking point
All other values are reserved.	
Recommendation (octet 3a)	
Bits	
7 6 5 4 3 2 1	
0 0 0 0 0 0 0	Q.931
0 0 0 0 0 0 1	GSM Recommendation (see note 2)
0 0 0 0 0 1 1	X.21
0 0 0 0 1 0 0	X.25
All other values are reserved.	
Note 1:	If octet 3a is omitted, Rec. GSM 04.08 is assumed.
Note 2:	This value is used only when octet 3a is extended and the cause in octet 4 is from Table 10.53/GSM 04.08.

TABLE 10.52/GSM 04.08
Cause information element

Cause value (octet 4)
The cause value is divided in two fields: a class (bits 5 through 7) and a value within the class (bits 1 through 4).
The class indicates the general nature of the event.
Class (000): normal event
Class (001): normal event
Class (010): resource unavailable
Class (011): service or option not available
Class (100): service or option not implemented
Class (101): invalid message (e.g. parameter out of range)
Class (110): protocol error (e.g. unknown message)
Class (111): interworking
The cause values are listed in Table 10.53/GSM 04.08 below and defined in Annex H.
Diagnostic(s) (octet 5)
Diagnostic information is not available for every cause, see Table 10.53/GSM 04.08 below.
When available, the diagnostic(s) is coded in the same way as the corresponding information element in section 10.
The inclusion of diagnostic(s) is optional.

TABLE 10.52/GSM 04.08
Cause information element (continued)

Cause value					Cause		Cause	Diag-	Remarks
Class			Value		num.			nostic	
7	6	5	4	3 2 1					
0	0	0	0	0 1	1	1.	Unassigned (unallocated) number	Note 9	
0	0	0	0	1 1	1	3.	No route to destination	Note 9	
0	0	0	0	1 1	0	6.	Channel unacceptable	-	
0	0	1	0	0 0	0	16.	Normal clearing	Note 9	
0	0	1	0	0 0	1	17.	User busy	-	
0	0	1	0	0 1	0	18.	No user responding	-	
0	0	1	0	0 1	1	19.	User alerting, no answer	-	
0	0	1	0	1 0	1	21.	Call rejected	Note 9 - user supplied diag- nostic (note 4)	
0	0	1	0	1 1	0	22.	Number changed	New destination (note	
0	0	1	1	0 1	0	26.	Non selected user clearing	-	
0	0	1	1	0 1	1	27.	Destination out of order	-	
0	0	1	1	1 0	0	28.	Invalid number format (in- complete number)	-	
0	0	1	1	1 0	1	29.	Facility rejected	Note 1	
0	0	1	1	1 1	0	30.	Response to STATUS ENQUIRY	-	
0	0	1	1	1 1	1	31.	Normal, unspecified	-	
0	1	0	0	0 1	0	34.	No circuit/channel available	-	
0	1	0	0	1 1	0	38.	Network out of order	-	
0	1	0	1	0 0	1	41.	Temporary failure	-	
0	1	0	1	0 1	0	42.	Switching equipment conges- tion	-	
0	1	0	1	0 1	1	43.	Access information discarded	Discarded info- mation element identifiers (note	
0	1	0	1	1 0	0	44.	requesteed circuit/channel not available	-	
0	1	0	1	1 1	1	47.	Resources unavailable, un- specified	-	
0	1	1	0	0 0	1	49.	Quality of service unavailable	Note 9	
0	1	1	0	0 1	0	50.	Requested facility not sub- scribed	Note 1	
0	1	1	1	0 0	1	57.	Bearer capability not au- thorized	Note 3	
0	1	1	1	0 1	0	58.	Bearer capability not pre- sently available	Note 3	

TABLE 10.53/GSM 04.08
Cause information element values

Cause value								Cause number	Cause	Diagnostic	Remarks
7	6	5	4	3	2	1					
0	1	1	1	1	1	1		63.	Service or option not available, unspecified	-	
1	0	0	0	0	1	1		65.	Bearer service not implemented	Note 3	
1	0	0	0	1	0	1		69.	Requested facility not implemented	Note 1	
1	0	0	0	1	1	0		70.	Only restricted digital information bearer capability is available		
1	0	0	1	1	1	1		79.	Service or option not implemented, unspecified	-	
1	0	1	0	0	1	1		81.	Invalid transaction identifier value	-	
1	0	1	0	0	0	0		88.	Incompatible destination	Incompatible parameter (Note 2)	
1	0	1	0	1	1	1		91.	Invalid transit network selection	-	
1	0	1	1	1	1	1		95.	Invalid message, unspecified	-	
1	1	0	0	0	0	0		96.	Mandatory information element error	Information element identifier(s)	
1	1	0	0	0	1	1		97.	Message type non-existent or not implemented	Message type	
1	1	0	0	1	0	0		98.	Message not compatible with control state or message type non-existent or not implemented	Message type	
1	1	0	0	1	1	1		99.	Information element non-existent or not implemented	Information element identifier(s) (notes 6,7)	
1	1	0	1	0	0	0		100.	Invalid information element contents	Information element identifier(s) (note 6)	
1	1	0	1	0	1	1		101.	Message not compatible with call state	Message type	
1	1	0	1	1	0	0		102.	Recovery on timer expiry	Timer number (note 8)	
1	1	0	1	1	1	1		111.	Protocol error, unspecified	-	
1	1	1	1	1	1	1		127.	Interworking, unspecified	-	

All other values are reserved.

TABLE 10.53/GSM 04.08
Cause information element values (continued)

Note 1: Diagnostic and error reporting for supplementary services handling are defined in Recommendation GSM 04.10. For other facilities (e.g. DTMF), no diagnostic is included.

Note 2: Incompatible parameter is composed of incompatible information element identifier.

Note 3: The format of the diagnostic field for causes number 57, 58 and 65 is as shown in Figure 10.52/GSM 04.08 and 10.48a/GSM 04.08 to 10.48h/GSM 04.08.

Note 4: User supplied diagnostics field is encoded according to the user specification, subject to the maximum length of the cause information element. The coding of user supplied diagnostics should be made in such a way that it does not conflict with the coding described in note 9 below.

Note 5: New destination is formatted as the called party number information element, including information element identifier.

Note 6: Locking and non-locking shift procedures described in sections 10.5.4.2 and 3 are applied. In principle, information element identifiers are ordered as information element order in the received message.

Note 7: When only locking shift information element is included and no variable length information element identifier follows, it means that the codeset in the locking shift itself is not implemented.

Note 8: The timer number is coded in IA5 characters, e.g. T308 is coded as "3" "0" "8". The following coding is used in each octet:
bit 8 : spare "0"
bits 7-1 : IA5 character

Note 9: The following coding is used:
bit 8 : 1
bits 7-3 : 00000
bits 2-1 : condition as follows:
00 - unknown
01 - transient
10 - transient

10.5.4.9 Congestion level

The purpose of the congestion level information element is to describe the congestion status of the call.

The congestion level is coded as shown in Figure 10.57/GSM 04.08 and Table 10.54/GSM 04.08.

The congestion level is a type 1 information element.

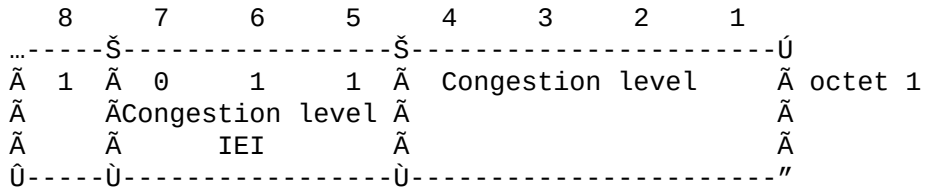


FIGURE 10.57/GSM 04.08
Congestion level information element

Congestion level (octet 1) bits 4 3 2 1	
0 0 0 0	receiver ready
1 1 1 1	receiver not ready
All other values are reserved.	

TABLE 10.54/GSM 04.08
Congestion level information element

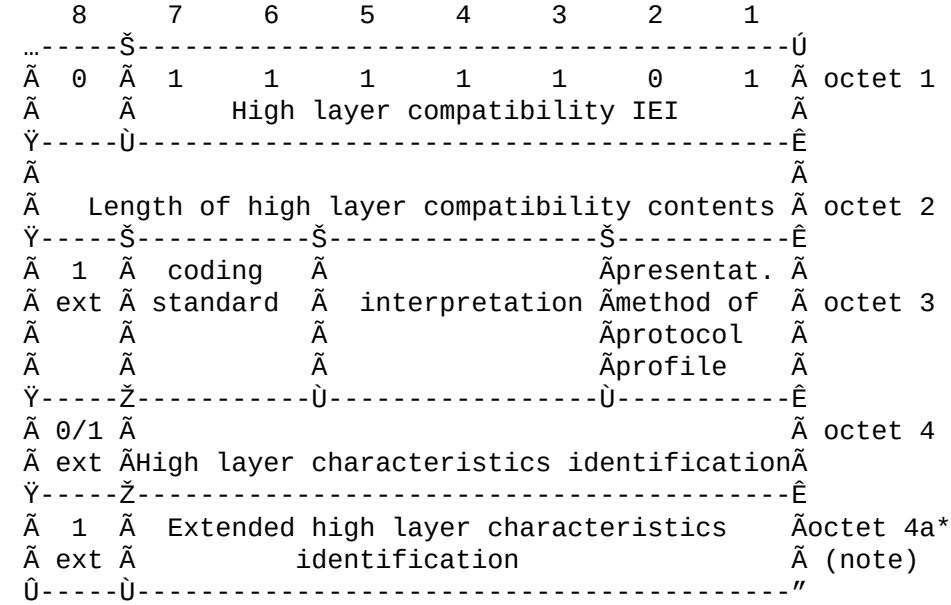
10.5.4.10 High layer compatibility

The purpose of the high layer compatibility information element is to provide a means which should be used by the remote user for compatibility checking. See Annex B.

The high layer compatibility information element is coded as shown in Figure 10.58/GSM 04.08 and Table 10.55/GSM 04.08.

The high layer compatibility is a type 4 information element with 5 octets length maximal.

Note: The high layer compatibility information element is transported transparently by a PLMN between a call originating entity, e.g. a calling user and the addressed entity, e.g. a remote user or a high layer function network node addressed by the call originating entity. However, if explicitly requested by the user (at subscription time), a network which provides some capabilities to realize teleservices may interpret this information to provide a particular service.



Note: This octet may be present e.g. when octet 4 indicates Maintenance or Management.

FIGURE 10.58/GSM 04.08
High layer compatibility information element

Coding standard (octet 3)
see CCITT Recommendation Q.931.
Interpretation (octet 3)
see CCITT Recommendation Q.931.
Presentation method of protocol profile (octet 3)
see CCITT Recommendation Q.931.
High layer characteristics identification (octet 4)
see CCITT Recommendation Q.931.
Extended high layer characteristics identification
(octet 4a) (alternative 2)
see CCITT Recommendation Q.931.

TABLE 10.55/GSM 04.08
high layer compatibility information element

10.5.4.11 Keypad facility

The purpose of the keypad facility information element is to convey IA5 characters, e.g. entered by means of a terminal keypad. (Note).

The keypad facility information element is coded as shown in Figure 10.59/GSM 04.08.

The keypad facility is a type 3 information element with 2 octets length.

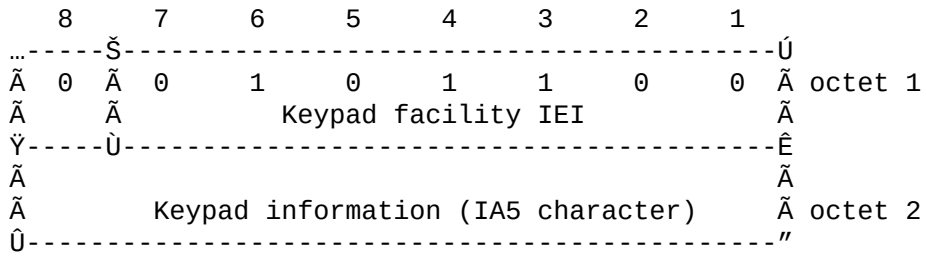


FIGURE 10.59/GSM 04.08
keypad facility information element

Note: In the GSM system this information element is only used to transfer one IA5 character as one DTMF digit (0, 1, ... , 9, A, B, C, D, *, #).

10.5.4.12 Low layer compatibility

The purpose of the low layer compatibility information element is to provide a means which should be used for compatibility checking by an addressed entity (e.g., a remote user or an interworking unit or a high layer function network node addressed by the calling user). The low layer compatibility information element is transferred transparently by a PLMN between the call originating entity (e.g. the calling user) and the addressed entity.

The low layer compatibility information element is coded as in CCITT Recommendation Q.931.

The low layer compatibility is a type 4 information element with 15 octets length maximal.

To allow a low layer compatibility information element to contain only information which is required in addition to the bearer capability information element (thereby avoiding duplication of information between LLC and BC information elements) a LLC interpretatin octet may be included in the low layer compatibility information element following octet 2. The octet indicates the content of the subsequent octet.
It is coded as in CCITT Recommendation Q.931.

Note: the coding for GSM PLMNs shall be as for the ISDN.

10.5.4.13 More data

The more data information element is sent by the mobile station to the network or to the network to the mobile station in a USER INFORMATION message. The presence of the more data information element indicates to the destination remote user/mobile station that another USER INFORMATION message will follow containing information belonging to the same block.

The use of the more data information element is not supervised by the network.

The more data information element is coded as shown in Figure 10.60/GSM 04.08.

The more data is a type 2 information element.

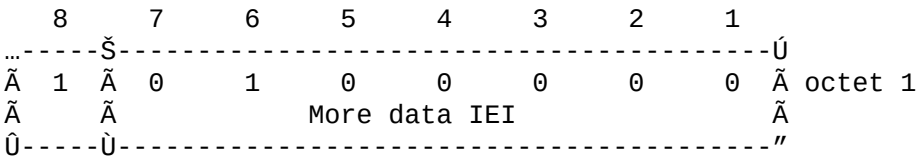


FIGURE 10.60/GSM 04.08
More data information element

10.5.4.14 Notification indicator

The purpose of the notification indicator information element is to indicate information pertaining to a call.

The notification indicator element is coded as shown in Figure 10.61/GSM 04.08 and Table 10.56/GSM 04.08.

The notification indicator is a type 3 information element with 2 octets length.

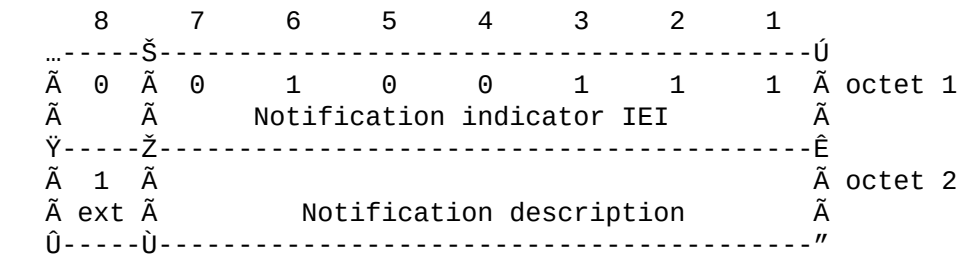


FIGURE 10.61/GSM 04.08
Notification indicator information element

Notification description (octet 2) Bits 7 6 5 4 3 2 1	
0 0 0 0 0 0 0	User suspended
0 0 0 0 0 0 1	User resumed
0 0 0 0 0 1 0	Bearer change
All other values are reserved.	

TABLE 10.56/GSM 04.08
Notification indicator information element

10.5.4.15 Progress indicator

The purpose of the progress indicator information element is to describe an event which has occurred during the life of a call. The information element may occur two times in a message.

The progress indicator information element is coded as shown in Figure 10.62/GSM 04.08 and Table 10.57/GSM 04.08.

The progress indicator is a type 4 information element with 4 octets length maximal.

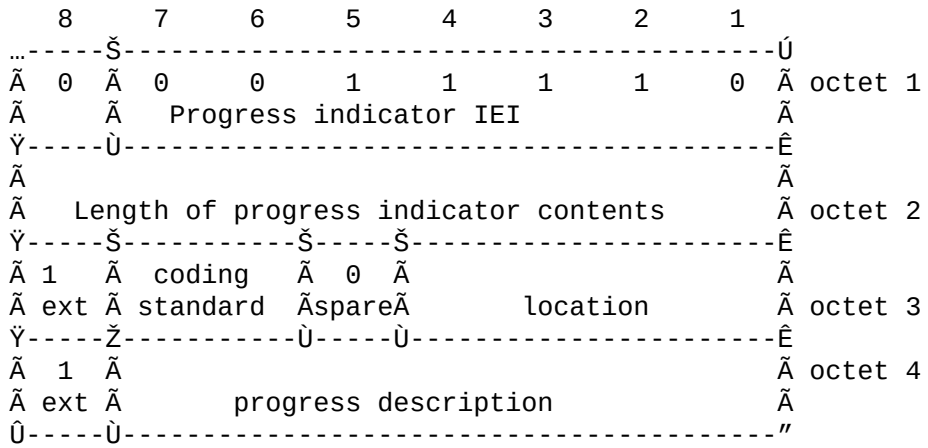


FIGURE 10.62/GSM 04.08
Progress indicator information element

Coding standard (octet 3)
Bits
7 6
0 0 Standardized coding, as described in CCITT Rec. Q.931 (Note)
0 1 Reserved for other international standards (Note)
1 0 National standard (Note)
1 1 Standard defined for the GSM PLMNS as described below
Note: These other coding standards should be used only when desired cause can not be represented with the GSM-standardized coding.
Location (octet 3)
Bits
4 3 2 1
0 0 0 0 User
0 0 0 1 Private network serving the local user
0 0 1 0 Public network serving the local user
0 1 0 0 Public network serving the remote user
0 1 0 1 Private network serving the remote user
1 0 1 0 Network beyond interworking point
All other values are reserved.
Note: Depending on the location of the users, the local public network and remote public network may be the same network.
Progress description (octet 4)
Bits
7 6 5 4 3 2 1 No.
0 0 0 0 0 0 1 1. Call is not end-to-end PLMN/ISDN, further call progress information may be available in-band
0 0 0 0 0 1 0 2. Destination address in non-PLMN/ISDN
0 0 0 0 0 1 1 3. Origination address in non-PLMN/ISDN
0 0 0 0 1 0 0 4. Call has returned to the PLMN/ISDN
0 0 0 1 0 0 0 8. In-band information or appropriate pattern now available
All other values are reserved.

TABLE 10.57/GSM 04.08
Progress indicator information element

10.5.4.16 Repeat indicator

The purpose of the repeat indicator information element is to indicate how repeated information elements shall be interpreted, when included in a message. The repeat indicator information element is included before the first occurence of the information element which will be repeated in a message.

The repeat indicator information element is coded as shown in Figure 10.63/GSM 04.08 and Table 10.58/GSM 04.08.

The repeat indicator is a type 1 information element.

Note: Use of the repeat indicator information element in conjunction with an information element that occurs only once in a message shall not in itself constitute an error.

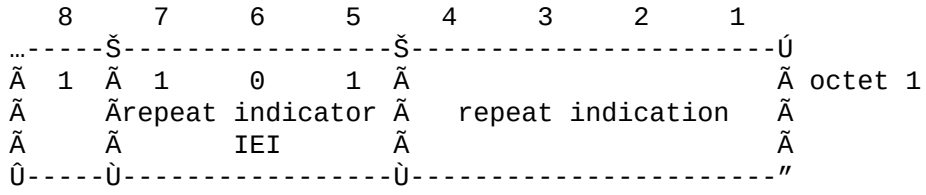


FIGURE 10.63/GSM 04.08
Repeat indicator information element

Repeat indication (octet 1)	
Bits	
4 3 2 1	
0 0 0 1	Circular for successive selection (Note 1)
0 0 1 1	Sequential for successive selection (Note 2)
All other values are reserved.	
Note 1:	Used for in-call modification procedure: mode 1 alternate mode 2
Note 2:	Used for in-call modification procedure: mode 1 and then mode 2.

TABLE 10.58/GSM 04.08
Repeat indicator information element

10.5.4.17 Signal

The purpose of the signal information element is to allow the network to optionally convey information to a user regarding tones and alerting signals (see sections 5.2.2.1 and 7.3.3.1).

The signal information element is coded as shown in Figure 10.64/GSM 04.08 and Table 10.59/GSM 04.08.

The signal is a type 3 information element with 2 octets length.

The signal information element may be repeated in a message.

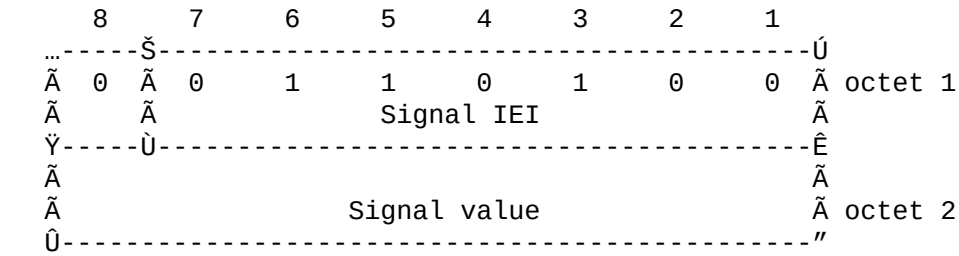


FIGURE 10.64/GSM 04.08
Signal information element

Signal value (octet 2) Bits 8 7 6 5 4 3 2 1	
0 0 0 0 0 0 0 0	dial tone on
0 0 0 0 0 0 0 1	ring back tone on
0 0 0 0 0 0 1 0	intercept tone on
0 0 0 0 0 0 1 1	network congestion tone on
0 0 0 0 0 1 0 0	busy tone on
0 0 0 0 0 1 0 1	confirm tone on
0 0 0 0 0 1 1 0	answer tone on
0 0 0 0 0 1 1 1	call waiting tone on
0 0 0 0 1 0 0 0	off-hook warning tone on
0 0 1 1 1 1 1 1	tones off
0 1 0 0 1 1 1 1	alerting off
All other values are reserved.	

TABLE 10.59/GSM 04.08
Signal information element

10.5.4.18 User-user

The purpose of the user-user information element is to convey information between the mobile station and the remote ISDN user.

The user-user information element is coded as shown in Figure 10.65/GSM 04.08 and Table 10.60/GSM 04.08. There are no restrictions on the content of the user information field.

The user-user is a type 4 information element with 35 or 131 octets length maximal.
In SETUP, ALERTING, CONNECT, DISCONNECT, RELEASE and RELEASE COMPLETE messages, the user-user information element has a maximum size of 35 octets in a GSM PLMN. In USER INFORMATION messages the user-user information element has a maximum size of 131 octets in a GSM PLMN. In other networks than GSM PLMNs the maximum size of the user-user information element is 35 or 131 octets in the messages mentioned above. The evolution to a single maximum value is the long term objective; the exact maximum value is the subject of further study.

Note: The user-user information element is transported transparently through a GSM PLMN.

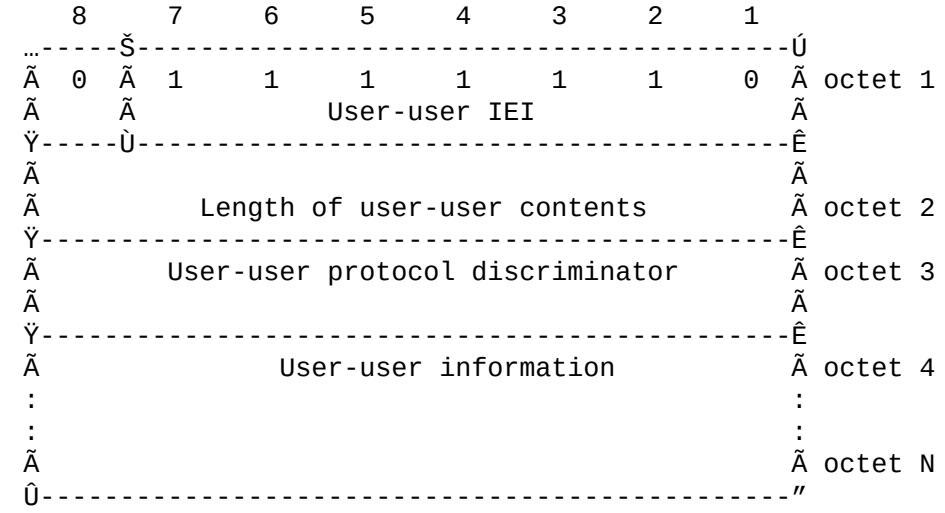


FIGURE 10.65/GSM 04.08
User-user information element

User-user protocol discriminator (octet 3)	
Bits	
8 7 6 5 4 3 2 1	
0 0 0 0 0 0 0 0	User specific protocol (Note 1)
0 0 0 0 0 0 0 1	OSI high layer protocols
0 0 0 0 0 0 1 0	X.244 (Note 2)
0 0 0 0 0 0 1 1	Reserved for system management convergence function
0 0 0 0 0 1 0 0	IA5 characters (Note 3)
0 0 0 0 0 1 1 1	Rec.V.120 rate adaption
0 0 0 0 1 0 0 0	Q.931 (I.451) user-network call control messages
0 0 0 1 0 0 0 0 through 0 0 1 1 1 1 1 1	Reserved for other network layer or layer 3 protocols including Rec.X.25 (Note 4)
0 1 0 0 0 0 0 0 through 0 1 0 0 1 1 1 1	National use
0 1 0 1 0 0 0 0 through 1 1 1 1 1 1 1 0	Reserved for other network layer or layer 3 protocols including Rec.X.25 (Note 4)
All other values are reserved	

Note 1: The user information is structured according to user needs.

Note 2: The user information is structured according to Rec.X.244 which specifies the structure of X.25 call user data.

Note 3: The user information consists of IA5 characters.

Note 4: These values are reserved to discriminate these protocol discriminators from the first octet of a X.25 packet including general format identifier.

TABLE 10.60/GSM 04.08
User-user information element

11 LIST OF SYSTEM PARAMETERS

The description of timers in the following table should be considered a brief summary. The precise details are found in sections 3 to 6, which should be considered the definitive descriptions.

11.1 Timers and counters for radio resource management

11.1.1 Timers on the MS side

T3120 : This timer is related to the ALOHA repetition on the uplink CCCH (random access messages).

Its value is randomly drawn as specified in section 3.3.1.1.

T3122 : This timer is used during random access, after the receipt of an IMMEDIATE ASSIGN REJECT message.

Its value is given by the network in the IMMEDIATE ASSIGN REJECT message.

T3124 : This timer is used in the seizure procedure during a hand-over, when the two cells are not synchronized.
Its purpose is to detect the lack of answer from the network to the special signal.

Its value is set to [320ms]. (It must be lower than Ny1 times T3105 for proper functions.)

T3110 : This timer is used to delay the channel deactivation after the receipt of a (full) CHANNEL RELEASE. Its purpose is to let some time for disconnection of the main signalling link.

Its value is set to such that the DISC frame is sent at least [2] times in case of no answer from the network. (It should be chosen to obtain a good probability of normal termination (i.e. no time out of T3109) of the channel release procedure.)

11.1.2 Timers on the network side

T3101 : This timer is started when a channel is allocated with an IMMEDIATE ASSIGNMENT message. It is stopped when the MS has correctly seized the channels.

Its value is set to [tbi]. (It must be higher than the maximum time for a L2 establishment attempt.)

T3103 : This timer is started by the sending of a HANDOVER message and is normally stopped when the MS has correctly seized the new channel. Its purpose is to keep the old channels sufficiently long for the MS to be able to return to the old channels, and to release the channels if the MS is lost.

Its value is set to [tbi]. (It must be higher than the maximum transmission time of the HANDOVER COMMAND, plus the value of T3124, plus the maximum duration of an attempt to establish a data link multiframe mode.)

T3105 : This timer is used for the repetition of the PHYSICAL INFORMATION message during the hand-over procedure.

Its value is set to [tbi]. (This timer may be set to such a low value that the message is in fact continuously transmitted.)

T3107 : This timer is started by the sending of an ASSIGNMENT COMMAND message and is normally stopped when the MS has correctly seized the new channels.
Its purpose is to keep the old channel sufficiently long for the MS to be able to return to the old channels, and to release the channels if the MS is lost.

Its value is set to [tbi]. (It must be higher than the maximum transmission time of the ASSIGNMENT COMMAND message plus twice the maximum duration of an attempt to establish a data link multiframe mode.)

T3109 : This timer is started when a lower layer failure is detected by the network, when it is not engaged in a RF procedure. It is also used in the channel release procedure.

Its purpose is to release the channels in case of loss of communication.

Its value is set to [tbi]. (Its value must be chosen higher than T100, to be sure the MS will have deactivated the channels if T3109 times out, plus maybe some time to allow some chance for a successful re-establishment.)

T3111: This timer is used to delay the channel deactivation after disconnection of the main signalling link. Its purpose is to let some time for possible repetition of the disconnection. Its value is equal to the value of T3110.

T3113: This timer is started when the network has sent a PAGING REQUEST message and is stopped when the network has received the PAGING RESPONSE message.
The value must be greater than the sum of the values of T3120 (this timer is related to the ALOHA repetition) and T3101 (this timer is started by sending of an IMMEDIATE ASSIGN message).

11.1.3 Other parameters

Ny1: The maximum number of repetitions for the PHYSICAL INFORMATION message during a handover (see section 3.4.4.2.2).

11.2 Timers of mobility management

Table 11.1/GSM 04.08 Mobility management timers - MS-side

TIMER NUM.	MM TIME OUT	MM TIME VAL.	CAUSE FOR START	NORMAL STOP	AT THE EXPIRY
T3210	3	20s	LOC_UPD_REQ sent	LOC_UPD_ACC LOC_UPD_REJ AUTH_REJ Lower layer failure	Start T3211
T3211	1 2	15s	LOC_UPD_REJ with cause #17 netw. failure lower layer failure during loc. updating	Time out cell change request for MM-connection establishment change of LA	Restart the Location updating proc.
T3212	1, 2	Note 1	termination of MM-service or MM signalling	initiation of MM-service or MM signalling	initiate periodic updating
T3213	1 2 11	4s	location updating failure	expiry change of BCCH parameter	new random attempt
T3220	7	5s	IMSI DETACH	release from RR-sublayer	enter Null or Idle, Not updated
T3230	5	15s	CM_SERV_REQ CM-REEST-REQ	Cipher mode setting CM_SERV_REJ CM_SERV_ACC	provide release ind. local release of RR connection
T3240	9 10	10s	normal end of LOC. UPD. or end of all MM connection	receipt of any correct message from the network	local release of RR connection

Note 1: The timeout value is broadcasted in a SYSTEM INFORMATION message

Table 11.2/GSM 04.08 Mobility management timers - network-side

TIMER NUM.	MM TIME VAL.	CAUSE FOR START	NORMAL STOP	AT THE FIRST EXPIRY	AT THE SECOND EXPIRY
T3250	6 s	TMSI-REAL-CMD or LOC UPD ACC with new TMSI sent	TMSI-REALL-COM received	Retransmit TMSI-REALL-CMD or LOC UPD ACC	Abort reallocation release MM- and RR-connection
T3260	5 s	AUTHENT-REQUEST sent	AUTHENT-RESPONSE received	Retransmit AUTHENT-REQUEST	Abort auth., release MM- and RR-connection
T3270	4 s	IDENTITY REQUEST sent	IDENTITY RESPONSE received	Retransmit IDENTITY RESPONSE	Abort auth., release MM- and RR-connection

11.3 Timers of circuit-switched call control

Table 11.3/GSM 04.08 Call control timers - MS side

TIM. NUM.	VAL	STATE OF CALL	CAUSE OF START	NORMAL STOP	AT FIRST EXPIRY	AT SECOND EXPIRY	CROSS REF.
T303	30s	Call initiated	CM-SER-RQ sent	CALL PROC, or REL COMP received	Clear the call	Timer is not restarted	Mandat.
T305	30s	Disconnect Request	DISC sent	REL or DISC received	REL sent.	Timer is not restarted	Mandat.
T308	30s	Release request	REL sent	REL COMP or REL received	Retrans. RELEASE restart T308	Call ref. release	Mandat.
T310 Note 1	30s	Outgoing call Proceeding	CALL PROC received	ALERT, CONN, DISC or PROG rec.	Send DISC	Timer is not restarted	Mandat.
T313	30s	Connect Request	CONN sent	CONNect ACKnowledge received	Send DISC	Timer is not restarted	Mandat.
T323	30s	Modify Request	MOD sent	MOD COMP or MOD REJ received	Clear the call	Timer is not restarted	Mandat. when in-call modif.

Note 1: T310 is not started if progress indicator #1 or #2 has been delivered in the CALL PROCeeding message or in a previous PROGress message.

Table 11.4/GSM 04.08 Call control timers - network side

TIM. NUM.	DFT VAL	STATE OF CALL	CAUSE FOR START	NORMAL STOP	AT FIRST EXPIRY	AT SECON EXPIRY	CROSS REF.	
T301	3 min	Call received	ALERT received	CONN received	Clear the call	Timer is not restarted	Mandat. Note 1	
T303	tbp	Call present	SETUP sent	CALL CONF or REL COMP	Clear the call	Timer is not restarted	Mandat.	
T305	30s	Disconnect Indication	DISC without progress indic. #8 sent	REL or DISC received	Network sends RELEASE	Timer is not restarted	Mandat.	
T306	30s	Disconnect Indication	DISC with progress indic. #8 sent	|REL or DISC received	Stop the tone/ announc. Send REL	Timer is not restarted	Mandat. Note 2	
T308	tbp	Release request	REL sent	REL COMP or REL received	Retrans. RELEASE	Release Call restart T308	Mandat. reference	
T310	tbp	Incoming call pro- ceeding	CALL CONF received	ALERT, CONN or DISC received	Clear the call	Timer is not restarted	Mandat.	
T313	tbp	Connect Indication	CON sent	CON ACK received	Clear the call	Timer is not restarted	Mandat.	
T323	30s	Modify request	MOD sent	MOD COMP or MOD REJ received	Clear the call	Timer is not restarted	Mandat. Note 3	

Note 1: The network may already have applied an internal alterting supervision alterting function; e.g. incorporated within call control. If such a function is known to be operating on the call, then timer T301 is not used.

Note 2: Mandatory when in-band tones/announcements are provided (see section 5.4.4.1 and Rec. I300)

Note 3: Mandatory when in-call modification is implemented.

ANNEX B
(to Recommendation GSM 04.08)

COMPATIBILITY CHECKING

B.1 Introduction

This Annex describes the various compatibility checks which should be carried out to ensure that the best matched MS and network capabilities are achieved on a call between a PLMN and the ISDN.

Three different processes of compatibility checking shall be performed:

i) at the user-to-network interface on the calling side (see B.2);
ii) at the network-user interface on the called side (see B.3.2);
iii) user-to-user (see B 3.3).

Note: In this context and throughout this annex the term "called user" is the end point entity which is explicitely addressed.
This may be an address interworking unit (IWU), see 07 series Recommendations.

For details on the coding of the information required for compatibility checking, see Annex C.

B.2 Calling side compatibility checking

B.2.1 Compatibility checking on the CM SERVICE REQUEST message

The network shall check if the service requested on the CM SERVICE REQUEST message is provided to that subscriber.

B.2.2 Compatibility checking on the SETUP message

At the calling side the network shall check that the bearer service requested by the calling MS in the Bearer Capability information element matches with the bearer services provided to that subscriber by the PLMN. If a mismatch is detected, then the network shall reject the call using one of the causes listed in Annex H.

Network services are described in Recommendations GSM 02.02 and 02.03 as bearer services and teleservices, respectively.

B.3 Called side compatibility checking

In this section, the word "check" means that the MS examines the contents of the specified information element.

B.3.1 Compatibility checking with addressing information

If an incoming SETUP message is offered with addressing information (i.e. sub-addressing or the appropriate part of the called party number, e.g. for DDI) the following actions will occur:

a) if a number (e.g. for DDI) or sub-address, then the information in a Called Party Number or Called Party sub-address information element of the incoming call shall be checked by the MS against the corresponding part of the number assigned to the user (e.g. for DDI) or the user's own sub-address.

   In the cases of a mismatch, the MS shall ignore the call. In the case of match, the compatibility checking described in B.3.2 to B.3.3 will follow.

b) if a MS has no DDI number or sub-address, then the Called Party Number and Called Party Sub-address information element shall be ignored. The compatibility checking described in B.3.2 to B.3.3 will follow.

   Note: According to the user's requirements, compatibility checking can be performed in various ways from the viewpoint of execution order and informations to be checked, e.g. first DDI number/sub-address and then compatibility or vice versa.

B.3.2 Network-to-MS compatibility checking

When the network is providing a bearer service at the called side, the MS shall check that the bearer service offered by the network in the Bearer Capability information element matches the bearer services that the MS is able to support. If a mismatch is detected, then the MS shall either ignore, reject the offered call using cause No 88 "incompatible destination", or negotiate as described in Rec. GSM 07.01. See also Rec. GSM 09.07.

B.3.3 User-to-User compatibility checking

See Recommendation GSM 07.01.

B.4 Interworking with existing networks

Limitations in network or distant user signalling (e.g. in the case of an incoming call from a PSTN or a call from an analogue terminal) may restrict the information available to the called MS in the incoming SETUP message. A called MS should accept limited compatibility checking (e.g. without the high layer compatibility information element) if a call is routed from an existing network which does not support high layer compatibility information element transfer.

In cases where the network cannot prove all incoming call informations, or where the network is not aware of the existence or absence of some service information (such as compatibility information), the incoming SETUP message includes a progress indicator information element, containing progress indicator No 1 "Call is not end-to-end ISDN, further call progress information may be available in band" or No 3 "Origination address is non-ISDN".

The terminal equipment receiving a SETUP with a progress indicator information element shall modify its compatibility checking, the terminal equipment should regard the compatibility as successful if it is compatible with the included information, which as a minimum, will be the bearer capability information element. A terminal equipment expecting information in addition to the bearer capability information element in a full ISDN environment need not reject the call if such information is absent but a progress indicator information element is included.

B.5 High layer compatibility checking

See Recommendation GSM 07.01.

ANNEX C
(to Recommendation GSM 04.08)

LOW LAYER INFORMATION CODING PRINCIPLES

C.1 Purpose

This annex describes principles that shall be used when the calling MS specifies information during call setup regarding low layer capabilities required in the network and by the destination terminal.

Note: In this context and throughout this annex the term "called user" is the end point entity which is explicitely addressed. This may be an addressed interworking unit (IWU) (see CCITT I.500-Series Recommendations and CCITT Recommendation X.31 case a).

C.2 Principles

C.2.1 Definition of types of information

There are three different types of information that the calling PLMN user may specify during call setup to identify low layer capabilities needed in the network an by the destination terminal:

a) type I information is information about the calling terminal which is only used at the destination end to allow a decision regarding terminal compatibility. An example would be modem type. This information is encoded in octets 5 to 7 of lower capability;

b) type II information is the selection of bearer service from the choice of bearer services offered by the network to which the calling user is connected. This type of information is present even if no interworking occurs. An example is unrestricted digital information (UDI).

This information is coded in:

i) octets 3 and 4 (including octets 4a and 4b if necessary) of the beare capability information element when the transfer mode required by the calling user is circuit;

ii) octets 3, 4, 6 and 7 (including 4a and 4b if necessary) of the bearer capability information element when the transfer mode required by the calling user is packet;

c) type III information is information about the terminal or intended call which is used to decide destination terminal compatibility and possibly to facilitate interworking with other PLMNs or other dedicated networks. An example is A-law encoding.This information is encoded in octet 5 of the bearer capability information element.

C.2.2 Examination by network

Type I information is user-to-user (i.e. not examined by network) when both types II and III should be available for examination by the destination user and the network. The low layer capability is an information element which is examined by the user and the network.

C.2.3 Location of type I information

Type I information (i.e. terminal information only significant to the called user) shall, when used, be included in the low layer compatibility information element.

C.2.4 Location of types II and III information

Type II (i.e. bearer selection) information shall be included in the bearer capability information element. Type III information, when used, is included in the bearer capability information element. The network may use and modify the information (e.g. to provide interworking). The rational for the user including some terminal related information in the type III information (interworking related) is shown by the following example.

Normally with UDI, the rate adaption technique chosen is related to terminal. The specification of a particular rate adaption scheme with a UDI bearer service could allow a compatibility decision by the destination terminal in a purely ISDN situation.
However, it could also conceivable be used to all interworking with a PSTN, assuming that the appropriate functions (i.e. data extraction, modem pool) are available at the interworking unit.

If the rate adaption information is carried in the low layer compatibility information element, and not in the bearer compatibility information element, then interworking by the network providing the bearer capability would not be possible.

Hence, there is some terminal-related information which may be considered interworking related. The consequence for the calling MS of not including such terminal related information in the bearer capability information element is that the call may not be completed if an interworking situation is encountered.

C.2.5 Relationship between bearer capability and low layer compatibility information elements

There shall be no contradiction of information between the low layer compatibility and the bearer capability at the originating side. However, as some bearer capabilities code points may be modified during the transport of the call, this principle implies that there should be minimal duplication of information between bearer capability information element and low layer compatibility information element.

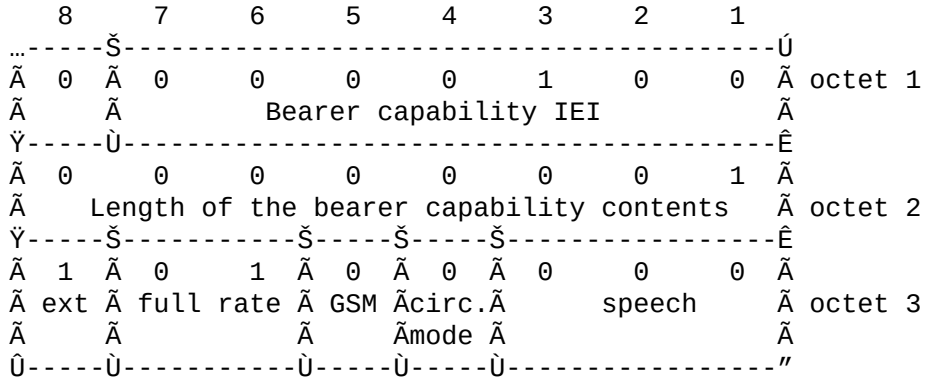
Note: If as a result of duplication, a contradiction occurs between the bearer compatibility information element and the low layer compatibility information element at the terminating side, the receiving entity shall ignore the conflicting information in the low layer compatibility information element.

ANNEX D
(to Recommendation GSM 04.08)

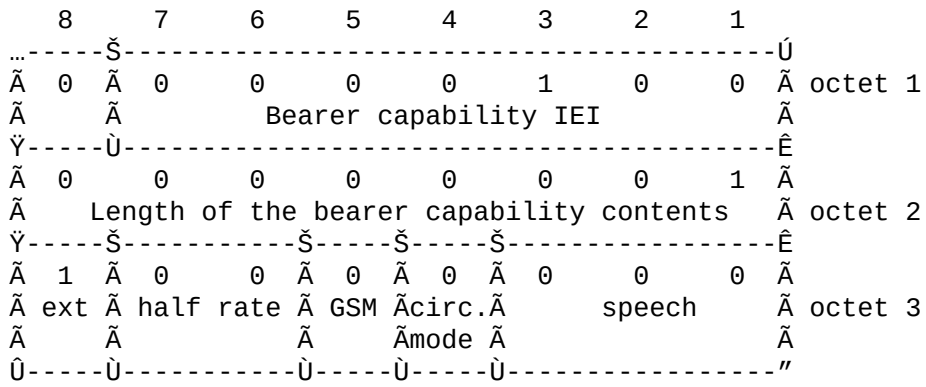
EXAMPLES OF BEARER CAPABILITY INFORMATION ELEMENT CODING

This annex gives examples on the coding of bearer capability information elements for various common bearer services.

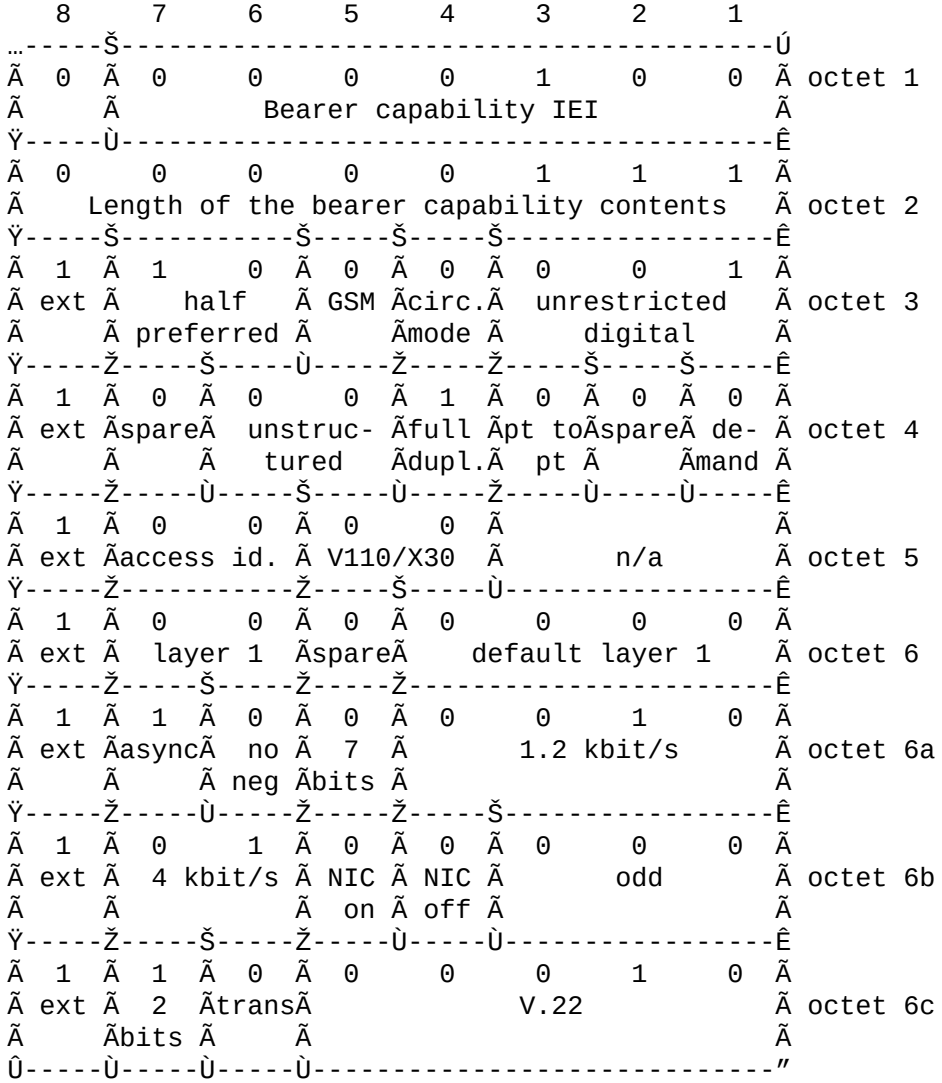
D.1. Coding for speech at full rate



D.2. Coding for speech at half rate



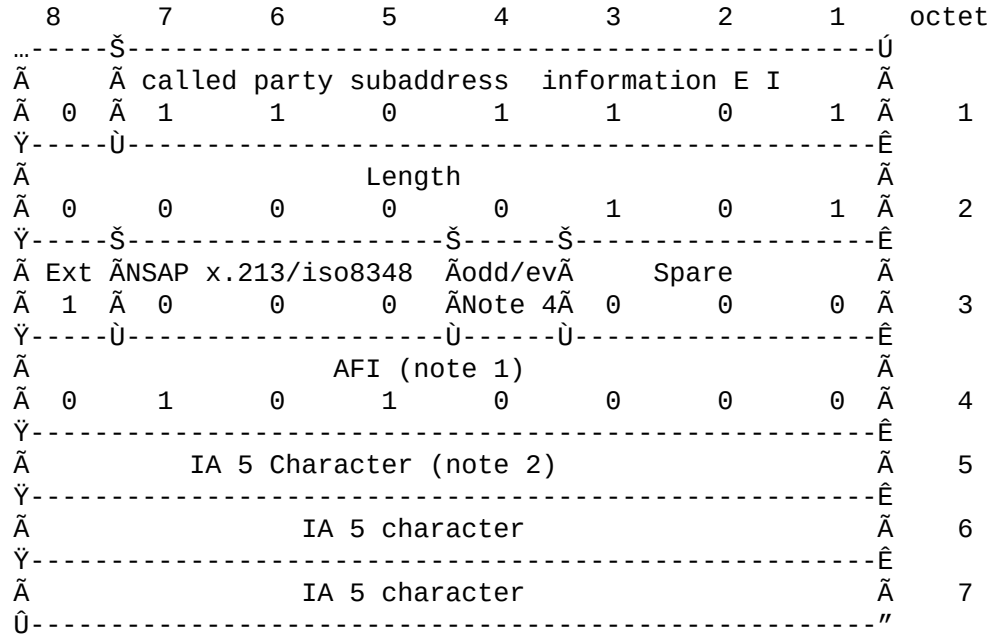
D.3. Coding for circuit-mode unstructured with unrestricted digital capability data circuit duplex asynchronous 1.2 kbit/s transparent



D.4. Coding for packet-mode service at 2.4 kbit/s transparent

Called /calling party subaddress inforemation element coding example

Coding of IA 5 subaddress' digits.



Note 1: AFI code 50 indicates that the subaddress consists of IA5 characters (see ISO standard 8348 AD2).

Note 2: IA5 character according to CCITT Recommendation T.50/ISO 646.

Note 3: The number of IA5 characters shown above is just an example
There may be up to 19 IA 5 characters.

Note 4: the value of this bit has no significance when the type of subaddress is "NSAP".

ANNEX E
(to Recommendation GSM 04.08)

COMPARISON BETWEEN CALL CONTROL PROCEDURES SPECIFIED IN RECOMMENDATIONS GSM 04.08 AND CCITT Q.931

The purpose of this annex is to provide a summary overview for comparison of procedures for call control as specified in CCITT Recommendation Q.931 (blue book) and Recommendation GSM 04.08.

If no comment is given, it means that the procedures as specified in CCITT Recommendation Q.931 and Recommendation GSM 04.08 are similar. However, it should be noted that also in such cases the procedures may be described in slightly different ways in the two recommendations.

TABLE E.1/GSM 04.08
Circuit-switched call control procedures

Procedure	Q.931	GSM 04.08
Call establishment at the originating interface	5.1	5.2.1
- call request	5.1.1	5.2.1.1.1 en-bloc sending only
- B-channel selection originating	5.1.2	not applicable
- overlap sending	5.1.3	not supported
- invalid call information	5.1.4	5.2.1.1.2
- call proceeding, en-bloc sending	5.1.5.1	5.2.1.1.3
- call proceeding, overlap sending	5.1.5.2	not supported
- notification of interworking at the originating interf.	5.1.6	5.2.1.1.4
- call confirmation indication	5.1.7	5.2.1.1.5
- call connected	5.1.8	5.2.1.1.6
- call rejection	5.1.9	5.2.1.1.7
- transit network selection	5.1.10	5.2.1.1.8

TABLE E.1/GSM 04.08
Circuit-switched call control procedures (continued)

Procedure	Q.931	GSM 04.08
Call establishment at the destination interface	5.2	5.2.2
- call indication	5.2.1	5.2.2.1 procedure for multiple terminal configuration not required, i.e. delivery of SETUP messages on broadcast data links is not supported
- compatibility checking	5.2.2	5.2.2.2 equivalent, except that delivery of SETUP messages on broadcast data links is not supported
- B-channel selection destination	5.2.3	not applicable
- overlap receiving	5.2.4	not supported
- call confirmation information	5.2.5	5.2.2.3 equivalent, except that delivery of SETUP messages on broadcast data links is not supported
- notification of interworking at the terminating interf.	5.2.6	5.2.2.4
- call accept indication	5.2.7	5.2.2.5
- active indication	5.2.8	5.2.2.6 equivalent, except that SETUP messages are not sent on broadcast data links
- non-selected user clearing	5.2.9	not applicable

TABLE E.1/GSM 04.08
Circuit-switched call control procedures (continued)

Procedure	Q.931	GSM 04.08
Call clearing	5.3	5.4
- terminology	5.3.1	5.4.1 terminology adapted to GSM applications
- exception conditions	5.3.2	5.4.2 only case a) of section 5.3.2 of Rec. Q.931 applies. All other exceptions apply to functions which are not relevant to GSM
- clearing initiated by the user/MS	5.3.3	5.4.3
- clearing initiated by the network	5.3.4	5.4.4
- clearing when tones/announcements are provided	5.3.4.1	5.4.4.1 exception: if not already connected, the traffic channel is connected in order to provide the tone/announcement
- clearing when tones/announcements are not provided	5.3.4.2	5.4.4.2
- completion of clearing	5.3.4.3	5.4.4.3
Clear collision	5.3.5	5.4.5

TABLE E.1/GSM 04.08
Circuit-switched call control procedures (continued)

Procedure	Q.931	GSM 04.08
In-band tones and announcements	5.4	5.5.1
Restart procedure	5.5	not supported
Call rearrangements	5.6	5.3.4 call suspension/call re-establishment not supported on the radio path. The functions, if required, are to be supported locally in the MS. On the radio interface, the notification procedure of Rec. Q.931 (section 5.6.7) applies
Call collisions	5.7	5.5.2 call collisions cannot occur
Emergency call establishment at the originating interface	not specified not supported	5.2.1.2
In-call modification	Annex O Rec. Q.931 is incomplete with regard to in-call modification procedures	5.3.4
DTMF protocol control procedures	not specified not supported	5.3.3
Call re-establishment	not specified not supported	5.5.4

TABLE E.1/GSM 04.08
Circuit-switched call control procedures (continued)

Procedure	Q.931	GSM 04.08
Status enquiry procedure	5.8.10, 5.8.11	5.5.3
User-to-user signalling	7	Rec. GSM 04.10
Packet communication accross the (radio) interface	6	6 contains only those elements of procedure which are related to call control. Does not specify packet communication via signalling channels.
User notification procedure	5.9	5.3.1

ANNEX F

GSM specific cause values for radio resource management

Cause value = 0 Normal release;

indicates that the channel is released because of a normal event.

Cause value = 1 Abnormal release, unspecified;

indicates that the channel is released because of an abnormal event without specifying further reasons.

Cause value = 2 Abnormal release, channel unacceptable;

indicates that the channel type or channel characteristics are not acceptable.

Cause value = 3 Abnormal release, timer expired;

indicating that the release is caused by a timer expiry.

Cause value = 4 Abnormal release, no activity on radio path;

indicating that some supervisory function has detected that channel is not active.

Cause value = 5 Preemptive release;

indicates that the channel is released in order to be allocated to a call with priority (e.g. an emergency call).

Cause value = 65 Call already cleared;

indicating that a handover is unsuccessful because the connection has been released by the network or the remote user.

Cause value = 95 Invalid message, unspecified;

See Annex H, section H5.10.

Cause value = 97 Message type non-existent or not implemented;

See Annex H, section H6.2.

Cause value = 98 Message not compatible with call state or message type non-existent or not implemented;

See Annex H, section H6.3

Cause value = 100 Invalid information element contents;

See Annex H, section H6.5

Cause value = 111 Protocol error unspecified;

See Annex H, section H6.8.

ANNEX G
(to Recommendation GSM 04.08)

GSM specific cause values for mobility management

G.1 Causes related to MS identification

Cause value = 1 Unallocated TMSI.

This cause is sent to the MS if the MS identifies itself by a TMSI which is not allocated in the relevant location area and open identification is not requested.

Cause value = 2 IMSI unknown in HLR

This cause is sent to the MS if the MS is not known (registered) in the HRL.

Cause value = 3 Illegal MS

This cause is sent to the MS when the MS does not pass the authentication check, i.e. the SRES received from the MS is different from that generated by the network.

Cause value = 4 IMSI unknown in VLR

This cause is sent to the MS when the given IMSI is not known at the VLR.

Cause value = 5 IMEI not accepted

This cause is sent to the MS if the IMEI given cannot be accepted by the network.

G.2 Cause related to subscription options

Cause value = 11 PLMN not allowed

This cause is sent to the MS if it requests location updating in a PLMN where the MS, by subscription is not allowed to operate.

Cause value = 12 Location Area not allowed

This cause is sent to the MS if it requests location updating in a Locationn area where the MS, by subscription, is not allowed to operate.

G.3 Causes related to PLMN specific network failures and congestion

Cause value = 17 Network failure

This cause is sent to the MS if the MSC cannot service an MS generated request because of PLMN failures, e.g. problems in MAP.

Cause value = 22 Congestion

This cause is sent if the service request cannot be actioned because of congestion (e.g. no channel, facility busy/congested etc.)

G.4 Causes related to nature of request

Cause value = 32 Service option not supported

This cause is sent when the MS requests a service/facility in the CM SERVICE REQUEST message which is not supported by the PLMN.

Cause value = 33 Requested service option not subscribed

This cause ist sent when the MS requests a service option for which it has no subscription.

Cause value = 34 Service option temporarily out of order

This cause is sent when the MSC cannot service the request because of temporary outage of one or more functions required for supporting the service.

Cause value = 38 Call cannot be identified

This cause is sent when the network cannot identify the call associated with a call re- establishment request.

G.5 Causes related to invalid messages

Cause value = 96 Mandatory information element error.

See Annex H, sect. H.6.1.

Cause value = 97 Message type non-existent or not implemented.

see Annex H, sect. H.6.2.

Cause value = 98 Message non compatible with call state or message type non-existent or not implemented.

see Annex H, sect. H.6.3.

Cause value = 99 Information element non-existent or not implemented

See Annex H, sect. H.6.4.

Cause value = 100 Invalid information element contents

See Annex H, sect. H.6.5.

Cause value = 101 Message not compatible with call state

See Annex H, sect. H.6.6.

Cause value = 111 Protocol error, unspecified

See Annex H, sect. H.6.8.

Annex H
(to Recommendation GSM 04.08)

Cause definitions for Call Control

H.1 Normal class

H.1.1 Cause No. 1 "unassigned (unallocated) number"

This cause indicates that the destination requested by the Mobile Station cannot be reached because, although the number is in a valid format, it is not currently assigned (allocated).

H.1.2 Cause No. 2 "no route to specified transit network"

Note: For further study

H.1.3 Cause No. 3 "no route to destination"

This cause indicates that the called user cannot be reached because the network through which the call has been routed does not serve the destination desired.

H.1.4 Cause No. 6 "channel unacceptable"

This cause indicates the channel most recently identified is not acceptable to the sending entity for use in this call.

H.1.5 Cause No. 7 "call awarded and being delivered in an established channel"

Note: Not supported

H.1.6 Cause No.16 "normal call clearing"

This cause indicates that the call is being cleared because one of the users involved in the call has requested that the call be cleared.

Under normal situation, the source of this cause is not the network.

H.1.7 Cause No.17 "user busy"

This cause is used when the called user has indicated the inability to accept another call.

It is noted that the user equipment is compatible with the call.

H.1.8 Cause No. 18 " no user responding"

This cause is used when a user does not respond to a call establishment message with either an alerting or connect indication within the prescribed period of time allocated (defined by the expiry of either timer T303 or T310).

H.1.9 Cause No. 19 " user alerting, no answer"

This cause is used when a user has provided an alerting indication but has not provided a connect indication within a prescribed period of time.

H.1.10 Cause No. 21 "call rejected"

This cause indicates that the equipment sending this cause does not wish to accept this call, although it could have accepted the call because the equipment sending this cause is neither busy nor incompatible.

H.1.11 Cause No. 22 "number changed"

This cause is returned to a calling Mobile Station when the called party number indicated by the calling Mobile Station is no longer assigned. The new called party number may optionally be included in the diagnostic field. If a network does not support this capability, cause No. 1 "unassigned (unallocated) number" shall be used.

H.1.12 Cause No. 26 "non-selected user clearing"

Note: Not supported

H.1.13 Cause No 27 "destination out of order"

This cause indicates that the destination indicated by the Mobile Station cannot be reached because the interface to the destination is not functioning correctly. The term "not functioning correctly" indicates that a signalling message was unable to be delivered to the remote user; e.g., a physical layer or data link layer failure at the remote user, user equipment off-line, etc.

H.1.14 Cause No. 28 "invalid number format (incomplete number)"

This cause indicates that the called user cannot be reached because the called party number is not a valid format or is not complete.

H.1.15 Cause No. 30 "response to STATUS ENQUIRY"

This cause is included in STATUS messages if the message is sent in response to a STATUS ENQUIRY message. See also section 5.5.3.

H.1.17 Cause No. 31 "normal, unspecified"

This cause is used to report a normal event only when no other cause in the normal class applies.

H.2 Resource unavailable class

H.2.1 Cause No. 34 "no circuit/channel available"

This cause indicates that there is no appropriate circuit/channel presently available to handle the call.

H.2.2 Cause No. 38 "network out of order"

This cause indicates that the network is not functioning correctly and that the condition is likely to last a relatively long period of time; e.g., immediately re- attempting the call is not likely to be successful.

H.2.3 Cause No. 41 "temporary failure"

This cause indicates that the network is not functioning correctly and that the condition is not likely to last a long period of time; e.g., the Mobile Station may wish to try another call attempt almost immediately.

H.2.4 Cause No. 42 "switching equipment congestion"

This cause indicates that the switching equipment generating this cause is experiencing a period of high traffic.

H.2.5 Cause No. 43 "access information discarded"

This cause indicates that the network could not deliver access information to the remote user as requested; i.e., a user-to-user information, low layer compatibility, high layer compatibility, or sub-address as indicated in the diagnostic.

It is noted that the particular type of access information discarded is optionally included in the diagnostic.

H.2.6 Cause No. 44 "requested circuit/channel not available"

This cause is returned when the circuit or channel indicated by the requesting entity cannot be provided by the other side of the interface.

H.2.7 Cause No. 47 "resource unavailable, unspecified"

This cause is used to report a resource unavailable event only when no other cause in the resource unavailable class applies.

H.3 Service or option not available class

H.3.1 Cause No. 57 "bearer capability not authorized"

This cause indicates that the Mobile Station has requested a bearer capability which is implemented by the equipment which generated this cause but the Mobile Station is not authorized to use.

H.3.2 Cause No. 58 "bearer capability not presently available"

This cause indicates that the Mobile Station has requested a bearer capability which is implemented by the equipment which generated this cause but which is not available at this time.

H.3.3 Cause No. 63 "service or option not available, unspecified"

This cause is used to report a service or option not available event only when no other cause in the service or option not available class applies.

H.4 Service or option not implemented class

H.4.1 Cause No. 65 "bearer service not implemented"

This cause indicates that the equipment sending this cause does not support the bearer capability requested.

H.4.2 Cause No. 66 "channel type not implemented"

Note: Not supported

H.4.3 Cause No. 70 "only restricted digital information bearer capability is available"

This cause indicates that one equipment has requested an unrestricted bearer service, but that the equipment sending this cause only supports the restricted version of the requested bearer capability.

H.4.4 Cause No. 79 "service or option not implemented, unspecified"

This cause is used to report a service or option not implemented event only when no other cause in the service or option not implemented class applies.

H.5 Invalid message (e.g., parameter out of range) class

H.5.1 Cause No. 81 "invalid call reference value"

This cause indicates that the equipment sending this cause has received a message with a call reference which is not currently in use on the MS-network interface.

H.5.2 Cause No. 82 "identified channel does not exist"

Note: Not supported

H.5.3 Cause No. 83 "a suspended call exists, but this call identity does not"

Note: Not supported

H.5.4 Cause No. 84 "call identity in use"

Note: Not supported

H.5.5 Cause No. 85 "no call suspended"

Note: Not supported

H.5.6 Cause No. 86 "call having the requested call identity has been cleared"

Note: Not supported

H.5.7 Cause No. 88 "incompatible destination"

This cause indicates that the equipment sending this cause has received a request to establish a call which has low layer compatibility, high layer compatibility, or other compatibility attributes (e.g., data rate) which cannot be accomodated.

H.5.8 Cause No. 91 "invalid transit network selection"

Note: For further study

H.5.9 Cause No. 94 "incomplete segmented message"

Note: Not supported, no segmentation at layer 3

H.5.10 Cause No. 95 "invalid message, unspecified"

This cause is used to report an invalid message event only when no other cause in the invalid message class applies.

H.6 Protocol error (e.g., unknown message) class

H.6.1 Cause No. 96 "mandatory information element error"

This cause indicates that the equipment sending this cause has received a message where a mandatory information element is missing and/or has a content error (the two cases are undistinguishable).

H.6.2 Cause No. 97 "message type non-existent or not implemented"

This cause indicates that the equipment sending this cause has received a message with a message type it does not recognize either because this is a message not defined or defined but not implemented by the equipment sending this cause.

H.6.3 Cause No. 98 "message not compatible with call state or message type non-existent or not implemented"

This cause indicates that the equipment sending this cause has received a message such that the procedures do not indicate that this is a permissible message to receive while in the call state, or a STATUS message was received indicating an incompatible call state.

H.6.4 Cause No. 99 "information element non-existent or not implemented"

This cause indicates that the equipment sending this cause has received a message which includes information elements not recognized because the information element identifier is not defined or it is defined but not implemented by the equipment sending the cause. However, the information element is not required to be present in the message in order for the equipment sending the cause to process the message.

H.6.5 Cause No. 100 "invalid information element contents"

This cause indicates that the equipment sending this cause has received an information element which it has implemented; however, one or more of the fields in the information element are coded in such a way which has not been implemented by the equipment sending this cause.

H.6.6 Cause No. 101 "message not compatible with call state"

This cause indicates that a message has been received which is incompatible with the call state.

H.6.7 Cause No. 102 "recovery on timer expiry"

This cause indicates that a procedure has been initiated by the expiry of a timer in association with Rec. 04.08 error handling procedures.

H.6.8 Cause No. 111 "protocol error, unspecified"

This cause is used to report a protocol error event only when no other cause in the protocol error class applies.

H.7 Interworking class

H.7.1 Cause No. 127 "Interworking, unspecified"

This cause indicates that there has been interworking with a network which does not provide causes for actions it takes; thus, the precise cause for a message which is being sent cannot be ascertained.

History

Document history		
May 1992	First Edition	
September 1997	One-step Approval Procedure (Second Edition)	OAP 9803: 1997-09-19 to 1998-01-16